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Factors Influencing the Adoption of Cloud Computing by Small and Medium-Sized Enterprises (SMEs)

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By

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Abstract

The main objective of this study is to determine the factors influencing the cloud computing adoption by Small and Medium sized Enterprises (SMEs). Based on two dominant theories in the field of diffusion of innovation, a conceptual model is proposed. In order to test the model empirically, an online survey was designed and launched. Decision makers of 101 SMEs agreed to participate in this survey. In order to evaluate the internal, convergent and discriminant validity of the instrument, factor analysis and reliability tests of panel data were performed. The logistic regression analysis was deployed to test the research hypotheses. The results of regression analysis reveal that decision maker's knowledge about cloud computing is the main influential factor in adopting this technology. A comparison between two groups of cloud adopters and non-adaptors confirm the recent Gartner's hype cycle model for emerging technology (as discussed in chapter 7) indicating a high expectation from cloud computing in both groups.

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Dedications

I dedicate my thesis to my lovely parents, who have supported me all the time since the beginning of my studies. I have a special feeling of gratitude to them, because without their love and support I could never achieve this accomplishment.

I also dedicate this thesis to my precious fiancé for the encouragement, admiration and inspiration.

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Chapter 1
Introduction

Economies are comprised of many companies, majority of which are Small and Medium-sized Enterprises (SMEs)[1]. They play a very important role in each market by significantly contributing to each country's Gross Domestic Product (GDP) and its labor 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 (ICT) (Tan, Chong, Lin, & Eze, 2009). Size and structure of SMEs make them face many challenges. The main challenge is to not have access to enough resources (e.g. financial resources). Moreover, in comparison to large companies, small firms have less tolerance in bearing cost and risk of adopting new innovations (Malecki, 1977). 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. Fixed costs, operation costs and training costs are different types of costs that are usually parts of any IT investment. On the other hand in many cases the actual cost of project becomes higher than the initial estimate (Jorgensen & Molokken-ostvold, 2006; Whittaker, 1999). The high costs and risks that are involved in IT projects prevent SMEs to easily invest in or adopt new technologies.

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 research 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

[1] SMEs are companies with less than 500 employees

services on-demand. In other words they can access the computing resources at anytime and anywhere they have access to the network (e.g. Internet). Cloud computing is an alternative of deploying applications and systems on-premises. Customers[2] do not need to install or develop computing resources in-house. Computing resources, which are, but not limited to networks, servers, storage, applications, and services can be accessed by customers over a network (e.g. Internet). One of the main differences between developing a system on-premises and using cloud computing is that customers are not responsible for operating the actual technology. Customers only use the computing resources and pay for the service they used. This significantly reduces the risk and cost of managing the technology. This is specifically beneficial to SMEs. Cloud computing allows SMEs to reduce the investment cost, the project risk, and the operation and maintenance costs (Khan, Zhang, Khan, & Chen, 2011).

Another difference between traditional computing (such as developing in- house systems) and cloud computing is the payment model of cloud computing. The payment model of pay-as-you-go allows companies to only pay for the amount of service that they have used. Companies can access and use the most sophisticated computing services, without being required to invest significant amount of money in advance. They do not need to pay upfront for buying, installing or licensing the system. Moreover, companies are not responsible for maintaining and upgrading hardware and software applications. Although cloud computing has many advantages for companies, there are also some drawbacks related to this new phenomenon. Some of the issues that have been discussed by other researchers are issues related to the cloud's security, reliability, availability etc. There are also some legal concerns about the ownership of the data and the location of data centers where data are saved. Majority of these concerns and issues can be taken

[2] In this research, customers are Small and Medium-sized Enterprises (SMEs)

care of by signing a comprehensive Service-Level-Agreement (SLA). Concerns and issues about cloud computing will be discussed in more details in section 3.1.

Cloud computing is not a new technology but rather it is the combination of already existing computing paradigms such as grid computing and virtualization. Cloud computing is considered as an innovation, because it offers a new method of computing by integrating the already existing technologies (Innovation, 2013). Similar to other innovations, in addition to costs and benefits of adopting cloud computing there are other factors that influence the decision to adopt cloud computing. Technology adoption is one of the biggest research streams in Information System (IS) field; and many different models and theories try to explain the factors that influence the adoption of new technologies. So far not many studies investigated the adoption process of cloud computing. Among these studies few of them focused on the adoption of cloud computing by SMEs. Majority of the studies in this field try to introduce cloud computing; and to determine the pros and cons of using cloud computing.

In this research I study the factors that influence the adoption of cloud computing by SMEs. In order to investigate the factors that influence the SMEs' decision to adopt cloud computing a conceptual model has been proposed. This model 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. Variables that are chosen for this study are measures that are most appropriate in the context of SMEs. The dependent variable of this model is the decision to adopt cloud computing; I asked participants to indicate whether they already adopted cloud computing or not. There are four different categories of constructs which influence the adoption of cloud computing among SMEs. The effect of these four categories of variables on cloud computing adoption is investigated. These four groups of variables 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's *Relative advantage, Cost, Security and Privacy, Trialability, Complexity and compatibility with company's norms and technologies.* The model and its constructs will be explained in more details later in chapter 5.

The conceptual model is empirically tested using online survey to collect IT decision makers' feedback about cloud computing Since convincing decision makers to participate in surveys are difficult, a market research company is hired to invite SMEs to participate in this research. The questionnaire consists of 25 simple and easy to understand questions. The collected data is quantitatively analyzed using statistical software (SPSS). In order to check the internal, convergent and discriminant validity of the questionnaire factor analysis and reliability check are performed. The proposed hypotheses are then tested using Logistic regression. Chapter six and seven of this paper describe the research methodology.

The rest of this paper is organized as follows: Chapter two outlines the research problem; and why it is important to conduct this research. Chapter three introduces the research question. Section one of chapter three describes cloud computing in details; and has a literature review about cloud computing. Chapter four reviews the background theories that have been used in this study. Two theoretical frameworks that are used are described in details. Research model and proposed hypotheses are discussed in chapter five. Chapter 6 explains the research methodology that is used in this study while chapter seven is focused on the results of data analysis. Chapter 8 describes the implications of this study, followed by chapter 9 which is a discussion about the limitations of this study. Finally, chapter ten concludes and summarizes the findings of this research.

Chapter 2
Research Problem

Cloud computing is one 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.

For the purpose of this research cloud computing is defined as a type of computing paradigm in which the computing services are delivered to the customers over a network (e.g. Internet). Customers can access the service on an on-demand basis, which means they can use the service, anytime they have access to the network (e.g. Internet). They have access to almost unlimited amounts of resources which can instantly be scaled up or down based on customers' demand. Customers do not need to invest in any computing infrastructure. Payment model of cloud computing is a utility-based model, in which customers only pay for the amount of resources that they use. A detailed explanation of cloud computing can be found in section 3.1.2.

Although the underlying 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. Below, these potential advantages will be discussed in more details.

2.1. 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 canceled 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). Another strategy which has been proven to enhance SMEs’ ability to compete against larger companies is the use of appropriate Information and Communication Technologies (ICT) (Tan, Chong, Lin, & Eze, 2009). Although adopting new technologies help SMEs gain competitive advantage, it usually involves high cost. These costs are fixed costs (such as hardware, software, storage, licensing etc.), operating costs (such as cost of operation, maintenance, systems upgrade, etc.) and training costs. Moreover in many cases IT projects involve cost overruns.[3] (Jorgensen & Molokken-ostvold, 2006; Whittaker, 1999).

Cloud computing, as a new computing paradigm, offers many advantages to companies, especially smaller ones. Flexibility, scalability, and reduced cost are just some of many advantages that cloud computing offer to SMEs. Detailed explanation of cloud computing's advantages will be discussed later in literature review section (section 3.1.3). Cloud computing enhances companies' competitive advantage (Throng, 2010). It also enables SMEs to access sophisticated technologies without spending significant amount money. These advantages help SMEs grow larger and become more efficient, productive and innovative, by allowing SMEs to focus on their core business. This is applicable to both start-ups and already existing companies. It should also be noted that cloud providers are specialized in providing IT services; therefore the service provided by these companies is better than the service that is delivered by IT department of SMEs. Relying on massive, centralized data centers, results in achieving economies of scale (Ryan, Merchant, & Falvey, 2011). Cloud's security measures are implemented on large scale, which makes it much cheaper. This is another result of levering economies of scale (Cattehhu & Massonet, 2009).

2.2. Economy and Cloud computing

As it is briefly mentioned in the introduction, SMEs are very important players of each market. Although they are not powerful enough to individually affect the economy, overall their effect on economy is considerable. SMEs make 98.8% of total employer businesses [4] in Canada. According to industry Canada, as of December 2011, 98.1% of all employer businesses in Canada are small-sized businesses, and 1.7% of businesses are medium-sized businesses. That

[3] Cost overrun is the case where the actual cost of project becomes higher than the initial estimated cost
[4] Employer Businesses are those which maintain a payroll of at least one person

makes large businesses account for only 0.2% of employer businesses (Key Small Business Statistics - July 2012 , 2012). According to statistics Canada in 2005, SMEs, including unincorporated businesses, contributed to 54.3% of GDP produced in the business sector. Also SMEs are very labor intensive. They accounted for 58.1% of the labor income component of GDP and for 40.1% of the operating surplus, which is a component associated with the return to capital (Statistics Canada, 2011). Moreover, smaller firms are the source of many innovations. Acs & Audretsch (1988) found that in comparison to larger firms, the correlation between the number of patents and rate of production innovation is much higher for smaller companies. Also, many of the giant players of today's market started their businesses as small companies some of the good examples are Ford, Microsoft and Boeing (Acs, Morck, Shaver, & Yeung, 1997).

The above mentioned factors make SMEs vital for economies. Acceptance and usage of any beneficial technology by SMEs have a positive influence on the economy as a whole. Since cloud computing help SMEs save money and become more efficient and productive, its widespread usage has a direct impact on the economy as well. The economy which consists of more innovative, efficient and productive businesses is better off than the economy in which businesses are neither successful nor productive. Moreover, the economies of scale always result in better use of resources; therefore an economy in which IT services operate on economies of scale uses resources more efficiently. It is another indirect advantage of cloud for the economy.

Chapter 3
Research Question

As it is mentioned in the previous chapter, determining the factors that influence the adoption of cloud computing is an important topic. So far, this topic has not received enough attention from researchers in the field. The main research question of this study is as follows:

What are factors that influence the decision to use cloud computing by SMEs?

Determining the factors that influence the decisions to adopt cloud computing allows us to predict the rate of adoption of cloud computing. In order to do so, I use the results from companies who already adopted cloud computing and those who have not adopted it. Comparing these two groups allows us to understand what factors prevented; and what factors encouraged companies to adopt cloud computing.

Among four well-known research paradigms[5], I used positivism as the research paradigm. Positivism paradigm views reality as discrete events that can be observed by human sense. In this paradigm, the only acceptable knowledge is the knowledge that is derived from experience; and I should be able to measure this knowledge (Blaikie, 2009). This research, which is a predictive one, follows a deductive strategy. A deductive research strategy tries to find an explanation for an association between two concepts by proposing a theory (Blaikie, 2009). The conceptual framework that is proposed in this research originated from two well-known theoretical frameworks in this field of study. These two theoretical frameworks are Diffusion of Innovation (DOI) theory developed by Rogers (1995; 2003) and Technology, Organization, Environment (TOE) framework proposed by Tornatzky and Fleischer (1990). Based on Rogers's DOI, individual characteristics, internal characteristics of organizational structure, and external

[5] Four research paradigms are positivism, Critical Rationalism, Classical Hermeneutics, and Interpretivism

characteristics are factors that influence the organizational innovativess (Rogers, 1995). He later proposed a new model to predict the rate of adoption in a social system. In this new model five influential categories are introduced which are attributes of innovation, types of innovation decision, communication channels, nature of social system, change agent's characteristics (Rogers, 2003). The second theoretical framework is the TOE framework developed by Tornatzky and Fleischer (1990). They determined three aspects of enterprise's context to be influential in adopting new technologies, which are Technological context, Organizational context and Environmental context. The conceptual framework that is being proposed in this study adapts selected elements from DOI and various from TOE. DOI proposed by Rogers in one of the most commonly used theories to study the adoption of innovations; however this theory has its own drawbacks; for instance, it does not take into account the environmental aspects of the context. In order to overcome the issue with DOI, we used the second theory which is TOE. Overall, studying the adoption rate of innovation is an interesting topic because first of all innovations have significantly changed our lives. For example Internet and computers are two of main innovation that changed our lives significantly. Another important reason that makes this field of study important is the fact that innovation providers face many challenges in spreading their products in the market. They may have a brilliant idea but not be able to spread it in the market because they do not know what the main factors that are important for consumers are.

3.1. Cloud computing Literature Review

3.1.1. History of Cloud Computing

The underlying concept of cloud computing was first introduced in 1950. During that time large scale mainframes was available for academia and corporations use. Mainframes were too costly and it was not practical to have separate mainframes for each user; therefore a new architecture was developed. Based on this new architecture users from different terminals were able to access the mainframe and share the CPU time and power. By doing so, the return on investment was increased and the mainframes' idle (inactive) time was decreased. Later, in 1960s this phenomenon became more popular after John McCarthy started to argue that computation will someday become a public utility (McCarthy, 1960). Nowadays this idea has become more popular than ever. Many believe that in near future, just like other types of utility (water, electricity, gas and telephony) the basic level of computing will be provided to people to meet their day to day needs (Buyyaa, Yeoa, Venugopala, Broberga, & Brandicc, 2009). Another influential person to the history of cloud is J.C.R. Licklider who developed APRANET[6]. He was probably anticipating the power of Internet and cloud computing when he was introducing his famous "intergalactic computer network" concept (A Complete History of Cloud Computing , 2012). In 1990s telecommunication companies, who used to deliver their services based on point to point data circuits, changed their service delivery strategies. They offered Virtual Private Networks (VPN) services. It was during those days when the symbol of cloud was first used to depict the connection between providers and users. Later, when computers become more popular, scientists and technologists developed new algorithms by which the computing resources were allocated to users more efficiently. These algorithms were providing the optimal use of computing resources, such as infrastructure, platform and applications (Cloud computing , 2013).

Salesforce.com, which started its operation in 1999, delivered the first actual cloud computing service. It was the first company who delivered an application from its own website. After the dot-com bubble collapsed, many companies went out of business. Research shows that only 50% of dot-com companies survived until 2004. Companies which survived had to redesign

[6] APRANET is the progenitor of global Internet; and it is the first network to implement TCP/IP

their business processes, to find new ways to make money. Internet was an opportunity to be used by these companies. For them Internet was not just a medium to do business but a vital part of their businesses. In 2002 Amazon.com introduced Amazon Web Service; this service was giving customers the ability to store their data and also to allow many people to work on the same task. In 2004 Facebook, which is a social networking website, was launched. Amazon's Elastic Compute Cloud (EC2) was launched in 2006, which was enabling users to run their application on cloud. The pay-as-you-go model of payment which is now the standard for cloud computing was first introduced by Amazon's Simple Storage Service (S3). In 2007, force.com which was a Platform-as-a-Service, was launched by Salesforce.com. In 2009, Google Apps, which was allowing people to create and store their documents online, was launched. Right now major cloud providers are thinking about finding a way by which they can integrate. In 2010, salesforce.com launched a cloud-based database which enabled customers to develop applications on cloud. Developed application can be used by any device, run on any platform and be written in any language. (A Complete History of Cloud Computing , 2012)

3.1.2. Definition of Cloud Computing

To date, there is no universal definition for cloud computing; different researchers defined cloud computing in different ways. Perhaps the most accurate definition of cloud computing is the one offered by the National Institute of Standards and Technology (NIST):

> "Cloud computing is 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. This cloud model is composed of five essential characteristics**,** three service models, and four deployment models." (Mell & Grance, 2011)

According to this definition, *on-demand self-service, broad network access, resource pooling, rapid elasticity,* and *measured service* are essential characteristics of cloud computing.

On-demand self-service allows users to increase the amount of computing resources that they use without any human interaction from cloud provider's side. *Broad network access* allows users to access the service over the network using any device (e.g. cell-phones, laptop, desktop) that is capable of connecting to the network (e.g. Internet). Using a multi-tenant model allows computing resources to be pooled by customers. This *Resource pooling* enables providers to serve multiple users by same computing resources. *Rapid elasticity* allows customers to use as much resource as they want based on their demands. *Measured service* allows customers and providers to have access to accurate resource usage. Providers and users are able to monitor, control and report their usage easily. (Mell & Grance, 2011)

As it has already been mentioned, cloud computing is the integration of already known computing services such as High Performance Computing (HPC), grid computing, virtualization and utility computing (Gong et al., 2010). There are some differences and similarities between cloud computing and other computing paradigms. Security, programming model, business model, compute model, data model, applications and abstraction are factors that differentiate cloud computing from other types of computing such as grid computing (Foster, Zhao, Raico, & Lu, 2008). Other aspects of cloud computing which distinguish it from other types of computing are cloud's ability to provision an on-demand service; be an autonomic computing system[7]; and finally be a scalable and flexible system (Wang, Laszewski, Younge, & He, 2010). Similar to grid computing, cloud computing uses distributed computing resources to accomplish the objective of the application. However, unlike grid computing, cloud computing uses virtualization to achieve the required objective. Cloud computing and utility computing are similar, because both of these computing services provide on-demand service to customers; and

[7] Autonomic computing system is self-management system, which can react to internal and external events without human interaction. Cloud computing uses this type of computing to reduce the resource costs

charge them only for resources they used. Virtualization is the basic technology based on which cloud computing has been shaped. It allows customers to pool resources and virtually access resources on an on-demand basis. Finally cloud computing is similar to autonomic computing because it enables autonomic resource provisioning (Zhang, Cheng, & Boutaba, 2010).

Cloud computing has three different service models: infrastructure-as-a-system (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS). IaaS which is the basic level of cloud service is the service of delivering infrastructure services to customers over a network (e.g. Internet). These infrastructure services include both hardware (e.g. storage and network) and software (e.g. operating systems and virtualization technologies). It is similar to hosting but different in a way that customers do not need to have long term contract with the provider of the service; and also they are allowed to provision resources on demand (Bhardwaj, Jain, & Jain, 2010). In this model of cloud computing, providers are only responsible for keeping data centers operational; and the rest such as deploying and managing software are part of customer's responsibilities. Customers have control over operating systems, storage, and deployed applications (Mell & Grance, 2011). In each billing period, customers are only required to pay for the amount of resources that were used. It can be based on the amount of compute usage per hour, storage per GB, data transfer etc. Amazon's Web Services Elastic Compute Cloud (EC2) and Secure Storage Service (S3) are two examples of IaaS.

The second level of cloud computing is called Platform-as-a-Service (PaaS). PaaS is a model of cloud computing by which customers have online access to all the resources that are required to build an application. Some of the services that are offered in PaaS model are application design, development, testing, deployment, and hosting tools (Velte, Velte, & Elsenpeter, 2009). Customers have access to programming languages, libraries, and other tools that are required to develop an application. PaaS allows developer to develop and deploy their applications without being concerned about buying, installing and managing the underlying infrastructure platform. Everything they need is available from the Internet. One potential problem with PaaS is that each cloud provider has its own programming language; therefore if a programmer develops an application using a provider`s programming language it is difficult for him/her to switch to another provider. For example the programming language used by Google's PaaS (AppEngine) are Python or Java, and the programming languages used by Microsoft's PaaS cloud (Windows Azure) are .Net, PHP, etc. (Windows Azure, 2012).

The last and the most common cloud computing model is Software-as-a-Service (SaaS). In this model an application or a piece of software is delivered to customers over a network such as Internet. The application is installed on providers' servers; and customers just use the application. Users can access the software anytime and anywhere they desire as long as they have access to internet (Fang & Yin, 2010). They do not need to be concerned about the development and maintenance of the application. The application is accessed by client devices through some thin client interfaces such as web browsers or through a program interface (Mell & Grance, 2011). Except some limited settings, usually consumers do not have access to infrastructure and cannot customize it (Khan, Zhang, Khan, & Chen, 2011). Usually customers are only able to change very basic configuration of the systems such as basic changes to the appearance of the system. Some may find it difficult to distinguish between PaaS and SaaS; the main difference is that PaaS users are able to develop applications while for SaaS users the application is already installed in the providers' server; and customers are using the application. Companies such as Salesforce and Google provide both types of services at the same time. This means that cloud users are able to develop an application on these companies' platforms and at the same time allow other people to access that application online (Velte, Velte, & Elsenpeter, 2009). Figure 1 depicts three levels of services offered by cloud computing.

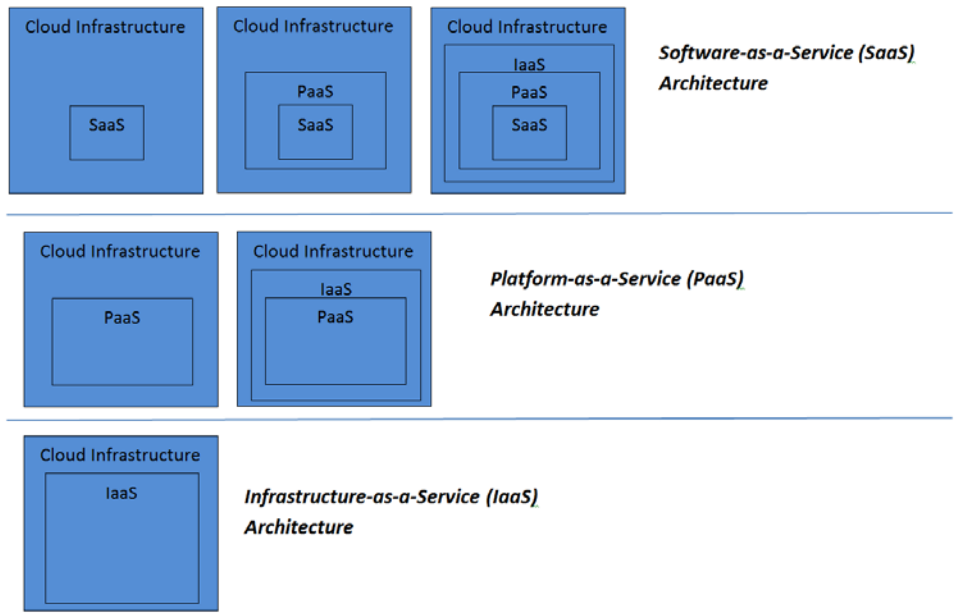

Figure 1 Cloud computing service models based on NIST's definition of cloud

As it can be seen in figure 1, in none of these models, customers have full control over cloud providers' infrastructure. Among these three models, IaaS is a service model with the most control over the provider's infrastructure. In comparison to IaaS, PaaS has less control over providers' infrastructure. In this model all the services that are offered in IaaS, are part of cloud providers' responsibilities. Finally SaaS is an application or software delivered to customers over a network. SaaS users of this service have very little control over the infrastructure in which the application is installed. Managing and controlling the underlying infrastructure and platform is part of the cloud providers' tasks.

Cloud computing also has four different deployment models: *private cloud, community cloud, public cloud and hybrid cloud*. *Private cloud* is a type of cloud computing in which the cloud service is not offered to public; it is exclusively offered to one particular organization. Consumers of this type of cloud are different units and departments of that specific organization. In this deployment model, the underlying infrastructure of the cloud can be owned (or leased), operated and managed by the organization itself, by a third party or by both. Depending on the company, the underlying infrastructure of the cloud can be on or off-premises (Mell & Grance, 2011). In this deployment model of cloud computing, any legal consequence of misusage of information by cloud providers can be prevented (Kim, 2011).

Similar to private cloud, community cloud is exclusively offering service to a specific unit. But unlike private cloud this unit is not comprised of one specific company, rather a group of organization in a community which shares a set of similar concerns such as mission, security requirements, policy, and compliance consideration, etc. is using this type of cloud (Mell & Grance, 2011). The ownership, management and operation of the cloud can be dedicated to one or more companies in the community; and in some cases it is outsourced to a third party. Similar to private cloud the infrastructure can be on or off-premises. In comparison to private cloud this deployment model brings economies of scale and equilibrium to the community (Dillon, Wu, & Chang, 2010).

Third deployment model of cloud computing is *Public cloud*. Nowadays, public cloud is the most common deployment model. It offers the service to general public. Cloud providers have the full ownership of the infrastructure; and they have their own rules, policies, and pricing models. Public cloud providers can be businesses, academic or government organizations. The service is offered to general public for use. The physical infrastructure of the cloud provider is on-premises of cloud providers. Some of the well-known public cloud providers are Amazon, Google, IBM and Microsoft (Grossman, 2009).

Finally, *hybrid cloud* is the combination of two or more previously explained models (private, community and public cloud). Different types of clouds are combined and bound together by standardized technologies and techniques that enable the portability of data and applications between different types of cloud (Mell & Grance, 2011). One of the main reasons for using hybrid cloud is to enhance the core competencies of the organizations. Companies are able to outsource their non-core activities to a public cloud provider, while managing their core activities using their on-premises private cloud. In such a way, organizations can maintain their cost and security at a reasonable level; but at the same time there are some issues regarding standardization and interoperability of clouds which should be considered (Grossman, 2009).

3.1.3. The Advantages of Cloud Computing

According to MarketsandMarkets global research company, the value of worldwide cloud market will be about $121 billion by 2015 (marketsandmarkets, 2010). A similar study conducted by Gartner, reports that by 2016 the value of global cloud industry will reach $148.8 billion (Jones, 2010). European Union (EU) prioritized the support of cloud computing, which positively supports the fact that experts are optimist about the future of cloud computing (Bajenaru, 2010). The reason behind this success is linked to the benefits that cloud computing brings for individuals and organizations.

Cloud computing has many advantages for companies. Cloud computing allows organizations save money; become more productive; increase their operational efficiencies and effectiveness; and concentrate on their core businesses instead of non-core activities such maintaining and upgrading systems. These are just some of the advantages of using cloud computing. In this section I will discuss in more details some of the benefits of cloud computing for organizations.

Chapter 3
Research Question

One of the characteristic of cloud computing which differentiates it from other types of computing is its payment model, which is a utility-based payment model. Utility-based payment model is a pay-as-you-go method, which involves minimal initial investment. This model correlates companies' payments to the actual resource they used. In other words companies only pay for the amount of service and resources they use. It converts the companies' capital expenditure (CapEx) into operational expenditure (OpEx) (Creeger, 2009). Traditionally companies had to forecast their peak demand; and according to that forecast, invest in infrastructure (CapEx). Using cloud computing, companies are not required to invest in or manage infrastructure. Eliminating the capital expenditure is beneficial for both start-ups and already existing companies. Start-ups tend to be very cost conscious. Cloud computing help start-ups manage their costs more effectively. Cloud computing is also advantageous for already operating companies. Based on their system analysts forecast, these companies already invested in some infrastructure. Incorrect forecast wastes their investment. Cloud computing provides companies with the opportunity to use their existing infrastructure (as a private cloud) to perform their core business activities; and use public cloud for their non-core activities. The conversion of CapEx to OpEx is specifically important for smaller firms.

Another beneficial characteristics of cloud computing is its on-demand self-service characteristic. It makes cloud computing more flexible than other computing paradigms. Unlike traditional models of computing, cloud computing is location independent, which means customers are able to access and use the service wherever they have access to the network. Using cloud computing is also device independent, which means the service is able to function on a wide variety of devices regardless of the local hardware on which the software is used. As long as users can connect to the network through a browser, they are able to use the service. Being location and device independent increases the flexibility of cloud computing in comparison to traditional forms of computing such as on-premises deployment. This flexibility in turn, increases the productivity and efficiency of the companies by letting them perform their job remotely.

Another main advantage of cloud computing is its ability to scale up and down. Majority of companies have different demands over time; therefore their need for computing services also varies over time. When estimating how much resources is needed, firms tend to provision for their peak time (Armbrust, et al., 2010). The problem with this provisioning of resources is that when companies are not at their peak time, their resources are idle. Not utilizing computing resources to their maximum capacity is wasting money. Scalability of cloud computing significantly reduces the resources idle time. Companies only use the amount of computing resources that they need. If their demand increases and they need more computing resources, they can instantly scale up the resources. Resources are dynamically released to customers with minimal human interaction (Marston et al., 2011)..

Maintaining internal applications and data centers is a stressful and costly procedure which can be reduced or eliminated by using cloud computing (Clark, 2009). Cloud computing helps SMEs use the most state of the art technologies, without being responsible for operating and maintaining the technology. Outsourcing company’s IT to cloud providers significantly reduces the complexity of using computing resources, because customers do not need to be concerned about upgrading or maintaining the technology. The service provided by cloud providers is accessible over the network and it takes negligible amount of time and effort for customers to deploy and use the system.

Cloud computing allows SMEs to focus more on their core business and innovation (Ashford, 2008). All the resources, time and effort that should had been allocated to the companies' IT department; can now be spent on other important areas of the business. SMEs, whose main business is not related to IT, do not need to be concerned about maintaining or upgrading their Information Systems (IS). Rather they can work on their core business; and increase the efficiency and productivity of their companies. It also allows them to become more innovative; and find new ways of doing business.

3.1.4. Concerns about Cloud Computing

Although cloud computing has many advantages, it involves some potential issues and risks. There are different opinions about the potential risks of using cloud. Some argue that these concerns are legitimate, while others may say these concerns are not valid. Some of the main issues with cloud computing which have been extensively discussed by scholars and researchers are cloud's security, reliability and privacy and ownership of data. According to Sultan and Tan et al. (2009) security and reliability are two main concerns about services offered by cloud computing (Sultan, 2011; Tan, Chong, Lin, & Eze, 2009). In addition to these issues, there are also some other barriers for companies specifically SMEs preventing them from adopting cloud computing.

The first and the most commonly discussed issue about cloud computing is the concern about security of the cloud. Security of the cloud refers to many issues such as privacy, confidentiality and auditability of the cloud (Zhang, Cheng, & Boutaba, 2010; Khan, Zhang, Khan, & Chen, 2011). Other researchers argue that security-related issues of cloud computing are related to third parties' access to their data; or the issues regarding the data transmission and data storage (Subashini & Kavitha, 2011). Hackers are also a big threat to the security of information that is transmitted to and from cloud (Kim, 2011). Identity theft is another main security-related issue that companies face (Chorafas, 2011). However, according to a survey done by Federal Bureau of Investigation (FBI), on origins of information security risks, disgruntled employees were the number one reason behind security breaches.

There are different perspectives about the security of the cloud. In a study conducted by Repschlaeger et al. (2012) managers of 30 companies participated in a survey. The finding of their survey show that 83% of managers ranked security and compliance as high importance. Some believe the cloud is not secure, while others believe it is more secure than other types of computing. Security issues that are discussed by opponents of cloud computing are security issues related to the cloud providers' resources, application security, data transmission security (e.g. network infrastructure security) and data storage security (server security) (Subashini & Kavitha, 2011). In 2008, IDC conducted a survey on 244 IT executives about cloud computing. Figure 2 summarizes the finding of this survey According to this survey for 74.5% of these IT executives the main issue about cloud computing is security concerns. (Gens, 2008).

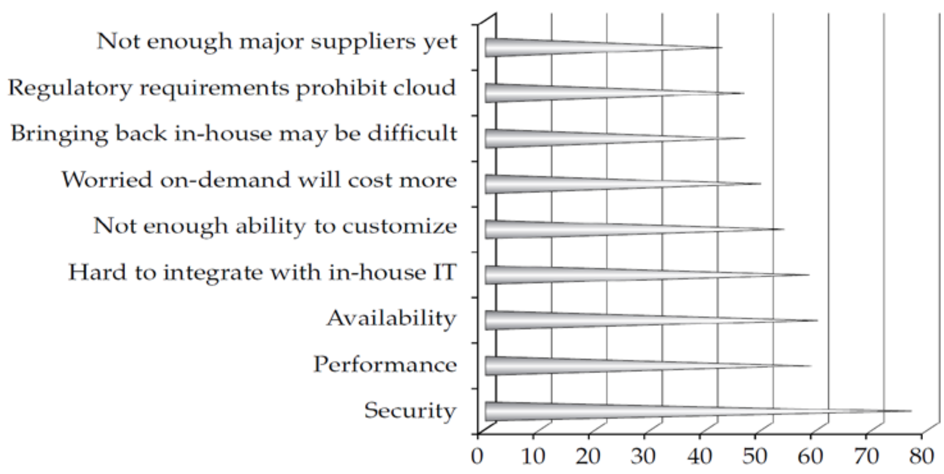

Figure 2 IDC's Findings about Issue Facing Cloud

Unlike previous studies about the security of the cloud, another study conducted by European Network and Information Security Agency (ENISA) suggests that because of the fact that cloud providers are specialized in creating data centers and security measures, they can provide better security than small companies who want to manage their own security (2009). They believe cloud providers offer up-to-date security measures to their data centers. Also because of the backup versions that they have, they can also take care of emergency problems if some happens.

Current businesses are so reliant on their Information Systems, that in many cases the service operation below 99.99%[8] is not acceptable for them. Reliability of the service is another concern about cloud computing services which depends on many factors. When continuity of a service is guaranteed, the service is considered as being reliable. Also a reliable system performs in the planned way. A reliable system should be available and operate without any failure, under certain conditions.

Customer lock-in is the next issue with cloud computing. Customer lock-in is the case where a customer who is using cloud computing cannot easily switch to another provider. There is no standardized format among cloud providers in storing data. Usually the format in which the customers' data are stored in the providers' data centers is unique to that specific provider. Therefore customers cannot easily transfer their data to another cloud provider. If they want to switch to another provider, they should change the format of the data; which may result in the loss or damage to the data. Customer lock-in forces customers to stay with the same cloud provider, even if they are not satisfied with the service they receive. Customer lock-in is a favorable situation for cloud providers.

[8] 99.99% service availability is equivalent to 52.56 minutes downtime per year; which is the same as 4.32 minutes per month

Other less discussed concerns about cloud computing are as follows:

- The place where data is stored, which may cause some legal consequences
- Who accesses the data
- Cloud providers' compliance with the agreement
- Complexity of the system

One way to overcome the problems that are just discussed is to create a set of rules and policies that address these concerns (Subashini & Kavitha, 2011). A good Service Level Agreement (SLA) addresses these problems. A comprehensive SLA includes both threats and opportunities of the service. Some argue that the security and privacy of the data should equally be distributed among parties that are involved. Developing new standardized and open technologies and programming languages create new business models for cloud providers, which improves cloud providers' value chain (Mohammad, Altman, & Hwang, 2009). Also, proposing standard rules and policies regarding the format of data significantly reduces the risk of customer lock-in. In summary, I believe for SMEs the benefits of using cloud computing significantly overweight the disadvantages of cloud computing. A good SLA can minimize the risks that are involved with cloud computing services.

3.1.5. Previous Studies on Cloud Computing

The aim of this section is to provide an overview of previously published papers about cloud computing. Many studies try to define what cloud computing is. They mainly try to improve the reader's understanding and knowledge about cloud computing. (Grossman, 2009; Youseff, Butrico, & Da Silva, 2008). Some other researchers aim to investigate the concept of cloud computing by studying only one type of cloud computing, for example Infrastructure-as-a-Service (Bhardwaj, Jain, & Jain, 2010; Kim, 2011; Repschlaeger et al. 2012). Some of the papers studies one specific system, for example ERP which is offered by cloud providers (Saeed, Juell-Skielse, & Uppström, 2011), e-learning applications (Doelitzscher, Sulistio, Reich, Kuijs, & Wolf, 2011), and Virtual Computing Lab (VLC) (Behrand, Wiebe, London, & Johnson, 2010).

Some other studies focus on the application of cloud computing in different fields of study such as construction (Liu, 2011), digital forensic investigations (Biggs & Vidalis, 2009), service industry (Borangiu, Curaj, & Dogar, 2010) and biology (Talukder, Gandham, Prahalad, & Bhattacharyya, 2010). Other studies aim to explain how consumers can benefit from using cloud computing. Depending on the study consumers are individuals, companies, or educational organizations.

Many other scholars conducted research about the risks of using cloud. They basically try to identify the challenges that are related to using cloud computing. These issues and challenges have already been discussed in section 3.1.4. (Dillon, Wu, & Chang, 2010; khorshed, Ali, & Wasimi, 2012; Subashini & Kavitha, 2011; Katsaros, Mehra, & Vakali, 2009; Jensen, Schwenk, Gruschka, & Iacono, 2009; Zhang, Cheng, & Boutaba, 2010). Some other researchers proposed different models, strategies and ways (such as change in policies, regulations and laws) that can be used to face the issues related to cloud (Li, Zhou, Shi, & Guo, 2010; Khan, Zhang, Khan, & Chen, 2011; Buyyaa, Yeoa, Venugopala, Broberga, & Brandicc, 2009; Ryan, Merchant, & Falvey, 2011; Khalid, 2010).

Diffusion of technologies is one of the interesting areas of research; however diffusion of cloud computing has not yet received much attention from researchers. Peiris et al. (2011) conducted a research about this topic, in which they tried to develop a model that not only considers the financial aspects of cloud computing but also other business initiatives such as IT governance structures, IT operational control structures and technical architecture requirements.

This model can be used by companies to define whether adopting cloud computing is beneficial for them or not.

Another study which investigates the adoption of cloud computing is conducted by Low et al. (2011). They investigated the influence of eight factors in adoption of cloud computing in high tech industry in Taiwan. They try to identify the factors that distinguish cloud adopters from non-adopters. They ran a survey; and collected 111 usable responses. Their regression analysis show that while relative advantage has a significant negative influence on adoption of cloud computing, top management support, firm size, competitive pressure, and trading partner pressure characteristics has a significant positive influence on diffusion of cloud computing. Compatibility and complexity were not significantly influencing the adoption of cloud computing (Low, Chen, & Wu, 2011).

Another study investigated the adoption of cloud computing by college students. On one hand they studied the acceptance of cloud computing by students' and on the other hand they studied students' future intention. They used Technology Acceptance Model3 (TAM3), as their theoretical model. They found that the students' characteristics such as their ability to travel to campus influence the usefulness perceptions. First-hand experiences with the platform and instructor support are other factors that influence students' perception about ease of use (Behrand, Wiebe, London, & Johnson, 2010).

In another study regarding the cloud computing adoption, authors suggest that the usage of cloud computing can be viewed from two different perspectives, IT outsourcing and technology adoption. They also suggest that using cloud computing may have negative consequences (such as losing money) for companies, if they adopt this technology without a thorough analysis of all positive and negative aspects of it. In this study authors propose a conceptual model containing both negative and positive aspects of cloud computing. This model is based on three different theories: transaction cost theory, resource dependence theory and diffusion of innovation theory. They have not conducted any empirical research. (Nuseibeh, 2011)

Taylor and Hunsinger (2011) conducted a research about the acceptance and usage of Google Docs[9] in a university setting. In order to complete their study they used the Theory of Planned Behavior. In order to collect data, they conducted interviews and surveys. After running regression analysis they found out that attitude, subjective norm, and perceived behavioral control are factors that significantly influence the students' acceptance and usage of Google Docs. According to this study, the person's emotional response is the factors that significantly influence the students' intention to use Google Docs.

Many countries such as Australia, Japan, Malaysia, Taiwan etc., significantly invested on cloud-related projects. This is another reason that makes research about cloud computing compelling (Lin & Yen, 2011). Despite its importance, few researchers studied the adoption process of cloud computing. This number is even less for studies whose main focus is on Small and Medium-sized Enterprises. Therefore, there is no doubt that this research question is appropriate and persisting. The results of this study will significantly contribute to the field of study; and will be valuable for both practitioners and researchers.

[9] Google Docs is a cloud service provided by Google

Chapter 4
Theory Review

Current market is characterized as being very competitive. Therefore, for companies who want to survive, it is essential to adopt innovations. As it has been mentioned previously, one of the most state-of-the-art technologies that assist companies gain competitive advantage is cloud computing. Cloud computing allows companies to access the most advanced technologies over a network (e.g. Internet). If companies switch to cloud computing, they can save time, energy and money. These resources can then be spent in other value-adding areas of their business. It makes companies more efficient and productive which is particularly true for SMEs.

If several companies switch to cloud computing the payback for companies and the economy is much higher. In that case cloud computing brings efficiency to the economy and environment. Cloud providers are specialized in offering IT services; therefore they can accomplish IT-related tasks more quickly and by spending fewer resources. Moreover, offering any service in large scale brings in economies of scale which results in more efficient operations. Economies consisting of more efficient and innovative companies are certainly better off than those which are comprised of inefficient companies. Widespread usage of cloud computing will reduce the number of data centers; because individual companies do not need to have their own data centers. Data centers that are operating by cloud providers consume resources in a more efficient manner than small datacenters. Cloud computing is based on virtualization, which results in consumption of less power. It is one way to achieve environmental sustainability.

Cloud computing is still in its early stages of diffusion; therefore studying its adoption process is very useful. It helps cloud providers recognize the factors that influence the decision to adopt cloud computing. In a study conducted by Marston et al. (2011) a research agenda about cloud computing is proposed. One of the topics that have been proposed in this study is research about technology adoption and implementation (Marston et al. 2011).

Practitioners and researchers agree that diffusion of an innovation in the market depends on different factors. During the last five decades, scholars have tried to determine the factors that influence the diffusion process of different technologies. Many different theories and models have been proposed to study the process of adopting new technologies. The eight major theories of this field are Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1980), the Technology Acceptance Model (TAM) (Davis, 1989; Davis F. , 1986), the Motivation Model (MM) (Davis, Bagozzi, & Warshaw, 1992), the Theory of Planned Behavior (TPB) (Azjen, 1985, 1991), the Combined TAM and TPB (c-TAM-TPB) (Taylor & Todd, 1995), the Model of PC Utilization (MPCU) (Thompson, Higgins, & Howell, 1991), Diffusion of Innovations (DOI) (Rogers, 1962)and Social Cognitive Theory (SCT) (Compeau & Higgins, 1995). Among these theories, DOI is one of the most commonly used theories that try to explain and predict the adoption of innovations. DOI is a theory developed by Rogers which is originated from Sociology field (Rogers, 1962). Majority of these theories explain and predict the adoption decision, based on factors that are related to the technology itself (such the characteristics of the technology, or users' perception about the technology). However, technology-related constructs are not the only factors that influence the adoption of technologies. There are other factors (such as environmental and organizational factors) that influence the decision to adopt an innovation. These factors, specifically environmental factors, are not taken into account in DOI. Technology-Organization-Environment (TOE) is another theoretical framework that overcomes this drawback. This framework not only uses technological aspects of the diffusion process, but also non-technological aspects such as environmental and organizational factors. None of these models are flawless; and each of them has its own shortcomings. In this research paper, I proposed a research model based on DOI and TEO. I believe this model explain the adoption of the technology (in particular cloud computing) more accurately. The aim of this chapter is to introduce Rogers's DOI and TOE framework.

4.1. 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 behavior of individuals. This study illustrated the importance of opinion makers' attitude in changing voters' mind. Later, Ryan and Gross (1943) studied the factors influencing the diffusion of seed corns in two Iowa communities.

Although this theory was used by other scholars, Rogers is the one who popularized this theory. 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). The objective of this theory is to define why one innovation successfully diffuses in a society, while another does not. 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' characteristics. The next section of this chapter aims to explain the DOI theory by defining the different constructs of this theory. It allows us to have a more clear understanding about the factors that influence the adoption of an innovation.

4.1.1. Key Elements

In the third edition of his famous book, Rogers (1983) defined diffusion of innovation as "the process in which an innovation is communicated through certain channels over time among the members of a social system". Based on this definition, diffusion of innovation comprised of four core elements: innovation, communication channel, time and social system. Below each of these elements are explained in detail.

"Innovation"

There are various definitions for innovations. Most commonly, innovation is considered as any new idea, process, product, technology etc. which is perceived as new by individuals. Rogers (1983) argue that each innovation has different attributes which influence its diffusion in the society. Relative advantage, compatibility, complexity, trialability, and Observability are the five key attributes of each innovation. Relative advantage is defined as "the degree to which an innovation is perceived as being better than the idea it supersedes" (Rogers, 2003). Often times, relative advantage has a positive influence on diffusion of innovation. Compatibility is "the degree to which an innovation is perceived as consistent with the existing values, past experience, and needs of potential adopters" (Rogers, 2003). Compatibility of an innovation also positively influences the speed of adoption in a society. An innovation, which is compatible with the norms and values of individuals or with norms of a social system, spreads faster than an innovation which is not compatible. Complexity is "the degree to which an innovation is perceived as relatively difficult to understand and use" (Rogers, 2003). Usually complexity has a negative effect on diffusion. This means that a more complex innovation has less chance to be successfully diffused in the society. Trialability is defined as "the degree to which an innovation may be experimented on a limited basis" (Rogers E. M., 2003). Last but not least, is observability which is "the degree to which the results of an innovation are visible to others" (Rogers, 2003). According to Tornatzky and Klein (1982), among all these five characteristics, relative advantage, compatibility and complexity are factors that most significantly influence the adoption rate of different innovations.

"Communication channel"

The second element of DOI is communication channel through which the innovation is spread. Any type of tool or medium which is used by individuals to transfer knowledge to someone else is considered as a communication channel. The innovation is transmitted from the unit of analysis (individual or firm) who has knowledge about the innovation to the second unit of analysis (individual or firm) who does not have knowledge and information about the innovation. This transfer of knowledge is done through a communication channel. According to Rogers (2003), there are two types of communication channels, mass media and interpersonal channels. The role of these channels is either to increase awareness about the innovation or to persuade targets to adopt the innovation. The purpose of using mass media (e.g. TV, newspapers, magazines, etc.) is to deliver information to general public. This type of media usually does not target a specific group; and its main objective is to increase awareness about an innovation. On the other hand, the objective of interpersonal channels is to persuade people to make their adoption decisions. The increased popularity of Web 2.0 makes internet to be both a mass media and an interpersonal channel.

"Time"

Time is another central element of DOI theory. The process of adopting an innovation does not occur instantaneous. It takes place over a period of time; and it involves different stages. As it is shown in figure 3, diffusion of an innovation involves five different stages: knowledge, persuasion, Decision, implementation and confirmation.

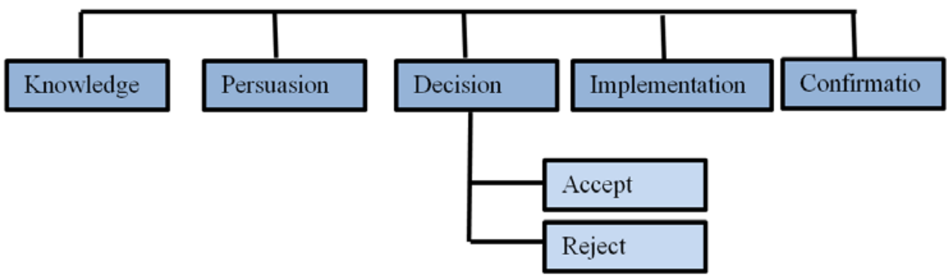

Figure 3 Innovation Adoption Process

During knowledge stage individuals come across an innovation, but they do not have much information about it. At this stage of adoption process, individuals are not inspired to find more information about the innovation. Persuasion stage starts, when individuals become interested in the innovation, and try to find more information and details about the innovation. During the decision stage individuals compare the advantages and disadvantage of the innovation; and decide whether to accept or reject the innovation. Implementation stage is the one during which individuals start to use the innovation. At this stage, based on their experience, individuals determine whether the innovation is useful or not. If it is useful they might look for more information about it. Confirmation stage is the last stage of this model in which individuals finalize their decision; they start to recognize the benefits of using the innovation; and promote the innovation to others.

In addition to stages of diffusion, time also defines various categories of adaptors. According to Rogers (2003), people have different degrees of willingness to adopt an innovation. He categorized adopters into five different groups: innovators, early adopter, early majority, late majority and laggards. His assumption is that number of individuals in different groups is normally distributed over time (Rogers, 2003). Members of each group share some common characteristics, for instance innovators tend to be younger, risk takers; and have higher social class and wealth. Figure 4 depicts various categories of adopters. As you can see, most adopters are part of early majority and late majority groups.

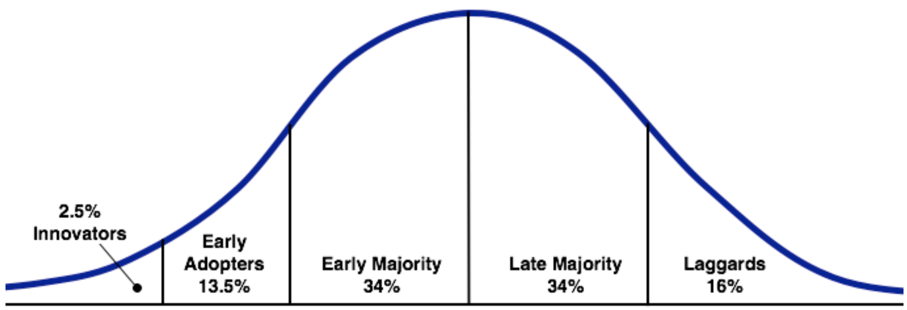

Figure 4 Categories of Adopters

"Social system"

According to Rogers (1983), social system is defined as "a set of interrelated units that are engaged in joint problem solving to accomplish a common goal". It is within the social system that norms and roles become meaningful. Diffusion of an innovation in a social system is influenced by some characteristics of the system which are *social structure, social norms, opinion leaders, change agents, types of innovation-decisions,* and *consequence of an innovation*. Rogers (2003) defined *social structure* as "the patterned arrangements of the units (individuals, organizations, informal groups, and etc.) in a system". Formal structure and informal or communication structure are two types of social structure in the social system.

According to Rogers (2003) *social norms* are the established behavior patterns among the members of a social system. As it is already stated innovations which are not compatible with social system's norms have less chance to be diffused in the system. *Opinion leaders* are individuals who have influence on other members of the social system. They can persuade other member to adopt an innovation. A *change agent* is an individual or an entity that also can influence other members' behavior in a desirable direction. They do not always support the diffusion of an innovation; in some cases they prevent the diffusion of the innovation. For instance, governments can slow down the diffusion of an innovation by enforcing laws and regulations; or they can speed up the diffusion of an innovation by offering subsidies and incentives (Rogers, 2003). *Consequence of innovation* is another factor that influences the diffusion of an innovation in the social system. Individuals are less likely to adopt an innovation if they do not obtain any short-term benefit by adopting it. For instance, the diffusion of sustainable products which have long-term consequences is slower than regular products. Figure 5 depicts all the elements of DOI.

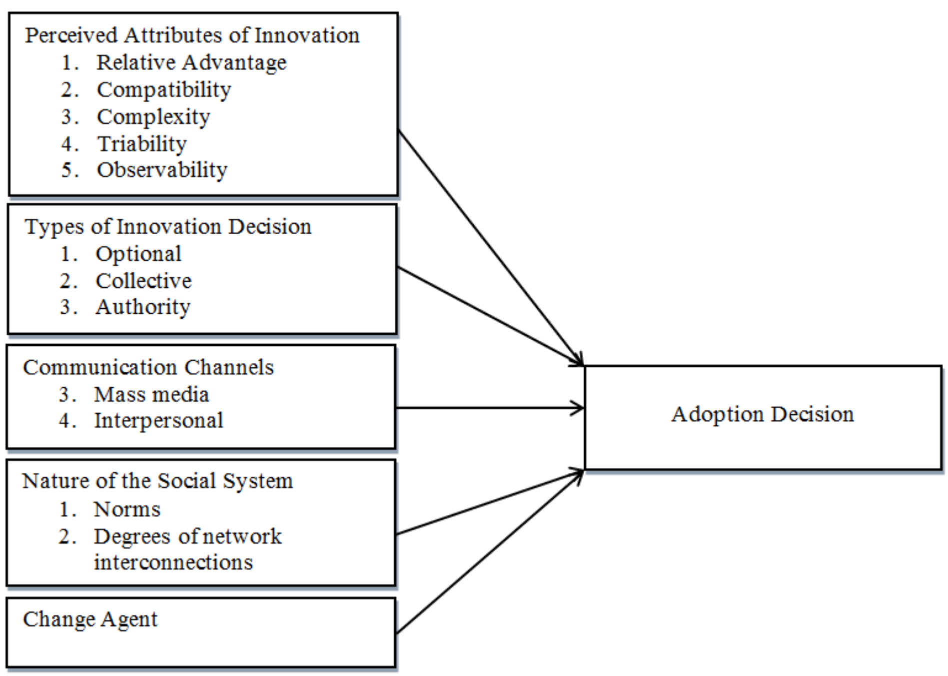

Figure 5 Factors Influencing the Rate of Adoption of Innovations in Social Systems

Types of innovation decision depend on two factors: the degree of voluntariness; and the person responsible for decision making. Optional decision making is the one in which one person who is distinguishable from others in social system, makes the decision. In collective decision making decision is made by all individuals in social system. Finally in authority decision making few people makes decisions on behalf of the whole social system (Diffusion of Innovations, 2012).

DOI not only describes individual level adoption, but also is applicable at firm level. When it comes to diffusion of innovation at firm level the story is somewhat different. In comparison to individuals, decision making at firm level is more complex, for the reason that firm level innovation-decision tend to involve more than one individual (presumably both supporters and opponents). Rogers (1995) proposed another model to explain the level of innovativeness at firm level. According to Rogers (1995), organizational innovativeness depends on the leader's characteristics, internal characteristics of organizational structure and external characteristics of the organization. Figure 6 depicts the DOI theory at firm level. He defined innovativeness as "the degree to which an individual or other unit of adoption is relatively earlier in adopting new ideas than the other members of a system" (Rogers E. M., 1995).

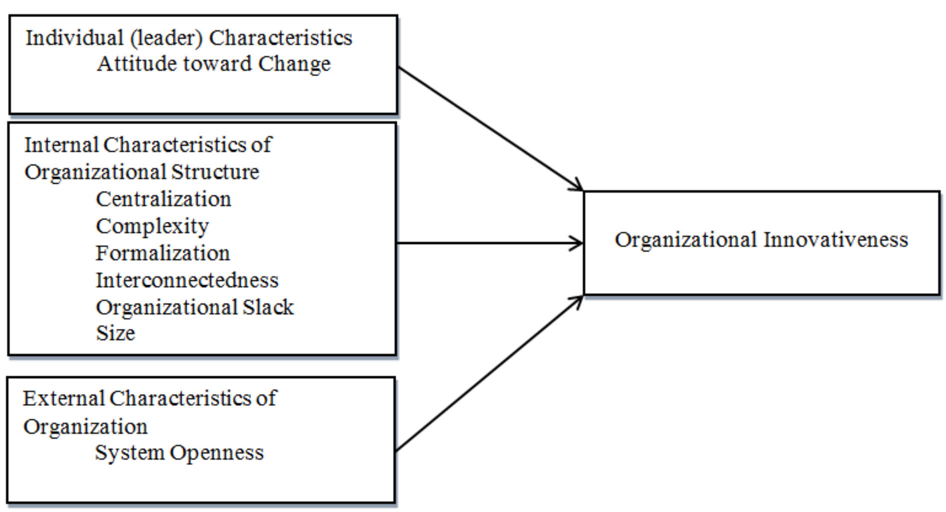

Figure 6 Diffusion of Innovations (Rogers, 1995)

Rogers (1995) described leaders' characteristics as their attitude toward change. The individuals' attitude toward change influences the level of their innovativeness. The individuals' attitude toward an innovation changes after they gain knowledge about an innovation (Sahin, 2006). Centralization, complexity, formalization, interconnectedness, organizational slack and size of the company are internal characteristics of the organization which impact the level of organizational innovativeness. According to Rogers (1995) "centralization is the degree to which power and control in a system are concentrated in the hands of a relatively few individuals"; "complexity is the degree to which an organization's members possess a relatively high level of knowledge and expertise"; "formalization is the degree to which an organization emphasizes its members' following rules and procedures"; "interconnectedness is the degree to which the units in a social system are linked by interpersonal networks"; "organizational slack is the degree to which uncommitted resources are available to an organization"; and finally "size is the number of employees of the organization". Rogers (1995) also define system openness as being the external characteristics of the organization, which influences the organizational openness.

4.1.2. Previous Studies on Diffusion of Innovation

Rogers's DOI has extensively been used by scholars from different fields. Majority of the studies aim to either confirm the validity of the model; or they used the constructs to interrogate the diffusion of an innovation. As stated by Rogers (2003) the variance in adoption of innovations is mainly explained by the five attributes of the innovation. Below, some of many studies in which DOI is used will be summarized. One of the leading studies in the field of diffusion of innovation is the research conducted by Cooper and Zmud. They investigated the implementation of Material Requirements Planning (MRP) system. The model that they developed aimed to investigate the influence of managerial tasks on the Information Technology; and then the influence of Information Technology on adoption and infusion of technology. They conducted a cross- sectional field survey to test the research hypotheses. They conducted phone interview with random sample of American Production and Inventory Control Society members in United States. Their findings emphasize on the importance of properly positioning managerial rationality. This factor is very important in explaining the diffusion of innovation, but not that explanatory in describing the infusion of the innovation. They also found that political interests influence the decision to adopt innovations. They argue that the political forces within the organization may be the reason that their model was not successful in predicting infusion of MRP system (Cooper & Zmud, 1990).

In 1999, Thong (1999) used Roger's DOI to develop a new model of IS adoption in the context of Small businesses. He argued that four categories of factors impact the decision to adopt a new IS; and the extent of IS adoption. Decision makers' characteristics, IS characteristics, organizational characteristics and environmental characteristics are determinants of IS adoption. In order to empirically test the model, a questionnaire survey was completed by 166 small businesses. In order to test the hypotheses, he used discriminant analysis. Their findings show that decision maker's innovativeness and IS knowledge, innovations' relative advantage, compatibility and complexity, business size and employees' IS knowledge have a positive impact on IS adoption. However, the extent of IS adoption is significantly determined by organizational characteristics. Finally, he found environmental characteristics not to be influential in the adoption of IS by small businesses.

In 2001, Eder and Ibgbaria studied the diffusion of Intranets in organizations. Their proposed model defined earliness of adoption, top management support, organizational structure, organizational size, IT infrastructure and IS structure to be influential in diffusion and infusion of innovations. They conducted a cross-sectional field survey to collect data from senior level computer executives from organizations across the United States. They sent the survey out to 1000 organizations. They received 281 useful responses from companies. They used hierarchical multiple regression to analyze their data. They performed a Principal Component Analysis to test the discriminant and convergent validity of their items. Their findings suggested that Intranet diffusion is positively associated with earliness of adoption, top management support, and organizational size. Moreover, according to this paper, earliness of adoption, top management support, and IT infrastructure flexibility are positively associated with intranet infusion; this association is mediated by intranet diffusion. (Eder & Igbaria, 2001)

Another study which investigated the adoption of a technology is the one conducted by Beatty et al. (2001). They surveyed 286 medium and large size US businesses, who already adopted websites. Their findings reveals that time play an important role in adoption of websites by businesses. They studied the influence of five different factors: perceived benefits, organizational compatibility, technical compatibility, top management support and complexity. Respondents were IS managers who were personally involved in web site development. They used MANOVA to test their hypotheses. Perceived benefits and compatibility with existing technology and organizational norms are factors that had significant impact on early adopters. There were no significant findings for later adopters. Authors suggest that late adopters may adopt the technology because they view it as a strategic necessity. They found benefits and compatibility as influential factors in adoption and continuous usage.

Another study that used Rogers's DOI is a study conducted by Bradford and Florin (2003), in which the adoption of Enterprise Resource Planning (ERP) Systems is investigated.

They developed and tested model based on DOI and Information Systems Success (IS) theories. This model, which is developed to study the ERP implementation success, is comprised of three categories of variables (innovative characteristics, organizational characteristics and environmental characteristics). They defined implementation success as organizational performance and user satisfaction. They developed a survey based on already existing instruments and measured responses based on a 7-point Likert –type scale. In total 51 managers completed the survey. They used a linear regression to analyze their data. According to their data analysis top management support and training are positively related to user satisfaction. At the same time perceived complexity of ERP and competitive pressure negatively impact user satisfaction. Although competitive pressure negatively influences user satisfaction, it is positively related to perceived organizational performance. Consensus in organizational objectives is another factor which is positively associated with perceived organizational performance. They conducted a post hoc analysis; this analysis identified user satisfaction as a moderator between certain DOI characteristics and organizational performance. According to these findings they proposed a new model of ERP implementation for future studies.

Many researchers not only used DOI constructs, but also in many cases modified the model to propose a new model. One of the studies which applied diffusion of innovation model to study the ICT adoption by SMEs is the paper written by Tan et al. (2009). They added some constructs to Roger's five influential factors; and proposed a new model. They used this model to study the factors that influence the adoption of internet-based ICT in SMEs. Using a questionnaire-based survey they collected data from 406 managers or owners of SMEs in the southern region of Malaysia. In order to test their hypotheses, they used a multiple regression analysis. Their findings show that internet-based ICT is perceived as a low cost yet effective communication tool for customers. However, security is still one of the major barriers to adopt. They found relative advantage, compatibility, complexity, observability, and security to significantly influence internet-based ICT adoption.

The application of DOI in adoption studies is not limited to quantitative studies. Gollakota and Doshi (2011) used DOI to perform a qualitative study to investigate the diffusion of rural telecenters in the developing world. According to their literature review and analysis, they found information and knowledge about technology as well as sufficient infrastructure to significantly influence the diffusion of telecenters in rural areas in developing countries. They also found out that the diffusion of telecenters in rural areas is significantly related to considering the existing traditions and practices, the importance of perceived complexity, and visibility of the use and benefits of the telecenters.

DOI does not take into account the environmental aspects of the context; therefore there is a need to use another theory which considers the environmental aspects as well. In this study I used another theoretical framework which takes into account other aspects of enterprise's context. Technology Organization Environment (TOE) framework is another theoretical framework which studies the factors that influence the adoption of new technologies. In the next section of this chapter I introduce this framework and its key elements. I then review previous studies that used this framework.

4.2. Technology Organization Environment Framework

TOE framework which is developed by Tornatzky and Fleischer (1990), is originally an organizational psychology theory. However, it has extensively been used by IS researchers. According to TOE framework, three aspects of enterprises' context influence the decision to adopt an innovation at firm level. Figure 7 depicts the TOE framework and its elements. As it shows the decision to adopt a technological innovation is influenced by technological, organizational and environmental aspects of the enterprise.

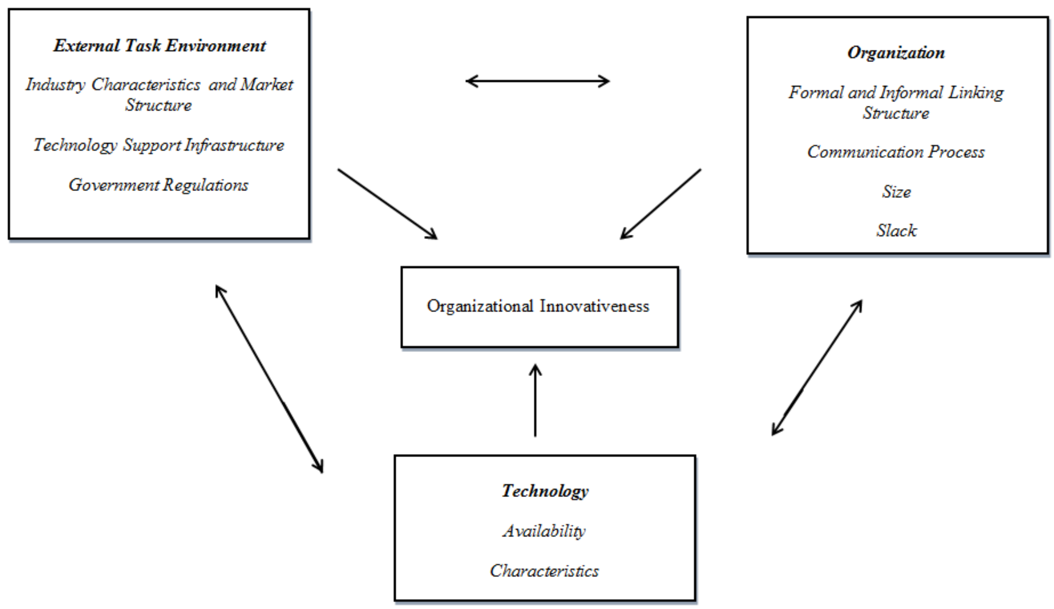

Figure 7 Technology Organization Environment Framework

TOE framework was first introduced and described in the book written by Tornatzky and Fleischer titled as "*The process of Technological Innovation*" (1990). The main purpose of the book is to describe the entire process of innovation at firm level. TOE framework is only one part of this book; the remaining chapters of the book describe the other parts of innovation process such as the development of innovation. Unlike DOI, which explains the innovation adoption at both individual and firm level, TOE‘s focus is on firm level adoption decision. The main difference between DOI and TOE is that TOE framework considers environmental aspects as well. TOE's dependent variable is not only the adoption decision but also the likelihood of adoption, intention to adopt, or the extent of adoption of the new technology. According to Hsu et al. (2006), TOE improves DOI's ability to explain the intra-firm innovation diffusion. In the next section of this chapter, the main elements of this theory are explained in more details.

4.2.1. Key Elements

As it is depicted in Figure 7, technological aspect of the TOE framework refers to both availability and characteristics of the technologies. Any internal and external technology that is relevant to the firm is part of the technological aspect. According to TOE, technologies that are currently in use by the firm and technologies which are in the market but not in use by the firm influence the adoption decision. Technologies that are currently in use by the firm influence the adoption decision, because they define the scope and limit of the technological change that the firm can accept. On the other hand the technologies that are in the market but not in use by the firm influence the adoption decision, because they indicate how firms can evolve by adopting new technologies. According to Tornatzky and Fleischer, Technologies that are outside the firm’s boundaries create incremental, synthetic or discontinuous changes. Technologies that offer incremental changes only add new features to the existing technologies. This type of technologies has the lowest amounts of risks. Innovations which produce synthetic changes are those which combine already existing technologies in a novel way. These innovations are moderately risky. Discontinuous changes are those which are radically different than the existing technologies. (Baker, 2012)

Organizational context of TOE framework describes the characteristics and resources of the organization such as its size, structure and communication processes. Organizational characteristics affect the adoption and implementation decisions in many ways. Organizational Structure is a factor that influences the adoption process. Researchers believe that decentralized organizations are best suited for innovation stage; while centralized organizations are best suited for implementation stage of innovation process. Communication process within the organization is another organizational factor that influences the adoption process. Top management behavior is also another influential factor which can promote or inhibit the adoption of an innovation.

There are different opinions about the role of slack resources in the organizations. Although the existence of slack is desirable for companies, it does not necessarily support the adoption process. The role of size in adopting innovations is not yet understood; and there is no defined relationship between size and adoption rate (Baker, 2012).

Environmental aspect of this framework refers to structure of the industry, technological support infrastructure, and government's regulations. Some researchers believe that in the rapidly growing industries the adoption is higher, while in mature or declining industries, innovation practices are not clear. Another environmental factor that influences the adoption process is the availability of skilled labor. The impact of government on innovation process is not clear. Government regulation can either support or inhibit the adoption of innovation (Baker, 2012)

4.2.2. Previous Studies on TOE Framework

TOE framework has been used by many researchers in IS field to study the process of adopting new technologies. In many studies the TOE framework is used as the only theoretical framework to investigate the adoption process, while in many other researches the theory is combined with other theoretical frameworks to investigate the adoption process. I first go through some of the studies that have solely used TOE model; and then review the studies that have combined TOE and DOI. The first reviewed study is the one that investigated the adoption process of open systems. In this study perceived Benefits, perceived barriers, perceived Importance of compliance to standards, interoperability, and Interconnectivity are part of technological context of the open-system. Complexity of IT infrastructure, satisfaction with existing systems, and formalization of system development and management are organizational factors. Finally market uncertainty is part of external environment context. They collected data by conducting face-to-face interviews with senior executives of 89 firms in Hong Kong. T-test, factor analysis and logistic regression are method that was used to analyze their data. Their findings suggest that companies tend to be more concerned about their ability to adopt rather than the benefits they gain by adopting. Also, adopter firms perceive higher government pressure but lower industry pressure than non-adopter firms do (Chau & Tam, 1997).

Another research which used TOE framework is the one conducted by Kuan and Chau (2001). These two researchers studied the adoption of Electronic Data Interchange (EDI) system. Perceived direct benefits and perceived indirect benefits are variables in technological contexts. Perceived financial cost and perceived technical competence are organizational factors. Perceived industry pressure and perceived government pressure are environmental factors. They developed a questionnaire and sent it to 575 small businesses in Hong Kong. They used factor analysis and logistic regression to analyze their data. Among six factors, five found to significantly influence the adoption of EDI by small firms. Their results indicate that direct benefits are perceived to be higher by adopter firms than by non-adopter firms; adopter firms perceive lower financial costs and higher technical competence than non-adopter firms do.

Zhu et al. (2003) studied the adoption of e-business by organizations. According to the conceptual model they proposed, IT infrastructure, e-business know-how, firm scope, firm size, consumer readiness, competitive pressure, and lack of trading partner readiness are factors that influence the adoption of e-business. They used industry and country effect as control variables. They collected their data by conducting telephone interview. They collected data from 3100 businesses and 7500 consumers from Germany, UK, Denmark, Ireland, France, Spain, Italy, and Finland. They analyzed their data by running Confirmatory Factor Analysis (CFA), second-order factor modeling, logistic regression, and cluster analysis (CA). The sample was divided into high

EB-intensity and low EB-intensity countries to check the adoption patterns. Their findings reveal that technology competence, firm scope and size, consumer readiness, and competitive pressure are significant adoption drivers, while lack of trading partner readiness is a significant adoption inhibitor.

Another study which is conducted by Zhu and Kraemer (2006) investigated the adoption of e-business by applying the TOE framework. In this research technology competence is the technological factor; size, international scope, and financial commitment are organizational factors and competitive pressure and regulatory support are environmental factors that influence the decision to adopt e-business. They added two more construct to this model which are front-end functionality and back-end integration. Data collection procedure was conducted by telephone interviews with 624 firms across 10 countries during 2002. Countries are chosen from both developed (Denmark, France, Germany, Japan, Singapore, U.S.) and developing (Brazil, China, Mexico and Taiwan) countries. In order to analyze the data authors used CFA, second-order factor modeling, and SEM.

Another research which was published by Zhu et al. is the research which not only focuses on the adoption of innovation but also other stages of innovation assimilation including initiation, adoption and routinization. Zhu et al. (2006) used TOE framework to develop a model based on which they hypothesized that technology readiness, technology integration, firm size, global scope, managerial obstacles, competition intensity, and regulatory environment are influential factors that impact the e-business assimilation at the firm level. They studied the influence of each factor on all stages of technology assimilation. In order to empirically test the proposed model they used a data set of 1,857 firms from 10 countries. They developed a questionnaire survey to collect data through a computer aided telephone interview. They had two different subsamples from developing and developed countries. They used covariance-based Structural Equation Modeling (SEM) by AMOS 4.0. Their findings reveal that competition positively affects initiation and adoption, but negatively impacts routinization. They found that large firms tend to enjoy resource advantages at the initiation stage, but at later stages they should overcome the structural inertia. They also found the effect of environment on innovation assimilation is higher in developing countries. They found technology readiness to be the strongest factor in developing countries, while integration to be the strongest influential factor in in developed countries.

The deployment of B2B e-commerce by organizations is studied using the TOE framework. In order to conduct data, authors conducted a field survey of senior IT executives from North American organizations. 249 firms participated in this study. Unresolved technical issues, lack of IT expertise and infrastructure, and lack of interoperability are technological factors of this model. Organizational factors of this model are difficulties in organizational change, problems in project management, lack of top management support, lack of e-commerce strategy, and difficulties in cost-benefit assessment. Environmental factors are unresolved legal issues, fear and uncertainty. After running factor analysis, univariate t-test and multivariate discriminant analysis, they figured out that key inhibitors in B2B deployment are the lack of top management support, unresolved technical issues, the lack of e-commerce strategy, and the difficulties in cost-benefit assessment of e-commerce investments. (Teo, Ranganathan, & Dhaliwal, 2006)

The adoption of e-commerce development as an innovative business process is studied by Liu (2008). Support from technology provider, and human capital are technological aspects of this model. Management level for information and firm size are organizational aspects. User satisfaction and e-commerce security are environmental factors; and finally firm property is used as control variable. They conducted email survey, online survey and telephone interview to collect data. To analyze their data they used factor analysis and PLS. Their findings reveal that technology foundation, user satisfaction, management, EC security, and potential technology investment tend to have the most significant impact on EC development. Firm size seemed to be a non-significant factor, while firm property was found not to affect EC development.

The adoption process of ERP systems was studied by Pan and Jang. (2008). They conducted face-to-face interview with 99 firms in Taiwan's communications industry. They believe IT infrastructure, technology readiness, firm size, perceived barriers, production and operations improvement, enhancement of products and services, competitive pressure, and regulatory policy are influential factors that can be grouped into three different categories. In order to analyze their data they performed factor analysis and logistic regression. According to their analysis technology readiness, size, perceived barriers and production and operations improvements are important determinants of the adoption of ERP. The R-Squared of this model is 79.8%; this means that the model correctly classifies the decisions made with respect to the adoption of ERP.

Electronic procurement is another technology whose process is studied using TOE framework. Li (2008) identified the factors that influence the adoption of electronic procurement in Chinese manufacturing enterprises. They proposed and tested a model based on TOE framework. They conducted a telephone interview with 120 managers. Reliability and validity of the model was tested. In order to analyze the data logistic regression was used. The results of their analysis supports the research model. Their findings show that relative advantage, top management support, external pressure and external support determine e-procurement adoption.

In another study conducted by Lin and Lin (2008) the internal integration of e-business and external diffusion of use of e-business were investigated. IS infrastructure, and IS expertise are constructs from technological context; organizational compatibility, and expected benefits of e-business are organizational constructs; and competitive pressure and trading partner readiness are variables from environmental context. They collected data through an Email survey during 2006. Their sample size was 163; they surveyed IS executives of large firms in Taiwan. In order to analyze their data they did Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM). Based on their analysis IS infrastructure, IS expertise, expected benefits of e-business, and competitive pressure are factors that influencing the diffusion of e-business among large firms.

Oliveira and Martins (2009) used TOE framework to study the adoption of website by firms. In their study they described technology readiness, technology integration and security application as technological aspects of the framework. In this study organizational factors are perceived benefits of electronic correspondence, IT training programs, access to the IT system of the firm, and internet and e-mail norms. Competitive pressure is the only environmental factor that is considered; and finally they used the service sector as the control variable of their model. They collected data from 3155 small and 637 large firms in Portuguese. In order to analyze their data they performed Multiple Correspondence Analysis (MCA). Same author published another paper on 2009 in which they studied the adoption of website and E-commerce. They used the same set of variables; and just added e-commerce pressure as another construct to the environmental aspects. This time the focus of their study was on 2626 Portuguese firms (Oliveira & Martins, 2009). Oliveira and Martins continued their study on adoption of e-business (2010). They collected data from 2,459 firms belonging to EU27 countries across two industries. Analysis stage was completed by employing factor analysis; also logistic regression was used to test the hypotheses. Their findings reveal that the perceived benefits and obstacles of e-business, technology readiness, competitive pressure, and trading partner collaboration influence the adoption decisions.

In many instances TEO framework is combined with other theoretical frameworks such as DOI and institutional theory. Below I review some of the researches which combined TOE framework and DOI theory. In 1999, Thong combined TOE and DOI to develop a conceptual model to be used to study the adoption of information systems by small firms. In this study any firms that was using at least one major software application such as accounting, inventory control, sales, purchasing, etc. was considered as an adopter. Furthermore, the extent of usage was measured by the number of PCs and software applications. In this model CEO's innovativeness, CEO's IS knowledge, relative advantage of IS, compatibility of IS, complexity of IS, business size, Employees' IS knowledge, information intensity, and competition were measured as independent variables. Among all these factors CEOs characteristics are from DOI; and the remaining variables are from TOE. The results of T-tests, factor analysis, discriminatory analysis and PLS was reported. According to their results innovativeness, level of IS knowledge, relative advantage, compatibility, complexity, business size and level of employee’s IS knowledge influence the decision to adopt e-business. However, they do not affect the extent of adoption. Organizational factors are found to influence the extent of adoption (Thong, 1999).

Next study which combined TOE and DOI is the research conducted by Zhu et al. (2006). The conceptual model proposed in this study aims to study the usage and impact of e-business on firms. Relative advantage, compatibility, costs, security concerns, technology competence, organization size, competitive pressure and partner readiness are variables of their model.

Among these factors relative advantage, compatibility, cost, and security concerns are from DOI. They conducted phone interview during 2002; and collected data from 1415 companies across Europe. They used SEM to analyze their data; and their results reveal that compatibility is the strongest driver, and customers are more concerned about security rather than cost. Technology competence, partner readiness and competitive pressure significantly influence e-business usage.

In another research the adoption of collaborative commerce (c-commerce) was studied. Relative advantage, compatibility, complexity, expectations of market trends, competitive pressure, trust, information distribution, information interpretation, top management support, feasibility, and project champion characteristics are constructs of the conceptual model that was proposed. In this study attributes of the innovation are from DOI. They conducted Email survey; their final sample size was 109 firms. They did multiple regression analysis to analyze their data. They found that external environment, organization readiness and information sharing culture significantly influence the decision to adopt c-commerce (Chong, Ooi, Lin, & Raman, 2009).

The last reviewed article is the paper written by Wang et al. (2010) in which TOE and DOI theories were combined to form a new conceptual model. Relative advantage, complexity, compatibility, top management support, firm size, technology competence, competitive pressure, trading partner pressure, and information intensity are constructs of this model. Among these factors relative advantage and compatibility are from DOI. They collected data from 133 Taiwan manufacturing firms using Email survey. They ran logistic regression to analyze their data; and what they found was that information intensity, complexity, compatibility, firm size, competitive pressure, and trading partner pressure are factors that significantly influence the adoption of Radio frequency identification (RFID) by manufacturing firms.

According to Olivirea and Martins (2011) combining different theories help us achieve a better understanding of technology adoption. Therefore in this research two different theoretical models have been combined; and a new conceptual model is proposed. In the next chapter, the research model is described in detail.

According to literature, two theories have found to dominantly been used by researchers to study the adoption of innovations. Attributes of innovation and change agent's characteristics are categories of variables which are most dominantly used in this context. Relative advantage, complexity and compatibility are factors which have the most significant influence on adoption decisions. In addition to these three factors trialability is also an important factor in the context of cloud computing. Moreover in the context of SMEs change agent's characteristics are influential. In this context change agents are decision makers. Again, according to articles related to the TOE framework, organizational factors and environmental factors influence the adoption of innovations. Competitive pressure has found to be a factor which significantly influences the adoption decisions. In the context of cloud computing, external support is considered to be very important factor. Employees knowledge about innovation has found to reduce the resistance against change in organizations; therefore it worth studying this factor. The above mentioned factors are grouped together to form our research model. The model, its constructs and related hypotheses are discussed in more details in following chapters.

Chapter 5
Research Model and Hypotheses

In this chapter the proposed research model and hypotheses are discussed. The first section of this chapter talks about the research model and its constructs. It is then explained which theory each construct belongs to. In the second section of this chapter, each construct is explained in detail and related hypothesis is introduced.

5.1. Research Model

In order to study the adoption of cloud computing by SMEs, I proposed a conceptual model. According to this model, twelve variables influence the decision to adopt cloud computing. These twelve factors are (1) external support, (2) competitive pressure, (3) decision maker's innovativeness, (4) decision maker's cloud knowledge, (5) employee's cloud knowledge, (6) firm's information intensity, (7) relative advantage, (8) complexity, (9) compatibility, (10) security and privacy, (1)triability, (12) cost. All factors except complexity, have positive influence on adoption of cloud computing. Figure 8 depicts the conceptual model proposed in this paper.

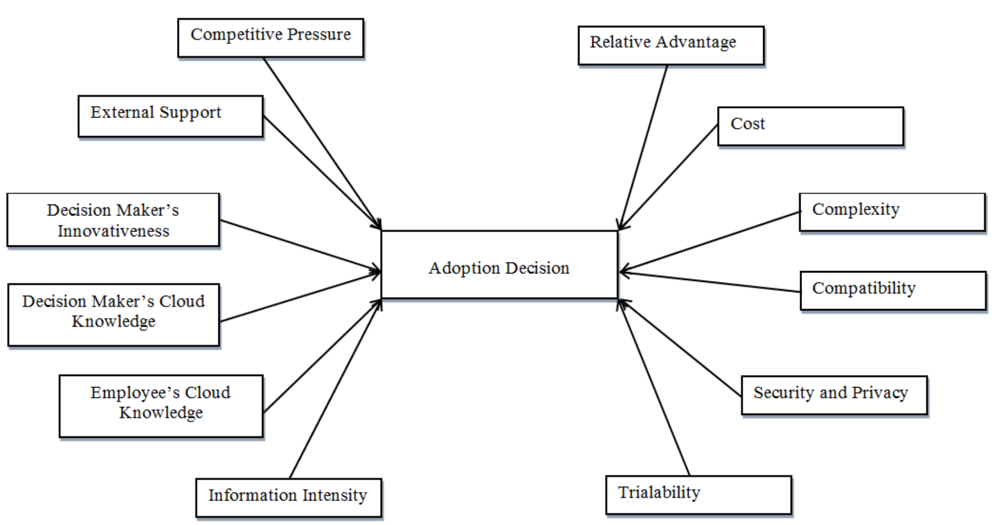

Figure 8 Conceptual Model

Twelve mentioned factors are grouped into four main categories. Figure 9 depicts the variables that are categorized into four groups. Environmental factors, human factors, organizational factors and technological factors are four groups of variables which impact the diffusion of cloud computing among SMEs. As it is already discussed in chapter four, these constructs come from Diffusion of Innovation Theory and Technology Organization Environment Framework. These factors are modified based on the context of SMEs. Environmental factors are those factors that are external to the organization. They may influence the decision to adopt new technologies. In my model competitive pressure and external support are environmental factors. Organizational factors are characteristics of the organization which influence the adoption decision. The company's information intensity and employees' knowledge about cloud computing are organizational factors. The third category of variables is human factors. According to Thong and Yap (1995) for SMEs, decision makers' characteristics considerably influence the decision to adopt an innovation. In my model, decision maker's innovativeness and cloud knowledge play an important role in adoption of new technologies. This is particularly true in the context of SMEs. Last category of constructs in our model is technological factors. This group of variables is mainly adapted from Rogers' DOI. Relative advantage, complexity, compatibility, and trialability are attributes of innovations identified by Rogers. A very important study done by Tornatzky and Klein (1982) reveals the fact that relative advantage, complexity and compatibility are characteristics of innovation which have the most influence on adoption of an innovation. In addition to these three factors, trialability is also included, because it is an important factor about cloud; and majority of the big cloud providers such as Microsoft offer trial versions of their cloud services.

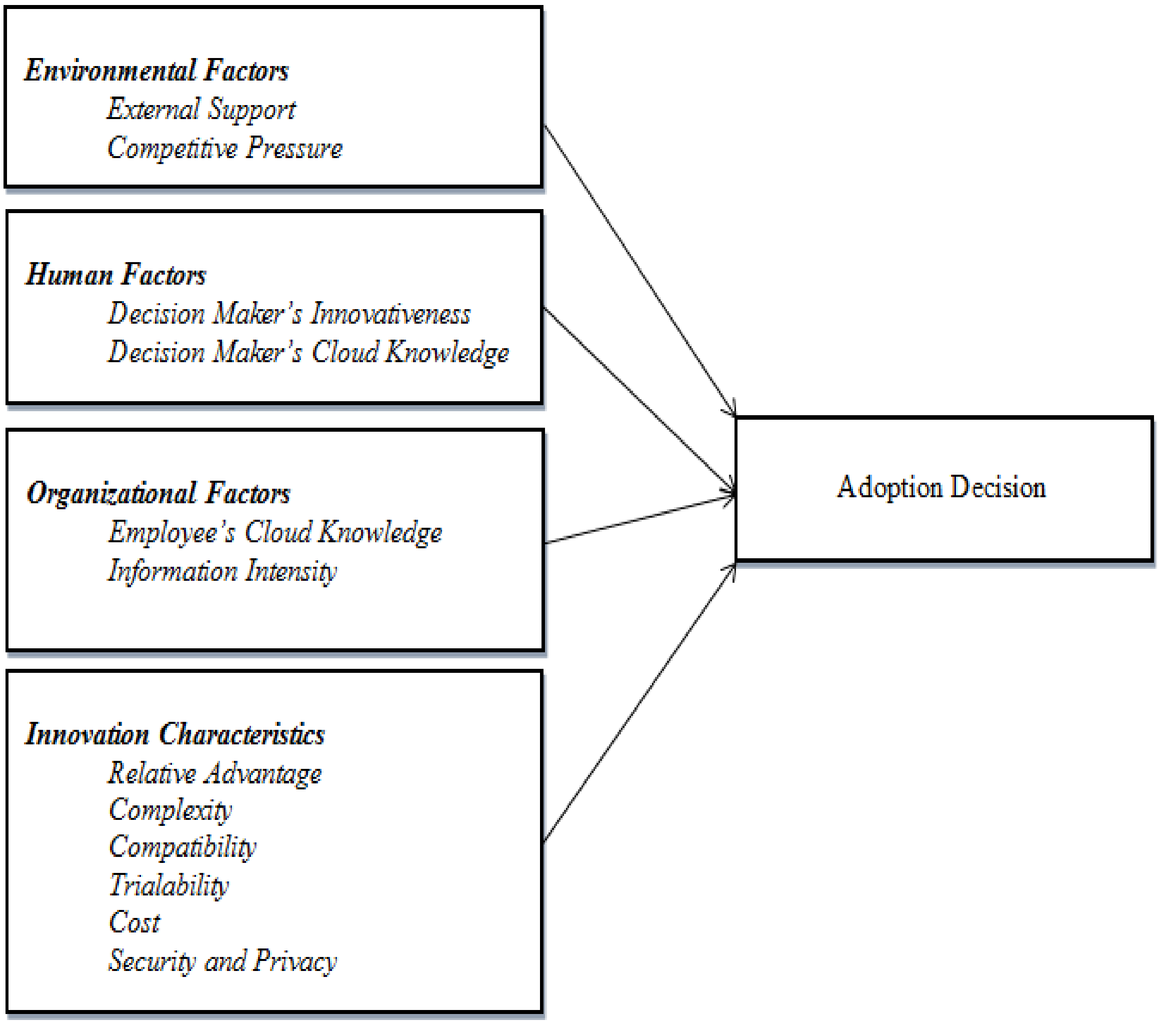

Figure 9 Research Model

Table 1 provides a more detailed definition of each construct and their hypothesized effect on diffusion of cloud computing.

Variable	***Definition of Variable***	***Effect on Decision***
Relative Advantage	The degree to which decision makers perceive cloud as being better than other computing paradigms	Positive
Complexity	The degree to which cloud computing is perceived as being relatively difficult to understand and use	Negative
Compatibility	The degree to which cloud computing is perceived as consistent with the existing values, past experience, and needs of companies	Positive
Security and Privacy	The degree to which cloud computing is perceived as more secure than other computing paradigms	Positive
Trialability	The degree to which cloud computing may be experimented on a limited basis	Positive
Cost	The degree to which people perceive the cost of using cloud computing as lower than other computing paradigms	Positive
Competitive Pressure	The degree to which competition exist among businesses in the market	positive
External Support	The perceived level of external support offered by cloud providers (Training, customer service and technical support)	Positive
Innovativeness	The level of Decision makers' preference to try solutions that have not been tried out; and therefore are risky	Positive
Decision Makers' cloud Knowledge	Decision Makers' knowledge about cloud computing (various aspects of cloud computing)	Positive
Employees' cloud Knowledge	Employees' knowledge about cloud computing (Based on decision makers' opinion)	Positive
Information Intensity	The degree to which information is present in the product or service of a business	Positive
Adoption Decision	Company's current status (adopted or not adopted cloud computing)	Dependant Variable

Table 1 Definition of variables and their effect on rate of cloud adoption

It can be seen Table 2 which theory each construct of my model belongs to. In this table each construct is linked to a theoretical framework. Also in this table you can find the difference between the original construct in the theory and the construct that is used in the context of cloud computing.

Original Theory	***Variable***	***Construct in original theory***
Diffusion of Innovation	Relative Advantage	Perceived attributes of innovation
	Complexity	Perceived attributes of innovation
	Compatibility	Perceived attributes of innovation
	Trialability	Perceived attributes of innovation
	Innovativeness	Change Agent
	Decision Makers' cloud Knowledge	Change Agent
Technology Organization Environment	Competitive Pressure	Environmental Context
	External Support	Environmental Context
	Security and Privacy	Technological Context
	Cost	Technological Context
	Employees' cloud Knowledge	Organizational Context
	Information Intensity	Organizational Context

Table 2 Original theories and constructs

As it is revealed in table 2, not all the constructs from original theories have been tested in this research. Only those constructs that were applicable to the context of cloud computing is being used. Some of the constructs of DOI theory, including types of innovation decision, communication channels and nature of social systems, are excluded from this research. The innovation-decision factor of DOI theory is excluded because I believe the decision to switch to cloud computing is completely voluntary; and no one can force a decision maker to switch to cloud computing. The nature of social system and communication channel possibly influence the decision to adopt cloud computing, but they are out of scope of this research. Further researches can study the influence of these factors on diffusion of cloud computing.

Among five different attributes of innovation defined in Rogers' DOI, the only factor that is not used in this research is observability. In the context of cloud computing, observability is not an influential factor. The main reason is that the adoption of cloud computing does not have any tangible results. Consequently observability does not influence the adoption of cloud computing[10], hence is not included in our research model. The other four attributes of innovation influence the diffusion of innovation; and therefore are included in our research model. According to literature, relative advantage is significantly influence the adoption of new technologies. However, I should investigate whether it really makes a difference in the diffusion of cloud computing. Complexity is the second attribute of innovation, which is adapted from DOI. As the name implies, complexity compares the difficulty of use of cloud computing with other computing paradigms. It is worthwhile to investigate whether the adoption of cloud computing actually depends on the complexity of the systems. As it is defined by Rogers (2003), compatibility refers to the innovations' consistency with both past behavior and existing values. This factor is also recognized as one of the main characteristics of innovations affecting its diffusion; as a result it is included in our research model. In this research, compatibility is defined as cloud computing's compatibility with norms and culture of the organization; I also examined the technical compatibility of cloud computing with the work environment. Regarding the trialability, it should be noted that, currently majority of the giant cloud providers offer a trial version of their service. For example, Microsoft offers a one month free trial of Windows Azure. As a result, it is worthwhile to study whether offering trial versions of a service actually makes any difference. Cost, security and privacy are other characteristics of cloud computing which I believe need to be investigated. Cloud providers claim that their service is cost effective; and is

[10] It should be noted that I compare the adoption of cloud computing with traditional computing paradigms such as in-house development or installation of computing services. Therefore, in this study I consider those factors which highlight the differences between these two choices

more secure than traditional client-server IT service (specifically for smaller size companies) (Microsoft, 2013; IBM, 2012; Amazon, 2013).

According to Thong and Yap (1995) for smaller size companies decision makers' characteristics significantly influence the adoption of any new technology. For the purpose of this research, IT decision makers are considered as the change agent in the organization. Studying change agent's behavior and characteristics is part of DOI theory. Therefore, I want to know whether their personal characteristics influences the decision to adopt cloud computing. Decision maker's cloud knowledge and innovativeness are factors that form this group. Together, external support and competitive pressure form environmental factors. This category is adapted from TOE model. External support is equivalent to *technology support environment* construct of TOE. Competitive pressure measures the *industry characteristics and market structure* construct of TOE framework. These two factors help us determine whether any pressure from company's environment influences the decision to adopt cloud computing. The last category of variables adapted from TOE model is organizational factors. Information intensity and employee's cloud knowledge are two constructs that form this group. Employees' knowledge is not measured directly; rather it is based on decision makers' perception. In the next section of this chapter, each variable and the related hypothesis is discussed.

5.2. Research Hypotheses

In this section of the research, each construct is explained in more details. The related hypothesis for each construct is then presented.

5.2.1. External Support

Chau and Hui (2001) argue that the size and structure of SMEs do not allow them to have sufficient internal IS support; instead they should rely on external parties. In this context, external support is defined as “The perceived importance of external support offered by cloud providers”. In this research external support includes training, customer service and technical support provided by cloud providers. I think higher levels of external support provided by cloud providers, increases the chance of cloud adoption by SMEs; therefore the first hypothesis is:

H1: Higher level of perceived external support from cloud providers positively affects the likelihood of cloud computing adoption by SMEs

5.2.2. Competitive Pressure

Competitive pressure is the level of competition among firms in the specific industry that the company operates in (Thong & Yap, 1995). It forces companies to be more innovative in order to stay in the business. Porter and Millar (1985) introduced five different competitive forces including new entrants, bargaining power of customers, bargaining power of suppliers, substitute product and services, and rivalry among business in the market. Among these five competitive forces I only consider the last two: rivalry among companies and the threat of substitution. Cloud computing, as one of the most current computing paradigms, is one way to achieve competitive advantage. In the context of cloud computing, the following hypothesis is developed:

H2: Businesses that operate in more competitive environment are more likely to adopt cloud computing

5.2.3. Decision maker’s Cloud Knowledge

As it is indicated in Diffusion of Innovation theory, having enough knowledge about an innovation is the first step in adoption process. According to a paper written by Thong (1999) CEO’s IS knowledge has a positive impact on adoption of information systems. I would like to find out whether this is also true in the context of cloud computing. I believe companies whose decision makers are knowledgeable about cloud computing are more likely to adopt cloud computing. Therefore in the context of cloud computing I developed the following hypothesis:

H3: Decision Makers' knowledge about cloud computing is positively related to the decision to adopt cloud computing

5.2.4. Decision maker's Innovativeness

Innovativeness is defined as "the level of decision makers' preference to try solutions that have not been tried out; and therefore are risky" (Thong & Yap, 1995). Level of innovativeness range from the person's ability to perform tasks in a better way, to his/her ability to perform the task differently. I believe decision makers who prefer to perform the tasks differently are more innovative; and hence they usually adopt new technologies. Therefore it is hypothesized that companies whose decision makers more innovative are more likely to adopt cloud are computing. Hypothesis 4 is related to the decision maker's innovativeness.

H4: Decision Makers' innovativeness is positively related to the adoption of cloud computing

5.2.5. Employee's Cloud Knowledge

Similar to decision maker's cloud knowledge, employees' knowledge about cloud computing is defined as "Employees' knowledge about cloud computing". Employees' knowledge of cloud computing is not directly measured; rather decision makers who participated in this research ranked their employee's IS knowledge. I believe a company whose employees have more knowledge about innovation face less resistance against adoption of new technologies. There are also some empirical evidence that shows the positive relationship between employees' IS knowledge and the decision to adopt IS (Thong, 1999). In the context of cloud computing, the following hypothesis has been developed:

H5: Employee's knowledge about cloud computing is positively related to the adoption of cloud computing

5.2.6. Information Intensity

According to Thong (1999), information intensity is defined as "the degree to which information is present in the product or service of a business". Companies in different sectors have different information intensity, for example financial brokers need to have access to most current information. In this study information intensity is defined as the company's reliance on accessing up-to-date, reliable, relevant and accurate information whenever they need it. I believe companies whose business depends on information are more likely to adopt cloud computing. The following hypothesis is related to this construct:

H6: Information intensity is positively related to the adoption of cloud computing

5.2.7. Relative Advantage

Rogers (2003) defined relative advantage as "the degree to which an innovation is perceived as being better than the idea it supersedes". In this research relative advantage is defined as "The degree to which decision makers perceive cloud computing as being better than other computing paradigms". Many studies which investigated the diffusion process of innovations have found relative advantage to be a significant determinant; therefore it is crucial to study this concept in the context of cloud computing. I would like to know whether being advantageous make any difference in making decision to adopt cloud computing. An advantageous technology is the one that enables companies to perform their tasks quicker, easier and more efficiently. Moreover it improves the quality, productivity and performance of the company. Because of the above mentioned reasons, relative advantage has a positive influence on adoption of cloud computing; therefore in the context of cloud computing the below hypothesis is formulated:

H7: Decision makers' perception about relative advantage of using cloud computing is positively related to cloud adoption

5.2.8. Complexity

Complexity is another factor adapted from Rogers DOI (2003). He defined complexity as "the degree to which an innovation is perceived as relatively difficult to understand and use". In the context of cloud computing, complexity is defined as "the degree to which cloud computing is perceived as being relatively difficult to understand and use". To be more specific, a technology that is difficult to understand, and use is considered to be complex. Furthermore, a technology is considered to be complex if it takes too much time and effort to be learnt; or if the user should spend too much time to perform its normal duties. Therefore, I hypothesize that in the context of cloud computing the level of complexity of the system has a negative influence on adoption of cloud computing:

H8: The perceived level of complexity of the cloud computing has a negative impact on the adoption of cloud computing.

5.2.9. Compatibility

Compatibility is the third constructs which is adapted from DOI. According to literature, compatibility is one of the three constructs which significantly influence the adoption rate of innovations. The definition of cloud computing proposed by Rogers is modified based on the context of cloud computing. In this research compatibility is defined as "the degree to which cloud computing is perceived as consistent with the existing values, past experience, and needs of companies". In this research compatibility is defined as compatibility with norms and culture of the organization, in addition to compatibility with technical aspects of the work environment. I believe the cloud computing's compatibility with work environment has positive impact on adoption of cloud computing; therefore the related hypothesis is as follows:

H9: Level of cloud computing's compatibility with company's norms and technologies has a positive influence on cloud adoption.

5.2.10. Trialability

Consistent with Rogers' definition of trialability, I defined this construct as "The degree to which cloud computing may be experimented on a limited basis". Although in many researches that used DOI, trialability is not an influential factor, in the context of cloud computing it perhaps makes a difference. Majority of the current cloud providers, such as Microsoft, IBM, Amazon etc. offer a trial version of their service. I believe, the opportunity to try and experiment cloud computing on a trial basis positively influences the adoption of cloud computing; therefore the next hypothesis based on the context of cloud computing is:

H10: Higher level of trialability has a positive influence on the adoption of cloud computing

5.2.11. Cost

In this study cost of cloud computing is defined as "the degree to which decision makers perceive the total cost of using cloud computing lower than other computing paradigms". As it has already been mentioned, cloud providers claim that their service significantly decreases the SMEs total IS cost. Total cost includes fixed costs such as initial investment, variable costs such as systems maintenance and upgrade, and training costs. Therefore I believe, low cost of obtaining the service increases the likelihood of adoption of cloud computing; therefore in the context of cloud computing the following hypothesis is developed:

H11. Decision makers' who perceive cloud computing as being less costly than other computing paradigms are more likely to adopt cloud computing

5.2.12. Security and Privacy

In the context of cloud computing security and privacy is defined as "The degree to which cloud computing is perceived as being more secure than other computing paradigms". Cloud providers claim that they are able to protect companies' data more securely than the companies themselves. Security is defined as the security of the service, data centers and media. This construct also takes into account, the privacy and confidentiality of the companies' data. I believe higher levels of security and privacy have a positive influence on the adoption of cloud computing; therefore in the context of cloud computing, the following hypothesis has been developed:

H12: The more decision makers perceive cloud computing as being secure, the more they adopt cloud computing.

Chapter 6
Research Methodology

As it is briefly described in introduction, I am conducting a predictive research. In this research I try to determine the factors that influence SMEs' decision to adopt cloud computing. I am using a positivism research paradigm. Based on this paradigm, reality comprises of a set of events that can be observed by human sense. Usually, knowledge is not considered as part of reality. There is only one exception about knowledge; and that is the knowledge gained from experience (Blaikie, 2009). The knowledge that is based on the experience can objectively be measured; and used to perform positivist research. In order to complete this study a quantitative method is used. According to Blaikie (2009), a quantitative method is a method in which different aspects of a phenomenon are quantified and then measured. In our research I developed a questionnaire; and asked decision makers to fill it out. Decision maker's opinions about different concepts are quantified based on a 5 point Likert-scale type questions. This way decision maker's knowledge which is based on their experience is quantified; and can be analyzed. This research, is a predictive research, and follows a deductive research strategy. Deductive research strategy tries to find an explanation for an association between two concepts by proposing a theory (Blaikie, 2009). The next section of this chapter briefly outlines the data collection and analysis procedure.

6.1. Data Collection

Data collection procedure of this research is based on a survey. I developed a questionnaire which was reviewed and modified by a panel of experts. Final version of the survey was launched online. The responses to our questions were captured based on a 5 point

Likert-type scale. Participants were able to access the survey online. According to a literature review conducted by Tornatzky and Klein (1982), most of the studies in the field of innovation adoption collected data using surveys or interviews. Similar to many other studies, I used a survey to gather data. I asked both adopter and non-adopter companies to participate in this survey. I inquired about their opinion about different aspects of cloud computing including technical characteristic of cloud computing in addition to organizational, environmental aspects of their company. The questions asked from participants are mainly adapted from already published papers in this field. In addition to the standard questions, I also developed some questions which are specific to the context of cloud computing. The survey was then launched; and responses were collected. In the next section of this chapter data collection procedure is explained in details.

6.1.1. Developing the Questionnaire

The developed questionnaire aimed to capture respondents' opinion about cloud computing, and other factors that may influence their decision to adopt cloud computing. The first draft of questionnaire consisted of 55 items. These items were trying to measure the research model's constructs. According to Moore and Banbasat (1991), in order to measure each construct, at least one item should be created. Items were developed based on a 5 point Likert-type scale. Five point Likert-type scales are one of the most commonly used survey formats. The belief is that scales with more than 7 points are confusing (Likert scale & surveys – best practices, 2007). Another study conducted by Dawes (2008), supports this idea. In this study it has been indicated that answers to 5 and 7 point Likert-type questions are almost similar; and had higher mean value than 10 point Likert-type scale. Majority of the items that were included in the questionnaire were adapted from already published articles. Items measuring *external* *support* and some of the items measuring *relative advantage* and *cost* are adapted from a paper written by Chau and Hui (2001), in which the adoption of EDI by small businesses was studied. Items measuring *competitive pressure* and *innovativeness* were adapted from a study performed by Thong and Yap (1995); in which different influential factors in adoption of IT were studied. Items measuring *information intensity, decision makers and employees' cloud knowledge* are adapted from a paper written by Thong (1999). Items measuring r*elative advantage, complexity, compatibility* and *trialability* are adapted from a very well-known instrument developed by Moore and Banbasat (1991). Some of these items, specifically technological characteristics, were modified based on the context of cloud computing. Moreover some of the other items were specifically designed for the purpose of this study. Items that measure *cost, security and privacy* were specifically designed for this study. First set of questions intended to obtain information about the decision makers, such as their innovativeness, and cloud knowledge. Other questions were designed to obtain the participants' view toward cloud computing, and other environmental, and organizational characteristics. The preliminary developed questionnaire can be viewed in appendix one.

6.1.2. Questionnaire items validation

In order to ensure the understandability and content validity of the questions, the questionnaire was reviewed by a panel of experts. It was first reviewed by four Masters' students to check the clarity of the questions. The panel of experts then examined the questionnaire to evaluate the content validity of the questionnaire. The panel of expert consisted of two ITM professors from Ryerson University, and four PhD students from different fields including Information Systems and Entrepreneurship. Based on their comments some of the items were removed, some modified and some other were added to the questionnaire. The new version of the questionnaire was sent to Ryerson's Ethic Board.

6.1.3. Set up the online questionnaire

In order to collect our data, an online questionnaire was launched. The software that was used to design and develop the online questionnaire is Qualtrics. Qualtrics is one of the most commonly used online questionnaire software in both in academic and business environment. Since convincing decision makers to participate in a study is very difficult, I decided to hire a market research company to collect data for us. Although Qualtrics has its own panel of participants, I decided to hire another market research company to find the participants for us. The decision was due to the budget constraint that I had. Empanel Online is the name of the market research company which was hired. Empanel is a well-known and reliable market research company whose expertise is on information technology and business decision makers. This was exactly what I was looking for. Empanel online is a member of Marketing Research Association (MRA); therefore they comply with the "the Code of Marketing Research Standards". The questionnaire was reviewed by an expert in Empanel. She made very good comments about the appearance of the questionnaire. According to her comments, grouping questions which are related into one matrix makes the survey more understandable for respondents. Based on her comments, the questionnaire was modified; and I left with 25 questions consisting of one or more items. Each question was trying to measure one aspect of this study. The final version of the questionnaire can be viewed in appendix 2.

6.1.4. Improve the quality of data

In order to improve the quality of the responses, I added two different Quality Assurance (QA) questions to our questionnaire. The first QA question added to the questionnaire was "if you are still reading this please select Strongly Agree". 54 responses failed to answer this question correctly; and were rejected. The second set of QA questions was added to the end of the questionnaire. They were two exactly opposite questions; and participants who answered the same to both questions were disqualified. Two questions are "cloud computing has *low* training costs" and "cloud computing has *high* training costs". At this stage 21 other participants were marked as disqualified; and rejected. These QA questions allowed me to filter out participants who were not actually paying attention to the questionnaire. They significantly improved the quality of the data that was collected.

6.1.5. Running a Pilot test

I first conducted a pilot study to check the reliability of our questionnaire. The pilot study was conducted on 10 SMEs. Respondents were IT decision makers of these companies. Responses were collected using the designed online survey. Table 3, summarizes the findings of our pilot study. For each construct number of items that was used to measure the construct, its Cronbach's Alpha and inter-item correlation mean is shown. I measured the Cronbach's Alpha and Inter-item correlation mean to check the reliability of the questions. For each constructs I had more than one questions; therefore using Cronbach alpha is appropriate.

Construct	*Number of Items*	*Inter-Item Correlation Mean*	*Cronbach's Alpha*
Relative Advantage	12	0.478	0.906
Complexity	5	0.127	0.559
Compatibility	7	0.124	0.485
Security and Privacy	6	0.568	0.849
Trialability	5	0.657	0.906
Cost	13	0.071	0.546
External Support	4	0.610	0.858
Decision Maker's Innovativeness	3	0.688	0.857
Competitive Pressure	3	0.193	0.408
Decision Maker's Cloud Knowledge	8	0.490	0.895
Employee's Cloud Knowledge	4	0.762	0.926
Information Intensity	3	0.833	0.933

Table 3 Reliability Check (Pilot Study)

Cronbach's alpha is a measure of internal consistency. It defines whether different items that intend to measure a construct, actually measure that specific construct. Based on what is indicated in Kline's (1999) handbook of psychological testing, the alpha greater than 0.7 is acceptable. Based on this rule of thumb, five of our constructs, complexity, compatibility, cost and competitive pressure are problematic. In addition to Cronbach's Alpha I measured the inter-item correlation mean. Inter-item correlation mean of above 0.3 is acceptable. The same five constructs were also problematic in terms of inter-item correlation mean. I carefully reviewed the items that measuring these items. Complexity was measured using the following five questions:

1. Working with cloud computing is complicated it is difficult to understand what is going on
2. It takes too long to learn how to use the cloud computing to make it worth the effort
3. Learning to operate the cloud computing system is easy for me
4. It takes too much time for me if I want to use cloud computing to do my normal duties

5. In general cloud computing is very complex to use

Removing item number 3 increased the alpha and inter-item correlation mean to an acceptable level (alpha = 0.844 and inter-item correlation mean = 0.672). Compatibility was measured using the following 7 items:

1. I think using cloud computing fits well with the way our company usually performs
2. Using cloud computing fits into our company’s work style
3. Using cloud computing is compatible with our company's norms and culture
4. Cloud can easily be integrated into our existing IT infrastructure
5. Cloud computing is NOT compatible with other systems that we are using
6. In order to use cloud computing I do NOT need to technically change anything
7. Using cloud computing is compatible with all aspects of our work

Removing item number 5 from the questionnaire increased the alpha and inter-item correlation mean to an acceptable level (alpha = 0.788 and inter-item correlation mean = 0.426). The next problematic construct was cost. Cost was measured by the following 13 items:

1. Cloud computing decreases our capital expenditure
2. Cloud computing decreases the investment in new infrastructure
3. Cloud computing eliminates the cost of licensing new software
4. Deployment process of cloud computing involves a negligible amount of time and effort
5. Cloud computing eliminates the cost of upgrading the system
6. Cloud computing decreases the cost of system maintenance
7. Cloud computing decreases our IT costs (such as IT personnel)

8. Cloud computing decreases our operating cost
9. Training process takes a lot of time and effort
10. All our employees need to be trained in order to use the cloud
11. Cloud computing has low training costs
12. Cloud computing has high training costs
13. The overall cost of using cloud computing is less than the cost of installing or developing a technology in house

Removing item number 10 and item 12 from the questionnaire increased the alpha and inter-item correlation mean to an acceptable level (alpha = 0.882 and inter-item correlation mean = 0.523). The final "problematic" construct is competitive pressure. The following three questions were measuring the degree of competitive pressure in the market.

1. It is easy for our customers to switch to another company for similar services/products without much difficulty
2. The rivalry among companies in the industry which my company is operating in is very intense
3. There are many products/services in the market which are different from our products but perform the same function

Removing item number 1 increased the inter-item correlation mean; however it slightly decreased the alpha. Although competitive pressure still had unacceptable rate, I decided to keep it in the questionnaire for the actual study. Table 4 shows the reliability results of the revised questionnaire.

Construct	***Number of Items***	***Inter-Item Correlation Mean***	***Cronbach's Alpha***
Relative Advantage	12	0.478	0.906
Complexity	5	0.672	0.844
Compatibility	7	0.426	0.788
Security and Privacy	6	0.568	0.849
Trialability	3	0.573	0.804
Cost	13	0.523	0.882
External Support	4	0.610	0.858
Decision Maker's Innovativeness	3	0.688	0.857
Competitive Pressure	2	0.255	0.406
Decision Maker's Cloud Knowledge	8	0.490	0.895
Employee's Cloud Knowledge	4	0.726	0.926
Information Intensity	3	0.833	0.933

Table 4 Modified Reliability Test (Pilot Study)

6.1.6. Selecting participants

After removing the problematic items from the questionnaire, it was ready to be launched for the main survey. The link to my survey was sent to more than 500 individuals. Among 500 participants, 320 were not eligible to continue taking the survey, because they were not meeting the criteria. Only individuals' who were working for a SME; and were familiar with the concept of cloud computing were eligible to participate in our study. I asked a question at the beginning of the survey; and asked participants to indicate how much they know about cloud computing. Those who answered "no information" about cloud computing was refused to participate in this study. Also individuals who were not personally involved in decision making process in the organization were not eligible to participate in this study. After filtering those who were not eligible and those who did not correctly answer QA questions I left out with 101 completed surveys.

6.2. Data analysis Method

In order to complete our research, the collected data needs to be analyzed. At first stage I used Factor Analysis (FA) to assess the construct validity of the theoretical model that is proposed. On the other hand, in order to test our hypotheses, I performed logistic regression. This method allows me to predict the factor that are important in predicting the adoption of cloud computing. Since our dependent variable is a binary variable; and has two distinct value, logistic regression was used to test my hypotheses. Below these two analysis method are briefly discussed. In the next chapter analysis method is explained in more details. SPSS version 20 is used for analyzing our data.

6.2.1. Factor analysis

The construct validity of each model which comprised of different variables should be evaluated. Construct validity, which has different components such as convergent and discriminant validity, defines the underlying structure of constructs. This method allows a researcher to analyze the correlation between items; and to determine a new set of variables that are highly correlated to each other. These new variables are known as factors. Convergent validity is one component of the construct validity, which determines whether all items that measure one factor converge. Factor loading and reliability test are two methods to check the convergent validity of the construct. Factor loading shows the correlation between each item and the related constructs. According to Hair et al. (2010) a factor loading above 0.5 is acceptable; and the factor loading above 0.7 is ideal. Reliability of the construct can also be checked by alpha; and an alpha above 0.7 is good. The second component of construct validity that needs to be checked is discriminant validity. Discriminant validity defines whether a construct is different than other constructs. Checking for cross loading is one way to determine the discriminant validity of constructs. Existence of cross loading indicates that there is a problem in the model. If an item has a cross loading with two different constructs it shows that the item does not actually measure one factor; and it measures different factors. Explanatory Factor Analysis is one way to test the discriminant and convergent validity of the instrument. This type of factor analysis is driven from data. In this research I performed an EFA to reduce the number of factors; and to eliminate items that have high cross loadings.

6.2.2. Analysis Method

In order to test our hypotheses and predict the adoption of cloud computing, logistic regression is used. Logistic regression is one type of regression which is used to explain and predict binary dependent variables. This method allows researchers to identify factors that influence the membership of a subject in a group. It creates a classification system based on which subjects can be assigned into different groups. Similar to other types of regression such as multiple regression, the coefficient indicates the relative impact of each constructs on the dependent variable. The direction and magnitude of coefficients can be interpreted in two ways: original and exponentiated coefficients. The direction of the effect can be interpreted both from original coefficient (negative or positive sign), and from exponentiated coefficient. The exponentiated coefficient which is less than 1 has a negative influence; and an exponentiated coefficient of more than 1 has a positive influence on the dependent variable. In this method of analysis, the dependent variable should be nonmetric (having two different values), while independent variables can be both nonmetric and metric variables. One of the characteristics of logistic regressions is that multivariate normality and equal variance is not required. In many cases this is considered as the advantage of logistic regression, because it can be applied in many cases. In this research my dependent variable is a binary variable (being an adopter or non-adopter). I used logistic regression in order to be able to identify the factors that influence the decision to adopt cloud computing. Each variable’s coefficient determines the relative impact of each constructs on the adoption decision. In the next chapter I will discuss in more details about how I applied this method; and what configurations were used.

Chapter 7
Data Analysis Results

The aim of this chapter is to describe the results of data analysis. I first describe each variable in details by going through the descriptive analysis. The results of reliability test of the model are then going to be explained. Later, I discuss our factor reduction method which is done through factor analysis. Factor analysis allowed us to reduce our factors, and test the convergent and discriminant validity of our instrument. Finally the results of logistic regression and our hypothesis testing are discussed.

7.1. Descriptive Analysis

In this section, the results of univariate analysis are discussed. Each variable is described in more details by performing descriptive analysis. For each variable its mean, standard deviation and frequency is stated. It should be mentioned that the missing values of my data were replaced by the series mean. Missing values can be handled in different ways. Such as deleting the observations or replacing it with some values. These values can be means, medians etc. In data sets that have low number of missing data, deleting the observation is not a wise idea; and replacing them with some values is more appropriate. My sample's missing values were less than 5%; 5%, which is considered as relatively low level of missing values; therefore replacing them by the series mean, is an appropriate method. According to Heir et al. when the amount of missing values is less than 10% any imputation method is appropriate. The descriptive analysis is performed after the missing values were replaced.

7.1.1. Sample Characteristics

Demographic characteristics of the respondents are summarized in Table 5-1. All our participants are IT decision makers are of North American SMEs who are familiar with cloud computing. Characteristics include decision maker's age group, gender, education level and industry-specific work experience.

Sample Characteristics	Size	Percent
Age		
18-25	6	5.9
26-35	30	29.7
36-50	54	53.5
501-65	11	10.9
Total	101	100
Gender		
Female	52	51.5
Male	49	48.5
Total	101	100
Education		
High School degree/GED	3	3
Some College	12	11.9
Associate degree	10	9.9
Bachelor's degree (BA, BS)	56	55.4
Master's or Doctoral degree (for example: MA, MS, MEng, MEd, MSW, MBA, PhD)	20	19.8
Total	101	100
Industry Specific Work Experience		
Less than 2 years	1	1
3-5 Years	17	16.8
6-10 Years	20	19.8
11-20 Years	45	44.6
More than 21 Years	18	17.8
Total	101	100

Table 5 Sample Characteristics

In addition to personal characteristics of decision makers, the company's characteristics were also captured. Table 5-2 summarizes the company's characteristics such as the company's size, the industry in which the company operates in and the age of the company.

Sample Characteristics	Size	Percent
Size		
1-10 Employees	12	11.9
11-500 Employees	89	88.1
Total	101	100
Industry		
Accommodation and Food Services	1	1
Administrative and Support, Waste Management and Remediation Services	4	4
Arts, Entertainment and Recreation	1	1
Construction	9	8.9
Educational Services	2	2
Finance and Insurance	2	2
Health care and Social Assistance	6	5.9
Information	2	2
Management of Companies and Enterprises	2	2
Manufacturing	25	24.8
Mining, Quarrying, and Oil and Gas Extraction	1	1
Professional, Scientific and Technical Services	19	18.8
Public Administration	4	4
Real Estate, Rental and Leasing	2	2
Retail Trade	3	3
Transportation and Warehousing	3	3
Utilities	1	1
Wholesale Trade	6	5.9
Other Services (Except Public Administration)	8	7.9
Total	101	100
Company Age		
1-3 Years	1	1
4-6 Years	21	20.8
7-10 Years	32	31.7
More Than 11 Years	47	46.5
Total	101	100

Table 6 Company's Characteristics

In order to test the non-response bias between early and late respondents, independent T-test was performed considering the gender and age of the respondents. The results of independent sample test are shown in Table 7.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Gender	Equal variances assumed	.053	.819	-.192	99	.848	-.021	.110	-.239	.197
	Equal variances not assumed			-.191	54.111	.849	-.021	.110	-.242	.200
Age	Equal variances assumed	2.367	.127	.230	99	.818	.038	.163	-.286	.361
	Equal variances not assumed			.208	44.368	.836	.038	.181	-.327	.402

Table 7 Results of Independent Sample Test

As it can be viewed, no significant difference between early and late respondent is recognized. For both variables the p-value is greater than 0.05. Therefore no response bias is determined. Below the descriptive analysis of each variable is explained.

7.1.2. External Support

External support is measured as decision maker's perception about technical support provided by cloud providers (ExtSup_TechSup), the customer service offered by cloud providers (ExtSup_CustSup), customer hotlines offered by cloud providers (ExtSup_CustHotln), and the training provided by cloud providers (ExtSup_Trng). Table 8 summarizes the descriptive analysis of items measuring external support. Figure 10 depicts the overall responses to each question. *It can be noted that for majority of respondents the level of external support delivered by cloud providers is important.*

Descriptive Statistics

	N	Mean	Std. Deviation
ExtSup_TechSup	101	4.36	.769
ExtSup_CustSup	101	4.18	.740
ExtSup_CustHotln	101	3.94	.892
ExtSup_Trng	101	4.14	.938
Valid N (listwise)	101		

Table 8 Descriptive Analysis (External Support)

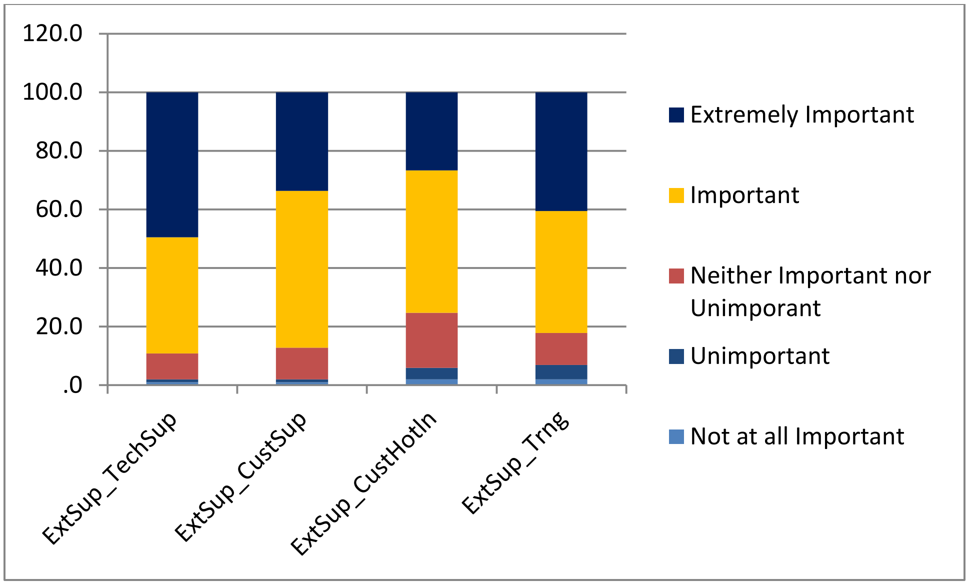

Figure 10 Analysis of respondents' perception about External Support

7.1.3. Competitive Pressure

Table 9 summarizes the mean and standard deviation of items that were used to measure the perceived competitive pressure of the market in which the company operates. Competitive pressure is measured based on the rivalry among companies in the industry which the company is operating in (CmpPrs_Rvl) and the degree of products/services in the market which are different from but perform the same function as the products offered by the company (CmpPrs_Prdt). Figure 11 depicts the respondents' opinion about the competitiveness of the market they operate in. *the results indicates that the majority of the respondents perceive a high level of pressure from the competitors in the market. More than 65% of respondents feel a high level of rivalry among the companies in the industry; and about 75% of respondents feel that there are many products/services in the market which are different from their products but perform the same function.*

Descriptive Statistics

	N	Mean	Std. Deviation
CmpPrs_Rvl	101	3.83	.928
CmpPrs_Prdt	101	3.67	.950
Valid N (listwise)	101		

Table 9 Descriptive Statistics of Competitive Pressure

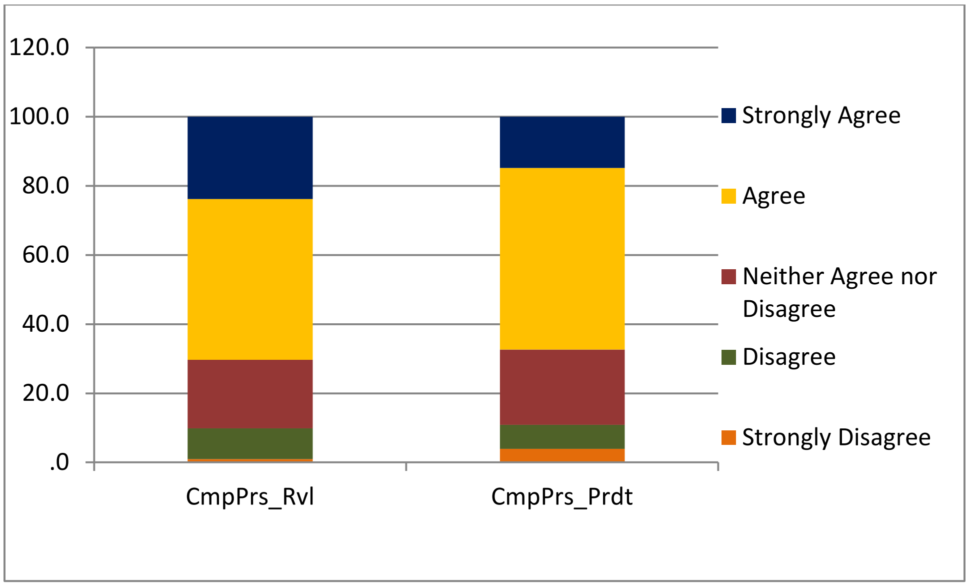

Figure 11 Analysis of respondents' perception about Competitive Pressure

7.1.4. Decision maker's Cloud Knowledge

Descriptive analysis of decision maker's cloud knowledge can be reviewed in Table 10. Mean and Std. Deviation of items are summarized in this table 10. Items are trying to capture decision maker's knowledge about different aspects of cloud computing. First item (CldKnw_Strct) measures decision maker's knowledge about the underlying structure of cloud computing. Second item (CldKnw_bnft) measures the decision maker's knowledge about the benefits of using cloud computing. Third item measures decision maker's general information (CldKnw_gnrl) about cloud computing. Item number four captures decision maker's knowledge about the difference between cloud computing and other computing paradigms (CldKnw_cmpt). The next item measures decision maker's knowledge about different models of cloud computing e.g. SaaS, PaaS and IaaS (CldKnw_models). Next item (CldKnw_type) measures the decision maker's knowledge about different deployment models of cloud computing e.g. public, private and hybrid cloud. Decision maker's knowledge about the pricing model of cloud computing (CldKnw_prcModel) was also questioned. Finally I asked decision makers to rank their knowledge in compare to people in similar positions (CldKnw_aver). Figure 12 depicts the respondent's answers to items related to cloud computing. In almost all the items the decision makers ranked their knowledge about cloud computing as being above good. It is consistent with our selection criteria. As it is mentioned in chapter 6, individuals who had no information and knowledge about cloud computing were not eligible to participate in this study; they were rejected in the filtering stage of data collection. *According to our descriptive and frequency analysis, our participants seem to have a very good knowledge about different aspects of cloud computing. Participants seem to have the best knowledge about the benefits of using cloud computing.*

Descriptive Statistics

	N	Mean	Std. Deviation
CldKnw_Strct	101	3.87	.934
CldKnw_bnft	101	4.16	.914
CldKnw_gnrl	101	3.97	.877
CldKnw_cmpt	101	4.00	.917
CldKnw_models	101	3.79	1.169
CldKnw_type	101	3.96	1.048
CldKnw_prcModel	101	3.67	1.176
CldKnw_aver	101	3.85	.921
Valid N (listwise)	101		

Table 10 Descriptive Analysis of Decision Maker's Cloud Knowledge

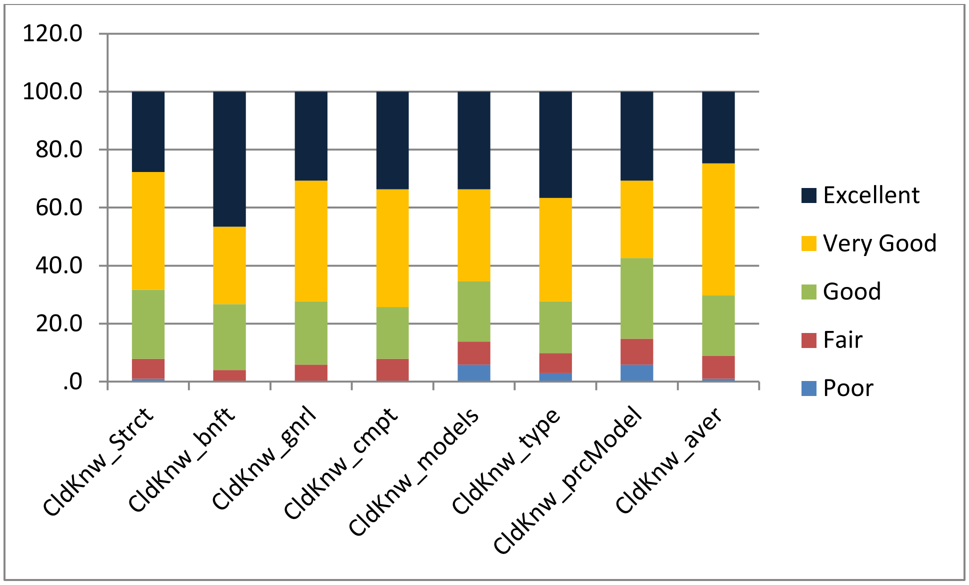

Figure 12 Analysis of respondents' perception about Decision Maker's Cloud Knowledge

7.1.5. Decision maker's Innovativeness

Descriptive statistic of decision makers' innovativeness of our sample can be viewed in Table 11. Innovativeness is measured based on decision makers' desire to create something new than improve something existing (INV_Impr) and their degree of risk aversion (INV_rsk). As it can be viewed in figure 13 more than 50% of respondents rather create something new than improve something which already exists. At the same time more almost 70% of participants mentioned that they would like to take risks of doing thing differently. *Overall, in our sample decision makers tend to be innovative.*

Descriptive Statistics

	N	Mean	Std. Deviation
INV_Impr	101	3.32	1.048
INV_rsk	101	3.68	1.067
Valid N (listwise)	101		

Table 11Descriptive Analysis of Decision Maker's Innovativeness

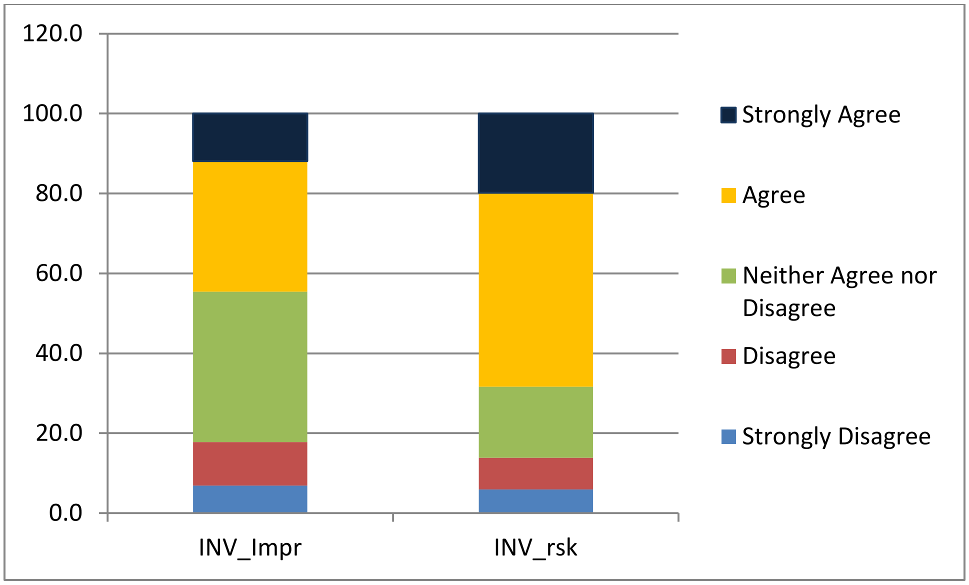

Figure 13 Analysis of respondents' perception about Decision Maker's Innovativeness

7.1.6. Employee's Cloud Knowledge

As it is mentioned in chapter 5, employees cloud knowledge is measured based on the decision makers' perception about the knowledge of their employees. I asked decision makers to rank their employee's basic knowledge about cloud computing (EmpCldKnw_bsc); their previous usage of cloud computing for personal and business purposes (EmpCldKnw_usg). Finally I asked decision makers to rank their employees in comparison to other companies in the same industry (EmpCldKnw_cmpr). Table 12 summarizes the decision maker's response about their employees' knowledge about cloud computing. Mean and standard deviation of three items are summarized. As it can be viewed in figure 14, almost half of the decisions makers think their employees have basic knowledge about cloud computing. However, in the sample just 40% of our decision makers believe that their employees have already used cloud computing for personal or business use. Finally decision makers of our sample ranked their employees as being knowledgeable about cloud computing in comparison to other employees to other companies in the same industry. *Overall it can be concluded that employees knowledge about cloud computing is high in our sample of SMEs.*

Descriptive Statistics

	N	Mean	Std. Deviation
EmpCldKnw_cmpr	101	3.58	.962
EmpCldKnw_usg	101	3.09	1.217
EmpCldKnw_bsc	101	3.25	1.260
Valid N (listwise)	101		

Table 12 Descriptive Analysis of Employees Cloud Knowledge

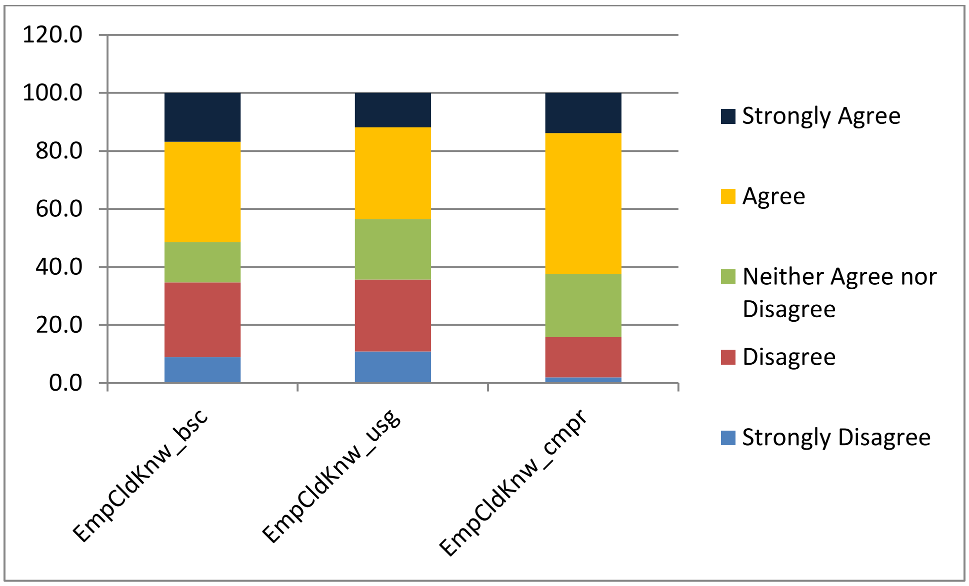

Figure 14 Analysis of respondents' perception about Employees' Cloud Knowledge

7.1.7. Information Intensity

Information intensity is defined as the degree to which information is present in the product or service of a business. I measured the company's information intensity as the its dependency on up-to-date information (InfoInt_Updt); the company's reliance on accessing information fast, whenever they need the information (InfoInt_fst); and finally the company's reliance on accessing reliable, relevant and accurate information (InfoInt_rra). Table 13 summarizes the mean and standard deviation of these three items. As it can be viewed in figure

15, almost all the companies are information intense. Almost all of the participants believe that their company requires having access to up-to-date, reliable, relevant and accurate information whenever they need the information. *Overall more than 80% of companies evaluate their information intensity as being high.*

Descriptive Statistics

	N	Mean	Std. Deviation
InfoInt_Updt	101	4.26	.744
InfoInt_fst	101	4.43	.766
InfoInt_rra	101	4.53	.641
Valid N (listwise)	101		

Table 13 Descriptive Analysis of the Company's Information Intensity

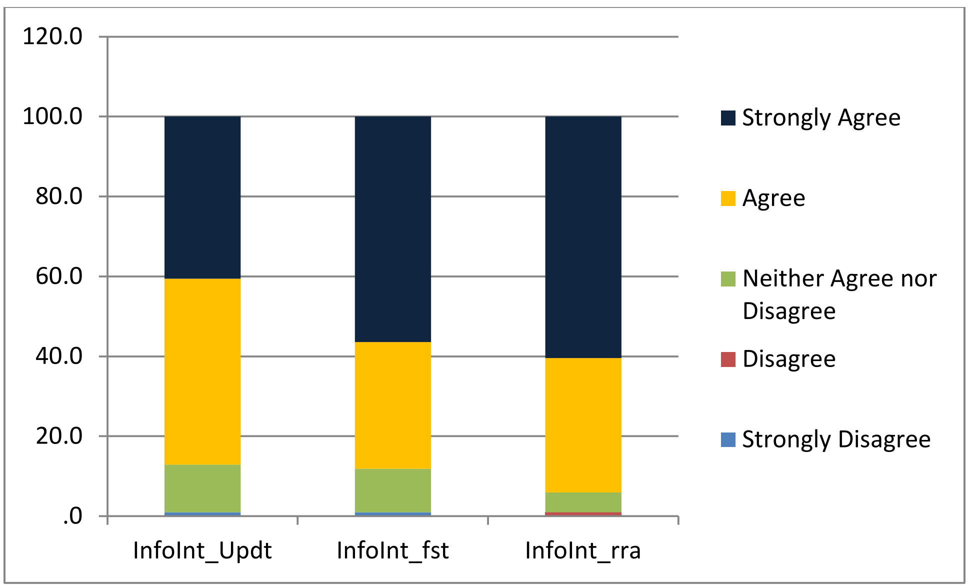

Figure 15 Analysis of respondents' perception about Information Intensity

7.1.8. Relative Advantage

Relative advantage is defined as the degree to which cloud computing is perceived as being better than the idea it supersedes. In this study relative advantage is measured by different items, which are listed below:

- Using cloud computing would enable us to accomplish tasks more quickly (RltAdv_Quik)
- Using cloud computing would improve the quality of the work I do (RltAdv_Qlty)
- Using cloud computing would makes it easier for us to do our job (RltAdv_easy)
- Using cloud computing would enhance our effectiveness on the job (RltAdv_eftv)
- Using cloud computing would increase our company's productivity (RltAdv_prdt)
- Using cloud computing would improve our job performance (RltAdv_prfmc)
- Cloud computing improves our operational efficiencies (RltAdv_effcny)
- Cloud computing would enhance our company's data storage capacity (RltAdv_cap)
- Compared to traditional computing, cloud computing would make data-intensive computing faster (RltAdv_fst)
- Cloud computing allows us to use the latest version of the technology (RltAdv_tech)
- The pay-as-you-go model of payment makes cloud computing an attractive solution (RltAdv_pymt)
- Overall I think using cloud computing would be advantageous for my business (RltAdv_advntg)

As it can be viewed in figure 16, majority of the decision makers in our sample feel positive about the relative advantage of cloud computing. More than 80% perceive cloud computing to be advantageous for their business. They feel cloud computing can help them achieve their tasks more quickly and easier; and allow them to enhance their storage capacity. At the same time, more than 75% of decision makers feel that cloud computing increases the quality of their job, the productivity, effectiveness and efficiency of their work. Moreover more than 70% of participants believe cloud computing enables them to improve the job performance. *Overall, majority of participants have found cloud computing to be advantageous for their company; therefore in our sample the perceived relative advantage of using cloud computing is high.*

Descriptive Statistics

	N	Mean	Std. Deviation
RltAdv_Quik	101	4.24	.838
RltAdv_Qlty	101	4.14	.928
RltAdv_easy	101	4.22	.856
RltAdv_eftv	101	4.25	.817
RltAdv_prdt	101	4.21	.941
RltAdv_prfmc	101	4.02	1.000
RltAdv_effcny	101	4.19	.891
RltAdv_cap	101	4.26	.820
RltAdv_fst	101	4.16	.935
RltAdv_tech	101	4.19	.796
RltAdv_pymt	101	3.99	.922
RltAdv_advntg	101	4.33	.763
Valid N (listwise)	101		

Table 14 Descriptive Analysis of the Perceived Relative Advantage

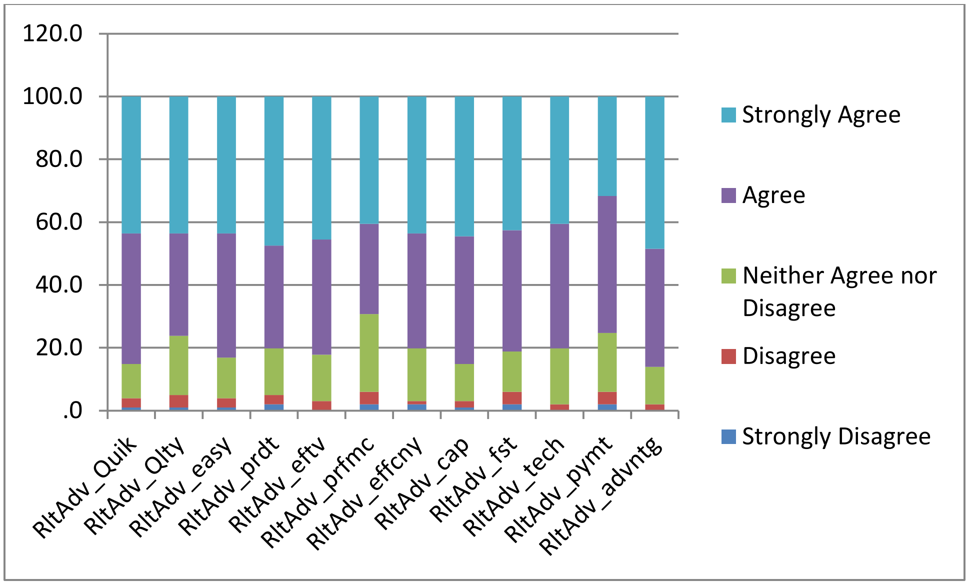

Figure 16 Analysis of respondents' perception about Perceived Relative Advantage

7.1.9. Complexity

Complexity which is the only factor that has negative influence on cloud adoption is measured by the following items. I asked decision makers whether they think cloud computing is complicated (Cmpx_complct); whether it takes too long to learn how to use the cloud computing (Cmpx_lng); whether it takes too much time for them if they want to use cloud computing to do their normal duties (Cmpx_tme); and finally I asked about their general idea about the complexity of the cloud computing (Cmpx_gnrl). Table 15 summarizes the descriptive analysis of complexity. About 70% of the respondents do not agree with the fact that cloud computing is complicated to use; and takes too long to learn how to use the cloud computing. More than half of the participants think it does not take too much time for them to use cloud computing to do their normal duties. About 60% of the respondents do not generally feel that cloud computing is very complex to use. *Overall majority of the respondents have not found cloud computing to be complex.*

Descriptive Statistics

	N	Mean	Std. Deviation
Cmpx_complct	101	2.29	1.134
Cmpx_lng	101	2.17	1.123
Cmpx_tme	101	2.50	1.213
Cmpx_gnrl	101	2.31	1.017
Valid N (listwise)	101		

Table 15 Descriptive Analysis of the Perceived Complexity of Cloud computing

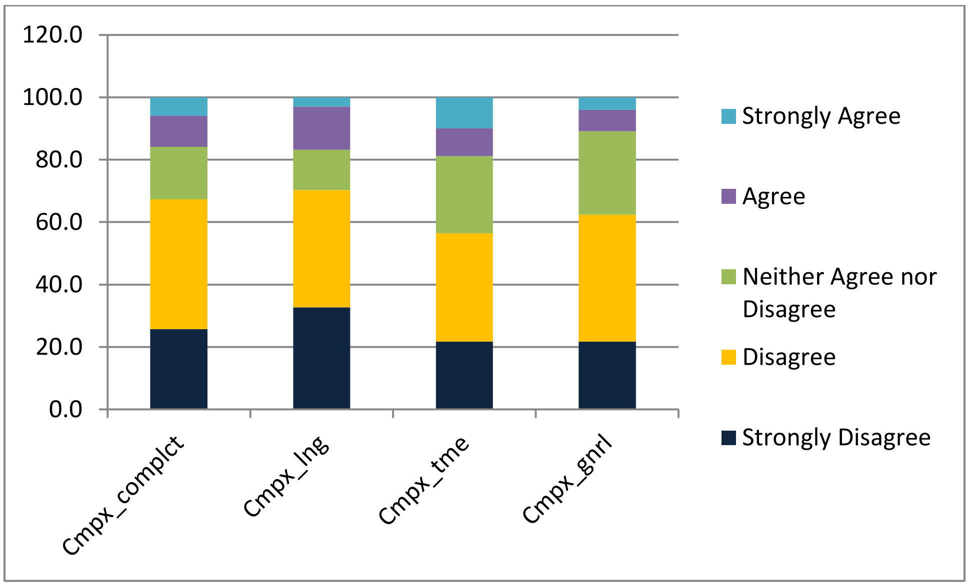

Figure 17 Analysis of respondents' perception about Perceived Complexity

7.1.10. Compatibility

In order to measure compatibility I asked decision makers to answer five questions. I asked whether they think cloud computing fits well with the way they perform (Comptblt_prfm); whether it fits into their company's work style (Comptblt_ws); whether it is compatible with their company's norms and culture (Comptblt_cltr); and whether it can be integrated into the existing IT infrastructure (Comptblt_IT). Finally I asked their general opinion about the compatibility of cloud computing with all aspects of their work (Comptblt_gnrl). As it can be viewed in figure 18, more than 80% of participants feel that cloud computing is compatible with their work style, culture and the way they usually perform. About 70% of respondents think that cloud computing is compatible with their IT infrastructure. *In general participants were very positive about the compatibility of cloud computing with different aspects of their work.*

Descriptive Statistics

	N	Mean	Std. Deviation
Comptblt_ws	101	4.16	.880
Comptblt_cltr	101	4.09	.884
Comptblt_IT	101	3.93	.993
Comptblt_gnrl	101	3.54	1.127
Comptblt_prfm	101	4.11	.835
Valid N (listwise)	101		

Table 16 Descriptive Analysis of the Perceived Compatibility of Cloud computing

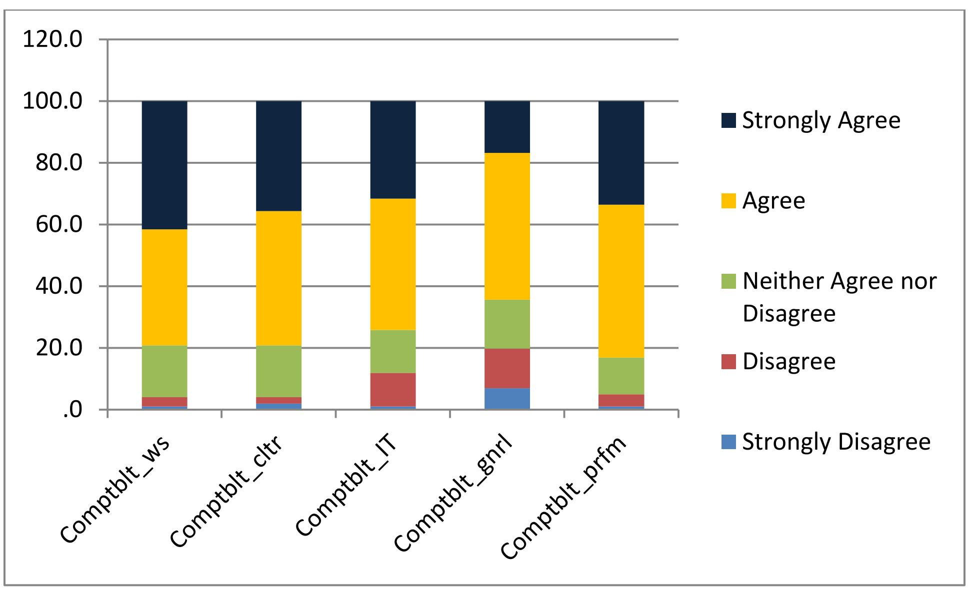

Figure 18 Analysis of respondents' perception about Perceived Compatibility of Cloud Computing

7.1.11. Trialability

Table 17 summarizes the descriptive analysis of the perceived importance of trialability for decision makers. I asked decision makers to define whether they have the opportunity to try various types of cloud computing (TRLABLT_Try); whether cloud computing is available to them to adequately test run various applications (TRLABLT_Tst); whether they are permitted to use cloud computing on a trial basis (TRLABLT_Trl). Moreover as it can be observed from figure 19, more than 70% of participants think they adequately are able to try, test and work on cloud computing on a trial basis. *Therefore the perceived level of trialability is high among the decision makers of our sample.*

Descriptive Statistics

	N	Mean	Std. Deviation
TRLABLT_Try	101	3.78	1.045
TRLABLT_Tst	101	3.98	1.039
TRLABLT_Trl	101	4.01	.933
Valid N (listwise)	101		

Table 17 Descriptive Analysis of the Perceived Trialability of Cloud computing

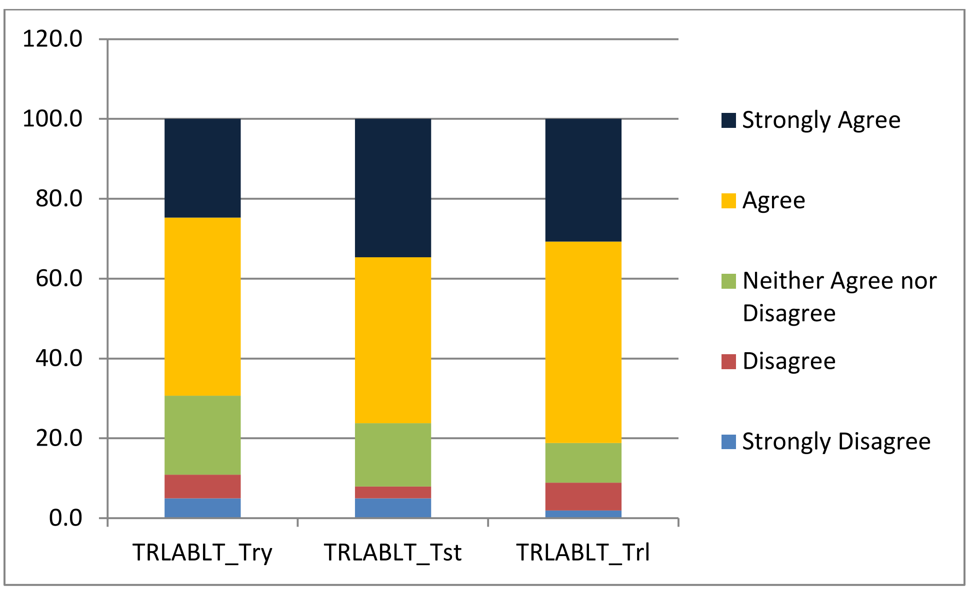

Figure 19 Analysis of respondents' perception about Perceived Trialability of Cloud Computing

7.1.12. Cost

The decision makers' opinion about the cost of cloud computing is measured from different perspectives. I asked decision makers whether they think cloud computing reduces their capital expenditure (Cost_CapEx), the initial investment (Cost_Inv), cost of licensing (Cost_licsng), deployment time (Cost_time), cost of upgrading the system (Cost_upgrd), cost of maintenance (Cost_mntnnc), cost of IT personnel (Cost_prsnl), their operating costs (Cost_oprtng), training time (Cost_trng), and the company's overall cost (Cost_ovral). Table 18 summarizes the descriptive analysis, including the mean and Std. deviation) of perceived trialability of cloud computing. In addition to summery of statistics about cloud computing figure 20 depicts the responses to each question. As it can be observed from figure 20, more than 65% of our respondents believe that cloud computing reduces the company's capital expenditure, initial investment, cost of maintenance, IT personnel, operating cost and company's overall costs. However, half of our respondent believe that cloud computing reduces the cost of licensing and upgrading the systems; and only 40% of our respondent believe cloud computing has low training cost. *In our sample the opinions about the cost vary because there are different types of cost that are taken into account.*

Descriptive Statistics

	N	Mean	Std. Deviation
Cost_CapEx	101	3.76	1.069
Cost_Inv	101	3.83	1.040
Cost_licsng	101	3.56	1.024
Cost_time	101	3.58	1.151
Cost_upgrd	101	3.63	1.074
Cost_mntnnc	101	3.87	.924
Cost_prsnl	101	3.80	1.030
Cost_oprtng	101	3.82	1.062
Cost_trng	101	3.17	1.105
Cost_trng1	101	3.61	.938
Cost_ovral	101	3.88	.791
Valid N (listwise)	101		

Table 18 Descriptive Analysis of the Perceived Cost of Cloud computing

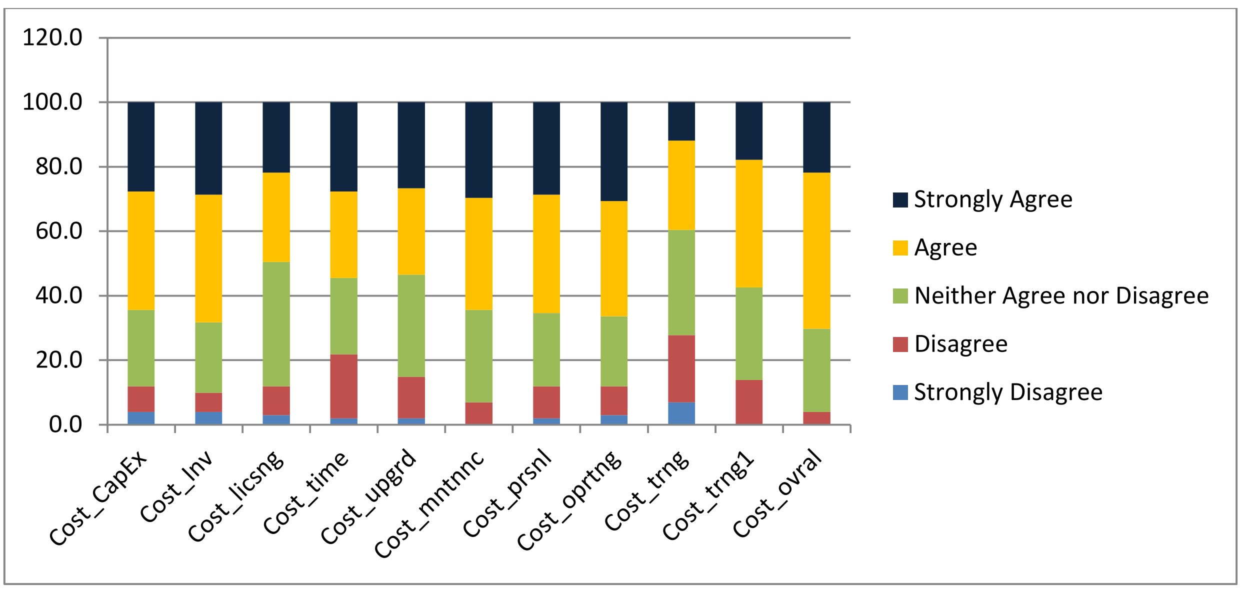

Figure 20 Analysis of respondents' perception about Cost of Cloud Computing

7.1.13. Security and Privacy

Table 19 summarizes the descriptive analysis of items which are related to security and privacy of cloud computing. Items that are used to measure cloud computing's security and privacy are questions related to the security of cloud itself (ScPrv_cld), the security of the servers (ScPrv_Srvr), the security of the media that is used to transmit the data (ScPrv_Mdia), privacy of the company's data (ScPrv_data), and the confidentiality of the company's data (ScPrv_cnfdtlty).

Descriptive Statistics

	N	Mean	Std. Deviation
ScPrv_cld	101	4.11	.859
ScPrv_Srvr	101	4.05	.876
ScPrv_Mdia	101	4.06	.892
ScPrv_data	101	4.12	.816
ScPrv_cnfdtlty	101	4.17	.849
Valid N (listwise)	101		

Table 19 Descriptive Analysis of the Perceived Security and Privacy of Cloud computing

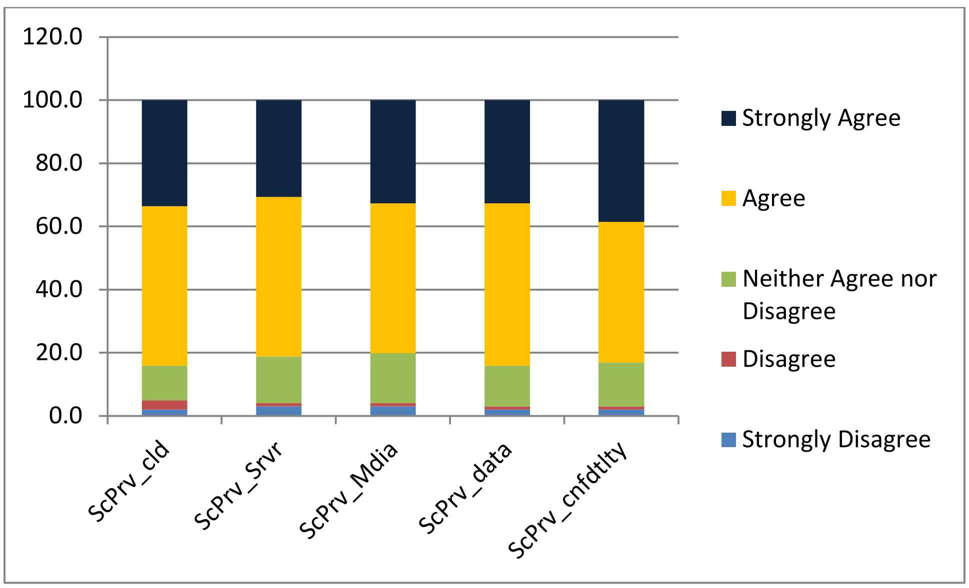

Figure 21 Analysis of respondents' perception about Cost of Cloud Computing

It can be viewed in Figure 21 that more than 80% of respondents feel cloud computing, cloud providers data centers, servers and the media that is used to transmit the data are secure.

They also believe that the confidentiality and privacy of their data is preserved if they use cloud computing.

In addition to these questions, I also asked some question about the intention to use cloud computing, if they already have not adopted it. Also for those who already adopted cloud computing I asked them whether they are satisfied with the service you receive from cloud provider. Below you can find the descriptive and frequency analysis of these two questions. Figure 22 depicts the frequency of answers to satisfaction question. As it just mentioned only those companies who already adopted cloud computing answered this question. As it can be seen, more than 90% of participants are satisfied with the service they receive.

Figure 22 Cloud Adopters Satisfaction

7.1.14. Intention to use

Respondents, who have not adopted cloud computing yet, answered these questions. I asked them whether they intent to adopt cloud computing in the next 12 months (INT_Int); whether they plan to adopt cloud computing in the next 12 month (INT_Plan); and whether they predict to use cloud computing in the next 12 months (INT_prdct). Table 20 summarizes the descriptive analysis of intention to use. It includes the number of respondents, the mean and the Std. Deviation. As it can be seen only 30 responses are recoded. Also figure 23 depicts the summary of the answers. As it can be seen more than 60% of non-adopters intend to adopt cloud computing in the next 12 months. *Overall the intention to adopt cloud computing is high.*

Descriptive Statistics

	N	Mean	Std. Deviation
INT_Int	30	3.87	1.106
INT_Plan	30	3.87	1.106
INT_prdct	30	3.83	1.147
Valid N (listwise)	30		

Table 20 Descriptive Analysis of the Perceived Security and Privacy of Cloud computing

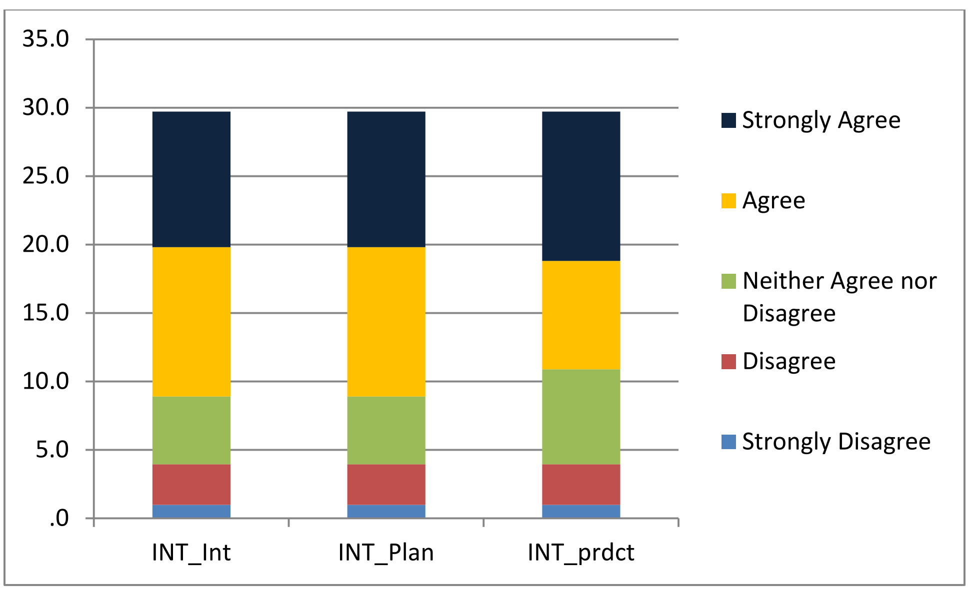

Figure 23 Analysis of non-adopters Intention to adopt in the next 12 months

7.2. Reliability Test

As discussed in Chapter 6, the reliability of any instrument needs to be evaluated. I performed a reliability test on our pilot sample. Some of the items which were negatively influencing the reliability of the questionnaire were deleted. The reliability of the final instrument should also be evaluated by checking the Cronbach's alpha and inter-items correlations of items that measure constructs. Table 21 summarizes the reliability test of our final questionnaire. Number of cases, the Coranbach's alpha, and inter-item correlations are summarized in this table. As I already stated in section 6.1.6. The Cronbach's value of above 0.7 is acceptable, while the inter-item correlation should be more than 0.3 in order to consider it as acceptable.

Construct's Name	***Number of Observations***	***Item-Total Correlation***	***Cronbach's Alpha***
Decision Makers' Innovativeness			0.743
INV_Impr	101	0.591	-
INV_rsk	101	0.591	-
Decision Makers' Cloud Knowledge			0.953
CldKnw_Strct	101	0.828	-
CldKnw_bnft	101	0.781	-
CldKnw_gnrl	101	0.856	-
CldKnw_cmpt	101	0.786	-
CldKnw_models	101	0.886	-
CldKnw_type	101	0.835	-
CldKnw_prcModel	101	0.840	-
CldKnw_aver	101	0.827	-
External Support			0.857
ExtSup_TechSup	101	0.748	-
ExtSup_CustSup	101	0.672	-
ExtSup_CustHotln	101	0.751	-
ExtSup_Trng	101	0.656	-
Competitive Pressure			0.406
CmpPrs_Rvl	101	0.255	-
CmpPrs_Prdt	101	0.255	-
Employees' Cloud Knowledge			0.838
EmpCldKnw_bsc	101	0.758	-
EmpCldKnw_usg	101	0.733	-
EmpCldKnw_cmpr	101	0.643	-
Company's Information Intensity			0.826
InfoInt_Updt	101	0.619	-
InfoInt_fst	101	0.692	-
InfoInt_rra	101	0.754	-

Cloud Computing's Relative Advantage			0.952
RltAdv_Quik	101	0.828	-
RltAdv_Qlty	101	0.780	-
RltAdv_easy	101	0.771	-
RltAdv_eftv	101	0.806	-
RltAdv_prdt	101	0.802	-
RltAdv_prfmc	101	0.748	-
RltAdv_cap	101	0.617	-
RltAdv_fst	101	0.761	-
RltAdv_tech	101	0.560	-
RltAdv_pymt	101	0.663	-
RltAdv_advntg	101	0.730	-
RltAdv_effcny	101	0.862	-
Cloud Computing's Complexity			0.864
Cmpx_complct	101	0.687	-
Cmpx_lng	101	0.792	-
Cmpx_tme	101	0.761	-
Cmpx_gnrl	101	0.618	-
Cloud Computing's Compatibility			0.779
Comptblt_prfm	101	0.710	-
Comptblt_ws	101	0.723	-
Comptblt_cltr	101	0.696	-
Comptblt_IT	101	0.495	-
Comptblt_gnrl	101	0.268	-
Cloud Computing's Degree of Security and Privacy			0.949
ScPrv_cld	101	0.897	-
ScPrv_Srvr	101	0.840	-
ScPrv_Mdia	101	0.882	-
ScPrv_data	101	0.771	-
ScPrv_cnfdtlty	101	0.909	-
Cloud Computing's Degree of Trialability			0.804
TRLABLT_Try	101	0.733	-
TRLABLT_Tst	101	0.734	-
TRLABLT_Trl	101	0.504	-
Cloud Computing's Cost			0.890
Cost_CapEx	101	0.761	-
Cost_Inv	101	0.639	-
Cost_licsng	101	0.658	-
Cost_time	101	0.591	-
Cost_upgrd	101	0.713	-
Cost_mntnnc	101	0.661	-
Cost_prsnl	101	0.766	-
Cost_oprtng	101	0.703	-
Cost_trng	101	0.384	-
Cost_trng1	101	0.252	-

Cost_ovral	101	0.656	-

Table 21 Reliability Test (Main Survey)

Compatibility general (Comptblt_gnrl) is deleted because its item-total correlation value is so low (0.268). This means that this item is not measuring the same construct that is being measured by other items of this construct. Table 22 shows the reliability test after the item Comptblt_gnrl is deleted. The improvement can be observed. Similarly, items measuring the training cost of cloud computing has a low correlation with other items. Deleting these items also had a significant influence on the reliability of the instrument which can be viewed in the Table 22.

Cloud Computing's Compatibility			0.847
Comptblt_prfm	101	0.788	-
Comptblt_ws	101	0.793	-
Comptblt_cltr	101	0.765	-
Comptblt_IT	101	0.447	-
Cloud Computing's Cost			0.907
Cost_CapEx	101	0.784	-
Cost_Inv	101	0.686	-
Cost_licsng	101	0.635	-
Cost_time	101	0.597	-
Cost_upgrd	101	0. 679	-
Cost_mntnnc	101	0.678	-
Cost_prsnl	101	0.765	-
Cost_oprtng	101	0.704	-
Cost_ovral	101	0.664	-

Table 22 Reliability Test of Compatibility and Cost after Deleting Items

Competitive pressure has a very low Cronbach's Alpha. Therefore I decided to delete this construct from our model; and not include it in later analysis stages such as factor analysis and regression.

7.3. Factor Analysis

As it briefly discussed in chapter 6, the construct validity of each model, consisting of different constructs, should be evaluated. Construct validity is evaluated by checking the discriminant and convergent validity of the model. According to Hair et al. (2010) convergent validity is "the extent to which the indicators of a specific construct converge or share a high proportion of variance in common". In other words, Convergent validity is used to determine whether items that intend to measure one construct actually measure that specific construct. Convergent validity can be checked by performing reliability test and factor analysis. Discriminant validity is defined as the "extent to which a construct is truly distinct from other constructs both in term of how much it correlates with other constructs and how distinctly measured items, measure a single construct." (Hair, et al. 2010) In other word, discriminant validity defines whether each item is measuring only one construct and no more. Each constructs should be different than other constructs. Factor analysis is not only used to check the convergent validity but also to check the discriminant validity of the questionnaire. In this research, EFA is used to investigate the convergent and discriminant validity of our questionnaire. Literature review reveals that Explanatory Factor Analysis is one of the most commonly used analysis methods to investigate the discriminant and convergent validity of an instrument (Sugianto & Tojib, 2011). Factor loading shows the correlation between each item and the related constructs. The minimum acceptable factor loading should have value of at least 0.3; but in general factor loadings above 0.5 are considered as significant.

The statistical software used in this study is SPSS version 20. In this research I performed an EFA, using the Principal Component extraction method based on Eigenvalues greater than 1 and Varimax rotation method. The Component method is best used when the purpose of the analysis is factor reduction. The eigenvalue greater than one is significant. Eigenvalue greater than 1 means that each item should account for the variance of at least a single construct. Rotation methods allows for simpler and more theoretically understandable and meaningful solutions. Orthogonal rotation methods are simple rotation methods. Varimax, which is one of the orthogonal rotation methods, is used in this research. It maximizes the sum of variances of the factor matrix. Although there is no significant difference between rotational matrixes, majority of statistical software have Varimax as the default method. I used factor analysis to check the convergent and discriminant validity of questions.

According to Hair et al. (2010) the minimum sample size to perform factor analysis is 50. The number of samples should be greater than the number of constructs. At least five observations are required for each constructs; and the acceptable ratio is ten to one. Based on this rule of thumb, our sample size is sufficient to perform factor analysis. 57 items fed into SPSS. Sample size plays an important role in the significance of factor loading. Smaller sample sizes require higher factor loading. In their book, Hair et al. (2010) indicated that for 100 observations, factor loading of 0.55 and higher is significant. Therefore constructs which have factor loadings less than 0.55 were suppressed.

One way to measure the appropriateness of the factor analysis is Bartlett’s test of sphercity. This test is based on the correlation between items. The significance level of Bartlett’s test of sphercity shows that there are adequate relationships between items; and that factor analysis is appropriate. As it can be observed in Table 23, the Bartlett’s test is significant in my research; it proves the suitability of performing factor analysis. Another value which is indicated in Table 23 is the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy, which is the summary of partial correlation among the items that are included in factor analysis. The KMO value is 0.839, which is considered as excellent (Kaiser, 1974). This value means that the degree of correlation among factors is sufficient to perform a factor analysis.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.839
Bartlett's Test of Sphericity	df	1596
	Sig.	.000

Table 23 KMO and Bartlett's Test

Table 24, shows the preliminary results of factor analysis. 11 different factors were identified. This is consistent with our conceptual model. However, there are high cross loading among some of the constructs. After investigating the results of factor analysis, I decided to delete items that have high cross loading; or have very low factor loading. It resulted in deletion of 10 items. Items measuring the compatibility were deleted, because they either had insignificant factor loading (e.g. less than 0.55) or they had high cross loading with other constructs (e.g. security and privacy). Items measuring trialability were also deleted because they had high degree of cross loading with other constructs (cloud knowledge and security). In addition to trialability and compatibility, RltAdv_pymt and ExtSup_Trng were also deleted from the research, because they had insignificant factor loadings.

	Component										
	1	2	3	4	5	6	7	8	9	10	11
RltAdv_effcny	.792										
RltAdv_prfmc	.752										
RltAdv_eftv	.736										
RltAdv_fst	.733										
RltAdv_prdt	.733										
RltAdv_Qlty	.720										
RltAdv_advntg	.718										
RltAdv_Quik	.716										
RltAdv_easy	.679										
RltAdv_cap	.598										
RltAdv_tech	.594										
RltAdv_pymt											
CldKnw_Strct		.828									
CldKnw_models		.818									
CldKnw_prcModel		.789									
CldKnw_type		.785									
CldKnw_gnrl		.760									
CldKnw_cmpt		.722									
CldKnw_aver		.717									
TRLABLT_Tst		.693									
TRLABLT_Try		.669									
CldKnw_bnft		.664									
ScPrv_Srvr			.770								
ScPrv_cnfdtlty			.763								
ScPrv_Mdia			.762								
ScPrv_data			.760								
ScPrv_cld			.744								
Comptblt_prfm											
TRLABLT_Trl											
Cost_Inv				.791							
Cost_CapEx				.693							
Cost_licsng				.681							
Cost_time				.667							
Cost_prsnl				.626							
Cost_oprtng				.617							
Cost_mntnnc				.568							
Cost_upgrd											
Cmpx_lng					.893						
Cmpx_tme					.845						
Cmpx_complct					.777						
Cmpx_gnrl					.691						
EmpCldKnw_bsc						.835					
EmpCldKnw_cmpr						.743					
EmpCldKnw_usg						.731					
InfoInt_rra							.873				
InfoInt_fst							.777				
InfoInt_Updt							.735				
ExtSup_CustSup								.742			
ExtSup_TechSup								.644			
ExtSup_CustHotln								.585			
ExtSup_Trng											
INV_Impr									.857		
INV_rsk									.759		
Cost_trng1										.844	
Comptblt_IT										.611	
Comptblt_cltr											
Comptblt_ws											

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 11 iterations.

Table 24 Preliminary Factor Analysis

In order to control the magnitude of factor reduction, problematic items were deleted one by one. After deleting each factor, the factor analysis was running again; and the results was reviewing. The final results of factor analysis can be viewed in Table 25. Nine different factors were identified.

	Component								
	1	2	3	4	5	6	7	8	9
RltAdv_effcny	.816								
RltAdv_prdt	.756								
RltAdv_eftv	.752								
RltAdv_fst	.738								
RltAdv_prfmc	.738								
RltAdv_Quik	.734								
RltAdv_advntg	.723								
RltAdv_Qlty	.723								
RltAdv_easy	.688								
RltAdv_tech	.598								
RltAdv_cap	.572								
CldKnw_Strct		.829							
CldKnw_models		.810							
CldKnw_gnrl		.800							
CldKnw_prcModel		.782							
CldKnw_type		.779							
CldKnw_cmpt		.735							
CldKnw_aver		.726							
CldKnw_bnft		.702							
Cost_Inv			.802						
Cost_CapEx			.717						
Cost_licsng			.679						
Cost_time			.676						
Cost_oprtng			.663						
Cost_prsnl			.655						
Cost_upgrd			.568						
Cost_mntnnc			.568						
ScPrv_cnfdtlty				.813					
ScPrv_Srvr				.790					
ScPrv_Mdia				.786					
ScPrv_data				.774					
ScPrv_cld				.759					
Cmpx_lng					.879				
Cmpx_tme					.865				
Cmpx_complct					.756				
Cmpx_gnrl					.716				
EmpCldKnw_bsc						.839			
EmpCldKnw_usg						.743			
EmpCldKnw_cmpr						.740			
InfoInt_rra							.872		
InfoInt_fst							.784		
InfoInt_Updt							.763		
ExtSup_CustSup								.773	
ExtSup_TechSup								.580	
ExtSup_CustHotln								.576	
INV_Impr									.873
INV_rsk									.793
Initial Eigenvalues	17.728	4.281	3.504	2.542	2.043	1.765	1.390	1.325	1.144
Variance	16.407	14.134	9.907	9.738	6.876	5.543	5.358	4.097	3.944

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

Table 25 Factor Analysis Final Results

All remaining factors have factor loading above the significance level (0.55). As it can be seen in the last two row of Table 25 all nine identified factors have eigenvalue above one. Together these nine factors account for 76% of total variance of all the variables in the research which is an acceptable level of variance. Factors one and two, which respectively account for 16.4% and 14.1% of total variance in explaining the total variance, play an important role.

In summary, I conducted factor analysis to reduce the number of variables in our study. Principal component extraction method with Eigenvalues more than one is used. Varimax rotation method is applied. The significance of Bartlett's test if Sphercity and the value of KMO measure of sampling adequacy (0.839) indicates that the factor analysis is appropriate. Communality of the items was checked and all of them had acceptable value (value more than 0.5). Because of the size of our sample, I should consider those factors that have loading of 0.55. Factors that had low factor loading or had high cross loading with more than one construct deleted from the model. The results of factor analysis determined nine different factors. Factor 1 is defined as *Relative Advantage*; factor 2 is defined as *Decision Maker's Cloud Knowledge*; Factor 3 is defined as *Cost*; factor 4 is defined as *Security and Privacy*; factor 5 is defined as Perceived *Complexity of Cloud Computing*; factor 6 is defined as *Employee's Cloud Knowledge*; factor 7 is defined as the Company's *Information Intensity*; factor 8 is defined as the *External Support* Provided by Cloud Providers; and finally factor 9 is defined as *Decision Maker's Innovativeness*. Based on the factors that were identified in factor analysis, for each factor a summated scale (composite value) was created. In this study the composite values are calculated based on the average of variables in the scale (Hair et al. 2010). The logistic regression is performed based on these scales. The reliability of the final set of variables was checked again. Table 27, summarizes the final results of reliability test. As it can be viewed all items have high Cronbach's data and inter-item correlation mean.

Construct	***Number of Items***	***Inter-Item Correlation Mean***	***Cronbach's Alpha***
Relative Advantage	***11***	***0.641***	***0.951***
Complexity	***4***	***0.612***	***0.864***
Security and Privacy	***5***	***0.787***	***0.949***
Cost	***8***	***0.531***	***0.899***
External Support	***3***	***0.646***	***0.842***
Decision Maker's Innovativeness	***2***	***0.591***	***0.743***
Decision Maker's Cloud Knowledge	***8***	***0.725***	***0.953***
Employee's Cloud Knowledge	***3***	***0.638***	***0.838***
Information Intensity	***3***	***0.622***	***0.826***

Table 26 Reliability of Composite Scores

7.4. Logistic Regression

This study is a predictive study; and I try to predict the adoption of cloud computing; therefore I used regression to test our hypotheses. Moreover, since the dependent variable of is binary the most appropriate analysis method is logistic regression. According Hair et al. (2010) "logistic regression is a special form of regression in which the dependent variable is a nonmetric, dichotomous (binary) variable." Dependent variable should be a categorical variable (nonmetric) while the independent variable can be metric or nonmetric. One of the advantages of logistic regression is that unlike other types of regression such as multiple regressions, the assumption of normality is not a necessity. In other words, normality is not a requirement for logistic regression. This is considered as an advantage because it makes this approach applicable to a wider range of researches. Moreover, logistic regression does not require linear relationship between dependent and independent variable. Although normality and linear relationship are not significant considerations in logistic regression, there are some other considerations such as sample size that needs to be taken into account. Sample size play an important role in regressions and the bigger sample size improves the significance of the results and predictability of the model. Furthermore, logistic regression is based on the Maximum Likelihood Estimation (MLE).

By nature this technique requires large sample size. The recommended sample size is 10 per parameter. However, majority of the studies have a mid-size sample; therefore one of the considerations that needs to be made while analyzing the results of regression is the size of the sample. In our research the dependent variable is the adoption of cloud computing, which is either Yes or No. Independent variables are composite values which are calculated in the previous section. Factor analysis determined the items that form the construct. Composite values are the average of determined items for each construct. Means, standard deviations and the results of normality tests of these new variables are shown in Table 27. In addition to independent variable indicated in table below the results of Intention to use is also included. None of the independent variables, except cost_reduction, in this research is normally distributed, majority of them are skewed (have negative skewness). All transformation methods (such as taking the square root, logarithms, squared or cubed) applied to correct the non-normality of the data, but unfortunately none could correct the non-normality of our data.

Descriptive Statistics

	Descriptive Statistics			Skewness	Tests of Normality Kolmogorov-Smirnov[a]	
Constructs	N	Mean	Std. Deviation	Statistics	Statistics	Significance
Relative_Advantage	101	4.1989	.71613	-1.167	.075	.000
CloudKnowledge	101	3.9097	.86839	-.701	.144	.000
Cost	101	3.7339	.80325	-.209	.128	.176
Security_Privacy	101	4.1010	.78262	-1.509	.191	.000
Complexity	101	2.3168	.94729	.679	.142	.000
Employees' Cloud Knowledge	101	3.9264	.84143	-.683	.105	.008
Information Intensity	101	4.4059	.61933	-1.079	.208	.000
External_support	101	4.1584	.70015	-1.292	.132	.000
Innovativeness.	101	3.5000	.94340	-.902	.213	.000
Intention to Use Cloud	30	3.8556	1.09223	-0.846	.153	0.072
Valid N (listwise)	101					

Table 27 Descriptive Analysis for Composite Scores

While performing logistic regression, one of the important considerations, is multicollinearity of the data. Multicollinearity indicates the high correlation that may exist among independent variables. The ideal situation is the one in which, there is high correlation between dependent and independent variables while there is minimum correlation between independent variables. Two of the most popular measures of examining the multicollinearity among independent variables are tolerance and variance inflation factor (VIF). Tolerance is the direct measure of collinearity, while VIF is the inverse of tolerance value. A high level of tolerance and a low level of VIF mean a low degree of multicollinearity. According to Hair et al. (2010) multicollinearity can have a significant influence on predictability of the model (reducing the overall R^2) in addition to the estimation of coefficient values and their significance levels. Multicollinearity creates problem specifically for small sample sizes. If multicollinearity exists among variables, the significance of the coefficient values is not properly predicted. In simple words the results are not significant. It not only affects the significance level, but also the value and sign of coefficients. In extreme cases, the level of collinearity is too high that although the overall predictability of the model is high, none of the independent variables become significant. The suggested threshold for tolerance is 0.1 which is equal to the value of 10 for VIF. Any value tolerance value lowers than 0.1 and VIF value higher than 10 is not acceptable. One way to minimize the negative effect of collinearity is to remove one or more of the items that have high collinearity with other variables. In our sample employee's Cloud Knowledge and decision makers' Cloud Knowledge have high collinearity; therefore one of the items needs to be deleted from the study. In the context of SMEs the role of decision makers is more important; therefore I decided to keep the decision maker's cloud knowledge and remove employees cloud knowledge from further analysis. The results can be viewed in Table 28. All independent variables meet the threshold values (0.1 for tolerance and 10 for VIF).

Model	Collinearity Statistics	
	Tolerance	VIF
Relative_Advantage	.336	2.978
CloudKnowledge	.453	2.210
Cost_Reduction	.477	2.096
Security_Privacy	.446	2.240
Complexity	.807	1.239
Information Intensity	.765	1.307
External_support	.478	2.094
Innovativeness.	.942	1.062

Table 28 Collinearity Results

Before conducting the regression, it is useful to examine the mean difference between groups of independent variables. Table 29 summarizes the group means for each independent variable. It gives us an idea of how data is spread among two groups. Different groups are adopters and non-adopters; and the test is based on 101 observations which create our sample. In order to test the significance of difference between groups One-Way ANOVA test is performed. As it can be viewed in the Table among eight variables, three of them (Relative_Advantage, Cloud_Knowledge and Cost_Reduction) have significant differences between groups. External_Support also has a 90% significance level. Since these four variables have the greatest difference between groups, they are candidates to be part of logistic regression model.

	Group Means		Test of Equality of Group Means	
Independent Variables	Adopters	Non-Adopters	F Value	Sig.
Relative_Advantage	4.2983	3.9636	4.781	.031
CloudKnowledge	4.1884	3.2500	32.344	.000
Cost_Reduction	3.8732	3.4042	7.672	.007
Security_Privacy	4.1521	3.9800	1.020	.315
Complexity	2.2817	2.4000	.327	.569
Information Intensity	4.4319	4.3444	.418	.519
External_support	4.2394	3.9667	3.274	.073
Innovativeness.	3.5423	3.4000	.477	.491

Table 29 Group Descriptive Statistics and Test of Equality for sample

Logistic regression calculates the log likelihood value of each independent variable. The method used is Enter; and the dependent variable has values of Yes (1) and No (0). The likelihood the event that has the value of one is predicted. There are different methods to assess the model's Goodness of Fit; in this study statistical measures are used to assess the model's overall fit. Table 30, summarizes the Goodness of Fit measures of the model.

Step	-2 Log likelihood	Cox & Snell R^2	Nagelkerke R^2
1	90.164	.277	.393

Table 30 Overall Model Fit: Goodness of Fit

Step	Chi-square	Sig.
1	14.501	.070

Table 31 Hosmer and Lemeshow Test

Two different ways to assess the model fit is to check the value of -2 LL and the significance of Hosmer and Lemeshow test. Smaller values of -2 LL and Hosmer and Lemeshow Test indicate a better model fit. In the case of Hosmer and Lemeshow Test, the significance level of the test means that there is a significant difference between the expected and actual data. The insignificant level of Hosmer and Lemeshow Test, in my research reveals that the model fit is acceptable. Cox & Snell R^2 and Nagelkerke R^2 are calculated based on the reduction in the -2LL value. As it is indicated in Table 31, the values of Cox & Snell R^2 and Nagelkerke R^2 are 0.277, 0.393 respectively which are not high values. According to Nagelkerke R^2 measure, 39.9% of data variation is explained by this logistic model.

Classification accuracy is the other way to assess the model's goodness of fit. Table 32 is the classification summary of the model. As it can be seen in the table, in 53% of cases a Non-adopter SME is correctly predicted as being non-adopter. The value is much higher for adopters; 90.1% of the time an adopter is accurately predicted as being an adopter. Our model's classification accuracy is 79.2%, which means in 79.2% of the time, the model correctly predicted the adoption decision. This is an acceptable level of prediction accuracy. If adoption of cloud computing were defined by random choice in our sample (30 adopters and 70 non-adopters), it would result in $(30/101)^2$ + $(70/101)^2$ which is equal to 56.85%. Thus it can be concluded that the results of logistic regression is more predictive than random choice model.

Observed		Predicted		
		Adoption		Percentage Correct
		No	Yes	
Adoption	No	16	14	53.3
	Yes	7	64	90.1
Overall Percentage				79.2

Table 32 Classification Table

Overall according to statistical measures, R^2 measures and classification accuracy of our model, it can be concluded that the goodness of fit of this model is acceptable. Now that I know the model has an acceptable goodness of fit, I can study the correlation between our dependent and independent variables; and determine whether there is any significant relationship between variables. Table 33 summarizes the results of our regression including the variables that are in the equation; their significance level, their coefficients, and Wald value. Among eight independent variables, only CloudKnowledge has a significant relationship with the adoption decision. As it is already mentioned at the beginning of this section, both the original and exponentiated coefficients allow us to identify the direction and extend of the correlations. The coefficient of each independent variable represents the likelihood of that event happening.

	B	S.E.	Wald	df	Sig.	Exp(B)
CloudKnowledge	2.245	.659	11.607	1	.001	9.440
Cost_Reduction	-.241	.568	.181	1	.671	.785
External_Support	.122	.567	.047	1	.829	1.130
Relative_Advantage	-.434	.672	.417	1	.518	.648
Security_Privacy	-.310	.512	.367	1	.545	.733
Complexity	.121	.350	.119	1	.731	1.128
Information_Intensity	-.571	.544	1.103	1	.294	.565
Innovativeness	.465	.295	2.485	1	.115	1.592
Constant	-3.534	2.903	1.482	1	.223	.029

Table 33 Logistic Regression Results

Wald statistics is used to provide statistical significance for each coefficient; it defines whether a variable should be part of the model or not. In our model, based on Wald statistics, cloud knowledge is defined as the only significant factor. Cloud knowledge has a positive correlation with adoption decision. It is determined based on the sign of the coefficient (B), which is positive; and the value of exponentiated B, which is above 1. In other words, the probability of adopting cloud computing is higher for individual's who has higher knowledge about cloud computing. For an additional unit increase in cloud knowledge the odds of adopting cloud computing increases by a factor of 2.245. Logistic regression transforms the binary dependent variable to a new variable which is assumed to have a linear relationship with independent variables. The results of logistic regression are based on odds of happening. The concept of odds ratio is the same as probability of an event happening. The odds ratio is the ratio of the probability of that event happening over the probability of that event not happening. (P(success)/ P(failure)). Based on the results, holding other factors at a fixed value, for each one unit increase in the cloud knowledge the odds of adopting cloud computing increases by 844%.

In logistic regression the value of Exp (B) minus one gives us the percentage change in odds (UCLA, 2013; Hair, Black, Babin, & Anderson, 2010).

Chapter 8
Final Results

The aim of this study is to identify the factors that impact the adoption of cloud computing. Logistic regression was used to distinguish the difference between adopters and non-adopters. Table 35 summarizes the results of our logistic regression. It shows the hypotheses and whether they were statistically supported or not. The results of our regression analysis demonstrate that decision makers' cloud knowledge is the only factor which has a statistically significant correlation with adoption decision of cloud computing. The remaining seven factors do not have a statistically significant impact on the decision to adopt.

Research Hypotheses	***Supported?***
H1: Higher levels of perceived external support from cloud providers positively affects the likelihood of cloud adoption by SMEs	*No*
H2: SMEs with more innovative decision makers are more likely to adopt cloud computing	*No*
H3: Decision Makers' knowledge about cloud computing is positively related to the decision to adopt cloud computing	*Yes*
H5: Information intensity is positively related to the likelihood of cloud computing adoption	*No*
H6: Decision makers' perception about cloud computing's relative advantage is positively related to cloud adoption	*No*
H7: The more decision makers feel the use of cloud computing is complex, the less they adopt cloud computing	*No*
H9: Decision makers' who perceive cloud computing as being less costly than other computing paradigms are more likely to adopt cloud computing	*No*
H10: Higher perception about cloud computing's security and privacy has a positive influence on cloud adoption	*No*

Table 34 Summarize Findings

Chapter 8

Final Results

Results of our regression predict that the adoption of cloud computing has a positive correlation with decision maker’s knowledge, which is consistent with findings of other scholars in other context. First of all, the fact that knowledge of cloud computing plays an important role in decision to adopt cloud computing, is consistent with what Rogers indicated in his Theory of Diffusion (2003). Referring back to Figure three, according to Rogers, gaining knowledge is the first stage of diffusion of any innovation. Moreover, there are other researchers who found the same results. Researchers such as Thong (1999), Dewar and Dutton (1986) and Senn and Gibson (1981) have also found similar results. These researchers found the knowledge about the technology and its benefits to be an influential factor in adoption of technologies. Moreover, Theory of Lowering Knowledge Barriers, developed by Attewell (1992) predicts the same results. According to this theory, the IS adoption is facilitated if companies, specifically smaller ones, improve their knowledge about the system. The positive sign of coefficient means that cloud knowledge has a positive influence on the decision to adopt cloud computing. In other words SMEs whose decision maker is knowledgeable about cloud computing are more likely to adopt cloud computing, than those SMEs whose decision makers do not have adequate knowledge about cloud computing. The value of exponentiated B is high in this case; what it means is that for each unit increase in decision maker’s knowledge about cloud computing, the chance of cloud computing adoption increases significantly. As it is mentioned in previous section, holding other factors at a certain value, for each one unit increase in the cloud knowledge the odds of adopting cloud computing increases by 844%. This positive correlation between cloud computing and adoption rate is logical too. Decision makers whose knowledge about various aspects of cloud computing and its benefits is high, are more likely to adopt the technology. Not having adequate knowledge about any technology increases the uncertainty about the technology. Uncertainly decreases the rate of adoption. The results demonstrate that having information about whether cloud computing is advantageous, complex, costly or secure are not influential factors in decision making. Decision makers should have detailed knowledge about different aspects of cloud computing such as its structure, different types and models. This is logical because companies, specifically smaller ones, who are more conservative than individuals, do not spend money on new technologies unless they have thorough knowledge about the technology.

Not getting statistically significant results for other variables depends on different reasons. One of the reasons is related to the size of our sample. As it is indicated in previous section, for logistic regression, size of the sample has a substantial influence on the accuracy of the results. (Hair, Black, Babin, & Anderson, 2010; Bergtold, Yeager, & Featherstone, 2011) Logistic regression requires ten observations for each variable per group. In our research the final number of variables was eight; and my dependent variable had two groups (adopters and non-adopters). Therefore, the adequate number of observations (sample size) is at least 160; I only had 101 observations. This limitation significantly influences the predictability of my model; and the results are not reliable. According to Hair et al. (2010) having small sample size not only influences significance of the results, but also the direction and magnitude of the relationship between dependent and independent variables. Furthermore, Bergtold et al. argue that the

Although the results of the study could have been different if I had large enough sample size, it is also possible that the factors that do not significantly influence our sample are not influential factors at all. In other words, even with an adequate sample size, it is possible that I obtain the same results. For example, in another research conducted by Low et al. (2011) which investigated the diffusion of cloud computing among high-tech companies, complexity is not found to be a significant factor influencing the adoption of cloud computing. Therefore, it is possible that complexity, which is a significant factor in other contexts is not important in the context of cloud computing. However, considering the results of two different studies do not allow us to generalize the fact that complexity is not an important factor in diffusion of cloud computing. More studies and researches in different environment are required.

Moreover, Comparing the means between different groups (adopters and non-adopters) shows that in our sample every one's opinion about cloud computing is positive at this point in time. Table 36 compares the average response to questions by different groups. As it can be reviewed in the table, average response to questions about relative advantage is high for both group (almost 4.3 for adopters and 4.0 for non-adopters); this means that both adopters and non-adopters perceive cloud computing as being better than already existing computing paradigms. Answers to cloud knowledge are different among groups, which is the main reason that made this factor statically significant. Adopters have higher knowledge about cloud computing (average response is equal to 4.2); while non-adopters' knowledge is not as high as (average response is equal to 3.3). Responses to the question about the cost of cloud computing is also similar among two groups (3.9 and 3.4 for adopter and non-adopters respectively); this means that on average, both groups agree that cloud computing lowers the cost of companies. Average response to questions about security and privacy of data is also similar for adopters and non-adopters (4.2 and 4.0 respectively). Respondents from both groups believe that cloud computing is secure and the privacy of their data is preserved. Answers to questions about the complexity of cloud computing also received similar responses from different groups. The average response from adopters is 2.3 while the average response from non-adopters is 2.4. The similar and low average response from two groups means that both adopters and non-adopters do not perceive cloud computing as being complex. Answers to information intensity questions were also comparable for both groups (4.4 for adopter and 4.3 for non-adopters); this means that companies who participated in this study perceived themselves as being reliant on accurate and reliable information. External support received an average of 4.2 and 4.0 from adopters and non-adopters respectively; meaning that in our sample external support is important for both adopters and non-adopters. Last but not least, decision makers' level of innovativeness is similar in both groups. Both adopters and non-adopters perceive themselves as having average level of innovativeness (3.5 for adopters and 3.4 for non-adopters).

	Group Means	
Independent Variables	Adopters	Non-Adopters
Relative_Advantage	4.2983	3.9636
CloudKnowledge	4.1884	3.2500
Cost_Reduction	3.8732	3.4042
Security_Privacy	4.1521	3.9800
Complexity	2.2817	2.4000
Information Intensity	4.4319	4.3444
External_support	4.2394	3.9667
Innovativeness.	3.5423	3.4000

Table 35 Comparing Groups Means

The possible reason that made two groups similar is related to cloud computing's hype cycle. The term hype cycle was first introduced by Jackie Fenn (1995). According to Hype-cycle, before a technology starts its normal diffusion process, it goes through an over enthusiasm period which will be followed by a period of disappointment. Hype cycle consists of five different stages before the actual and normal diffusion process starts. As depicted in figure 24, these five stages are Technology Trigger, Peak of Inflated Expectations, Trough of Disillusionment, Slope of Enlightenment (increasing realism), and Plateau of Productivity.

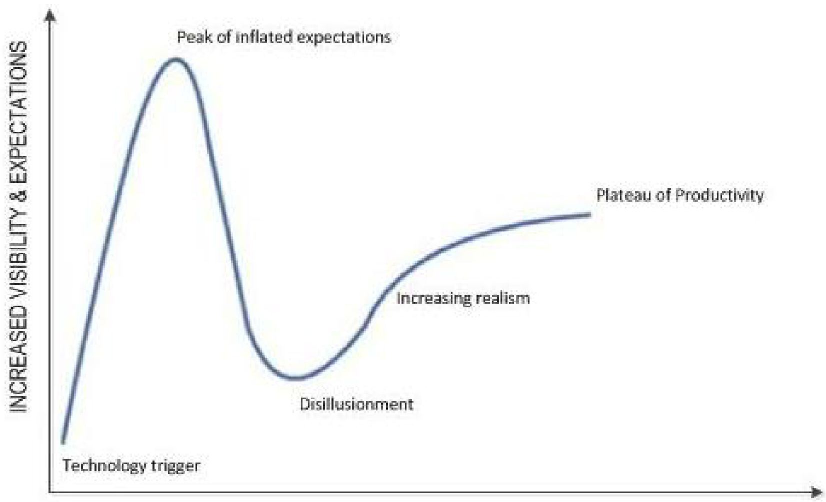

Figure 24 Hype Cycle

Technology trigger is the stage in which the technology is introduced. At this stage massive publicity is generated through media. During the peak of inflated expectations over enthusiasm and unrealistic expectation about the technology is formed; everyone feels and expects high from the technology. During this stage some success stories are produced. Right after this stage, cases of failure starts to emerge. The stage of trough of disillusionment is the stage in which the technology fails to meet the expectation of public; and starts to become unfashionable. At this stage public interest becomes lower. The stage of slope of enlightenment is the one in which businesses who continued to use the technology start to understand the benefits of the technology. Finally at the plateau of productivity stage, the mainstream adoption starts; the advantages of using the technology are widely understood and accepted by businesses (Gartner, 2013). Results of my research shows that cloud computing may be at its peak of inflated expectations stage. Publicity about cloud computing is very high. Majority of decision makers expect very high from cloud. Findings of my research are consistent with Gartner's hype cycle for emerging technologies (Gartner, 2011). As it can be viewed in figure 25, cloud computing is at the peak of inflated expectations stage and it takes 2 to 5 years to reach its mainstream adoption.

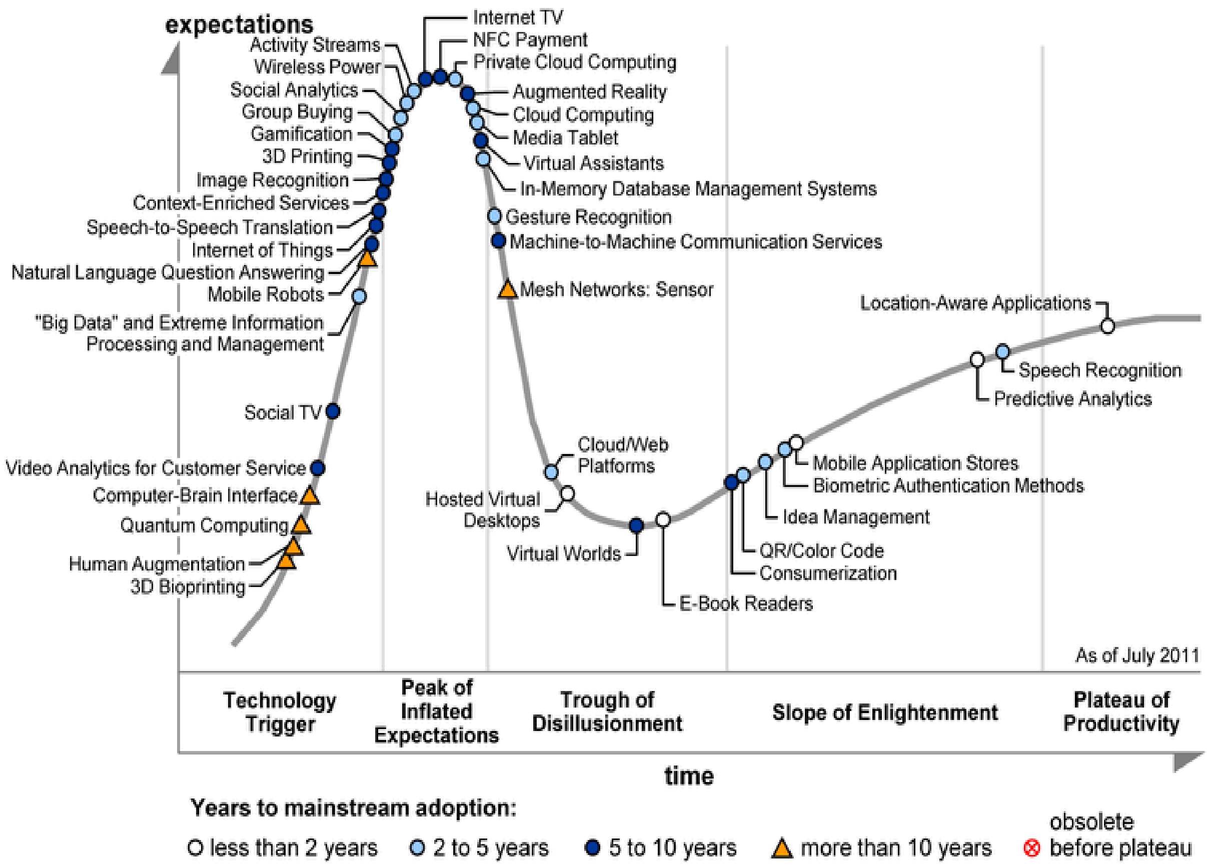

Figure 25 Hype Cycle for Emerging Technologies (2011)

Chapter 9
Implications

Results of this study have both practical and academic implications; and contribute to both business practice and academia. Both researchers and business practitioners benefit from the results of this study. This research's contribution to the field of study is linked to the conceptual model proposed in this study, which is a novel model, developed for the purpose of this research. Although components (variables) of the model are adapted from other studies, the model is novel. The proposed model can be used to study the diffusion of other innovations in the context of SMEs. In comparison to other models developed to study the adoption of cloud computing, the proposed model is the most comprehensive one. It takes into account all aspects such as technical, organizational, environmental and managerial aspects. According to Rogers (2003) the research in the field of adoption of innovation is still not mature. He mentioned that majority of the studies in the field of diffusion of innovation focus only on the attributes of the innovation; and the numbers of studies which consider different aspects of the context are limited. From this perspective, this research fills out the gap that exists in literature; and contributes to the field of study.

In addition to researchers, business practitioners will also benefit from this study. The results of this study can be used by both cloud providers and SMEs. Although the results cannot be generalized to all SMEs, it helps cloud providers to realize the fact that there are some important factors which are not related to the technology; but influence the decision making process. Our findings reveal that knowledge about cloud computing is the primary reason that influences the decision to adopt cloud computing by SMEs. In this context knowledge refers to the awareness about different aspects of cloud computing; such as its underlying structure, different types and deployment models. Based on our results, increasing the awareness about various aspects of cloud computing has a direct, positive influence on cloud computing. In our sample, the main sources of information for decision makers are cloud providers. The awareness about cloud computing can be increased, if providers use other social media such as Facebook, Tweeter, LinkedIn, etc. to increase general knowledge about cloud computing. As it is mentioned in chapter four, there are two different types of media, interpersonal and mass media. Our results shows that so far cloud providers use interpersonal channels to increase awareness about cloud computing. Findings disclose that the diffusion of cloud computing is facilitated if cloud computing, its benefits, and structure becomes widely recognized among SMEs. The use of mass media to deliver information to general public is helps. Because of the limitations of this study, I do not suggest cloud providers to forgo the already existing marketing strategies that they have. However, I recommend cloud providers to pay more attention to knowledge enhancement strategies; and to use other mass media to increase the general knowledge among companies.

The results of this study are also beneficial for SMEs. Findings of our research reveal that cloud computing is in its peak of inflated expectations stage of its hype cycle. According to Gartner’s report (2011) it takes 2 to 5 years for cloud computing to achieve the mainstream adoption. After cloud computing passes its peak of inflated expectations stage, it will face a period of disappointment. One of the characteristics of this stage is that more failure stories will be heard; and the publicity of cloud computing will be lowered. SMEs should consider this fact. These failure stories and negative publicity should not force SMEs to discontinue using cloud computing. The decision to start and give up using cloud computing should be based on a detailed cost-benefit analysis; not just based on the media coverage.

Chapter 10
Limitations and Future Studies

As it is briefly mentioned in previous chapter, this research has some limitations, because of which the results cannot be generalized to all SMEs[11]. The results are only applicable to our sample of the study. Our main limitation is related to my sample size. Due to the fact that the study is a predictive one; and the dependent variable is binary, the most suited analysis method is logistic regression. Sample size becomes problematic because in order to get significant results, I should have at least 10 observations per groups of dependent variable. Having eight different variables, our ideal sample size is 160, which is well beyond our actual sample size. A larger sample would provide us with different results; and I could get significant results for more than one variable, if our sample was bigger. Unfortunately because of the budget constraint that I had, I was not able to collect more data.

Moreover, our sample is selected from North American companies. The results of this research are only applicable to SMEs which are located in North America. The results of this study cannot be generalized to SMEs from other parts of the world. SMEs from other countries and regions have different requirements and opinions. The geographical area from which the data is gathered from is not the only issue with the sample. I did not restrict our data to a specific industry; this is problematic because each industry has its own characteristics and requirement. In comparison to the population, our overall sample was too small to capture the characteristics and requirements of mixed industries. With this sample size it was more practical to focus on one or few industries rather than any type of industry.

[11] SMEs are our units of analysis

Chapter 10
Limitations and Future Studies

Performing further researches in this field of study is highly recommended. Cloud computing is a new phenomenon; and not many studies have been conducted in this field. I highly recommend other researchers to test and confirm the proposed conceptual model in other contexts. The same study may also be replicated using larger sample sizes, and in different industries. Performing a longitudinal study is also useful. Majority of the companies who have not adopted cloud computing strongly intend to adopt cloud computing within the next 12 months. It is useful to recognize whether they actually will adopt cloud computing; or they were intended to adopt cloud computing because of the hype cycle that cloud is in. Longitudinal study also defines whether companies who currently use cloud computing, continue their usage; and whether cloud users are satisfied with the service they received. It is always recommended that researchers improve the models that are proposed, by adding or removing construct from the model. Therefore I highly recommend other researchers to modify the model by adding or removing variables. It is helpful in a sense that it allows both researchers and practitioners to have a better understanding about cloud computing in the context of SMEs.

Chapter 11
Conclusion

Cloud computing is a new computing paradigm which is advantageous for both companies and individuals. Cloud computing differ from other types of computing paradigms in many ways. It allows users to access and use the most sophisticated technologies without being required to pay enormous amounts of money to purchase the system; or to develop it in house. The service is delivered to customers over a network; this network can be a private network or a public network such as Internet. Users can access the service on an on-demand basis; and only pay for the resources that they used. One of the entities which benefit the most from cloud computing are Small and Medium sized Enterprises. Services offered by cloud providers help SMEs perform their tasks easier, quicker, and more efficient; it also allows SMEs to improve the productivity and performance of their companies. Cloud computing is not a complex system; and users can easily learn how to perform the system. In some cases they do not even recognize the difference; they use the same system without installing it locally. Another main advantage of cloud computing for SMEs is its payment system. The payment model of cloud computing which is a utility-based payment; is different than other types of computing. Using the pay-as-you-go method of payment allows SMEs to reduce their costs significantly; and to convert the capital expenditure into operational expenditure. According to the survey conducted in this research SMEs feel the service provided by cloud computing cloud computing is more secure than the service that is provided in house. These factors altogether make cloud computing a very interesting solution for Small and Medium Enterprises (SMEs).

Chapter 11
Conclusion

SMEs are important players of each market; and they significantly contribute to each economy's GDP and labor force. Although SMEs are not powerful enough to influence the economy individually, overall they have a great impact. Therefore proposing new strategies and technologies that help SMEs become more efficient and effective also have a positive impact on the economy as a whole. One strategy that helps SMEs compete against larger companies is investing in ICT (Tan, Chong, Lin, & Eze, 2009). The issue with investing in ICT is that in many cases these projects cost a fortune; and they are risky as well. The size, structure and limited budget that SMEs have, prohibits them from having access to IT services. IT services include but not limited to reliable and secure systems and expert IT staff. As it previously mentioned SMEs can overcome this limitation if they adopt cloud computing. In addition to SMEs, the economy also benefits from the widespread adoption of cloud computing. One of the main underlying computing paradigms that cloud computing is based on is virtualization. Virtualization significantly lowers the amount of power that is being used by data centers. Moreover, widespread use of cloud computing limits the number of private data centers that are operating. Cloud computing has its own disadvantages as well. Many researchers and practitioners argue against cloud computing. Security and reliability of cloud computing is being questioned by its opponents. Data lock-in, availability of the systems, bandwidth and legal consequences are some other issues that are mentioned by cloud computing opponents.

Similar to any innovation the diffusion of cloud computing depends on various factors. The decision to adopt an innovation is not a simple process; and is influenced by various factors. Numerous papers have been published about the adoption process of various innovations. In the context of cloud computing, not many researchers have been conducted; therefore studying the factors that influences the adoption decision of cloud computing is important. Hence, in this research I investigated the adoption process of cloud computing by SMEs. I not only studied the technical aspects of the cloud computing but also other factors such as environmental, organizational and managerial factors. For this purpose a conceptual model is proposed, and empirically tested. The proposed model consists of four groups of variables, environmental, organizational, managerial and technological factors. External support and competitive pressure are environmental factors. Employee's cloud knowledge and information intensity are organizational factors. Decision maker's knowledge about cloud computing and their innovativeness are managerial factors. Finally cloud computing relative advantage, complexity, compatibility, trialability, cost, security and privacy are technological factors that I believe influences the decision to adopt cloud computing.

Our research is a predictive research following a positivism research paradigm and deductive research method. The proposed model is developed based on two well-known theoretical frameworks in the field of technology adoption, which are Diffusion of Innovation (DOI) developed by Rogers (1995), and Technology-Organization-Environment (TOE) framework developed by Tornatzky and Fleischer (1990). Based on the research model, a set of hypotheses were proposed. In order to empirically test the model, I asked decision makers of SMEs to participate in an online survey. The questionnaire which was launched online consisted of 25 questions containing one or more items. Each of these questions aimed to capture decision makers' opinion about one aspect of this context. Majority of the questions included in the survey adapted from already published papers. These questions were modified based on the context of cloud computing and SMEs. A panel of experts consisting of three ITM professors and four PhD students reviewed the questionnaire. After getting the approval from ethic board, the questionnaire was launched online. The online survey software used to develop the survey was Qualtrics. The link to the anonymous survey was then given to a market research company to invite decision makers of SMEs. Convincing IT decision makers to participate in a survey is a though and time consuming process; that is why I hired a market research company to collect data. Only those individuals who were working for a SME; who had some knowledge about cloud computing; and were personally involved in decision making process of the companies were eligible to participate in this study. In order to maximize the quality of data, couples of Quality Assurance questions were added.

Data analysis was performed using SPSS version 20. I first collected 10 completed questionnaires; and ran a pilot study on those 10 questionnaires. During the pilot study, the reliability of the questions was measured. In order to increase the reliability of the questions, some of the items were removed from the questionnaire. The revised questionnaire was then sent to more than 500 individuals. The response rate was 20%; out of 500 surveys, the final number of usable questionnaires was 101. The reliability of the questions was checked once again. All questions except one were reliable (Cronbach's alpha was higher than 0.7). Competitive pressure had an alpha lower than 0.7; therefore I decided to remove this item from further analysis. After the internal validity of the items was checked; I performed factor analysis to check the convergent and discriminant validity of the constructs. The extraction method used, is principal component; and the rotation method used is varimax with Kaiser Normalization. At this stage some of the items were also deleted. Items were deleted either because they had factor loading of less than 0.55[12]; or because they had high cross loadings with other constructs. Removing these items left us with nine different factors; trialability and compatibility were removed from further analysis.

[12] For sample size of 100, the significant factor loading is 0.55

Since this research is a predictive one, regression analysis was used to test the hypotheses. Furthermore, our dependent variable is binary; therefore the most appropriate method of analysis is logistic regression. Logistic regression gave us the power to predict the factors that influence the decision to adopt cloud computing. Before conducting logistic regression, the collinearity of the items was checked. Employee's cloud knowledge and decision makers' cloud knowledge had high levels of collinearity. In the context of SMEs decision makers play a more important role; therefore I decided to keep decision maker's cloud knowledge and remove employees cloud knowledge from further analysis. Logistic regression was conducted. Based on the results, the only factor which significantly influences the adoption decision of cloud computing is decision maker's knowledge about cloud computing. This knowledge is defined as the knowledge about the underlying structure of cloud computing, benefits of cloud, different types of cloud computing (SaaS, PaaS, and IaaS), various deployment models (public, private, hybrid) and the pricing model of cloud computing. The reason that only one of the factors becomes significant is that both adopters and non-adopters had similar opinions about different aspects of this research (group means for each variable is close to each other). The main reason behind this similarity is that cloud computing is in its hype cycle's *peak of inflated expectations* stage. Gartner has introduced a concept named hype cycle. According to this cycle, before each technology starts its normal diffusion process, it goes through a 5-stage cycle, named hype cycle. In the *peak of inflated expectations* stage individuals and companies have unrealistic expectation from the technology. At this point of time, until cloud computing failure cases start to emerge, everyone has a very high expectation from the cloud computing. Based on our results, even those who have not adopted cloud computing has a very high intention to adopt cloud computing.

This contributes to both academia and business practice. First of all, the model proposed in this study is unique and has never been used in other studies. It is recommended that other researchers use the same model to investigate the adoption of cloud computing in different contexts. The model can also be modified and used to study the other innovations. Cloud providers can use the results of this study to increase the rate of adoption among SMEs. Based on the results of this study, cloud knowledge is the key factor in diffusion of cloud computing. Cloud providers can use various mass media such as Facebook, LinkedIn and Tweeter to increase awareness about cloud computing. In our sample the main source of information about cloud computing are cloud providers. Also it is recommended that SMEs understand the hype cycle of cloud computing. According to hype cycle, cloud computing will face a *phase of disappointment* after the *peak of inflated expectations.* SMEs decision to adopt or discontinue using cloud computing should be based on a detailed cost-benefit analysis, not just based on the publicity generated by media.

This study has its own limitations as well. The size of our sample is the biggest issue in this study. Logistic regression is sensitive to smaller sample size; this may be the reason that I did not get significant results for majority of our independent variables. Due to budget limitation I was not able to collect more data. Also the sample is from different industries. Studies based on specific industries are recommended. Moreover the sample is collected from North American SMEs; it makes the result not being applicable to SMEs from different parts of the world. Overall, the results of this study cannot be generalized. Further researches are required to gain a solid understanding of this phenomenon.

Appendices

Appendix 1: Preliminary Questionnaire

Managerial (Human) Factors

Familiarity

Are you familiar with Cloud computing?

Yes

No

Note: Answer "No" to this question, excludes the respondent from the population

Age

Please specify your age range:

18 - 25

25 - 35

35 - 50

45 – 65

More than 65

Education level

What is the highest degree you have earned?

High school diploma

College diploma

Bachelor's degree

Master's degree

PhD or higher

Professionalism (background)

Appendices

Which industry is your company operating in?

Information and Communication Technology (ICT)

Service industry

Manufacturing and production

Financial Sector

Marketing

Media

Others

Experience

For how long have you been working in this industry?

Less than 2 years

2 to 5 years

5-10 years

10-20 years

More than 20 years

Decision Maker's innovativeness

Do you consider yourself an innovative person?

(Answer to these questions is Likert-type scale ranging from strongly agrees to strongly disagree)

I have original ideas

I would rather create something new than improve something existing

I often risk doing things differently

Decision Maker's IS knowledge

How do rate your own IS knowledge?

(Answer to these questions is Likert-type scale ranging from strongly agrees to strongly disagree)

I would rate my own understanding of cloud computing as very good compared to other people in similar positions [1]

I have had the following cloud computing experience (You may circle more than one)

1) Read about cloud computing or attended a cloud computing conference/seminar/class

2) Used cloud computing at home for personal use (e.g. Google Apps)

3) Used cloud computing at work for business purposes (SaaS, PaaS or IaaS)

4) Have formal qualification in the use and operation of cloud computing

Environmental Factors

External Support

Are you satisfied with the external support provided by cloud providers?

(Answer to these questions is Likert-type scale ranging from strongly agree to strongly disagree)

We receive an excellent technical support from the cloud provider

The customer service provided by the provider is exceptional

Cloud providers offer adequate training courses

Cloud computing enhances our disaster recovery capabilities

Organizational Factors

Size of the company

How many employees are working for your company?

Number of employees:_____

No. of years in operation

For how many years is your company operating in this industry?

Less than one year

1 to 3 years

3 to 6 years

6 to 10 years

More than 10 years

Employee’s IS knowledge

(Answer to these questions is Likert-type scale ranging from strongly agree to strongly disagree)

All my employees are familiar with cloud computing

We have at least one employee who is a cloud expert

I would rate my employees’ understanding of cloud computing as very good compared with other small companies in the same industry (before adopting cloud)

Information intensity

How important is “information” for your company’?

(Answer to these questions is Likert-type scale ranging from strongly agree to strongly disagree)

My company is dependent on up-to-date information

It is very important for my company to access information fast whenever we need the information

It is very important for my company to have access to reliable, relevant and accurate information

Innovation

Relative advantage

How advantageous do you think cloud computing is?

(Answer to these questions is Likert-type scale ranging from strongly agree to strongly disagree)

Cloud computing improves our operational efficiencies by enabling us to perform our job remotely

Cloud computing increases our company’s productivity because it allows us to focus on our core business without being worried about technical issues

Cloud computing allows us to scale up or scale down our resources to meet real time demand

The service provided by cloud providers is reliable

Cloud computing is more flexible than traditional computing (e.g. on-premises deployment), by allowing us to access information wherever we have access to the Net

Cloud computing allows us to use the latest version of the technology

Cloud computing, compare to traditional computing, makes data-intensive computing much faster

Cloud computing enhances company's data storage capacity

Integrity and confidentiality of our company's data is preserved under cloud computing model

Cloud computing offers a guaranteed service based on the service level agreement (SLA)

The pay as you go model of payment makes cloud computing an attractive solution

Overall I find using cloud computing to be advantageous for my business

Cost

Do you think your company would save money if you adopt cloud computing?

(Answer to these questions is Likert-type scale ranging from strongly agree to strongly disagree)

Cloud computing's deployment process takes negligible amount of time and effort

Cloud computing has low fixed costs because we do not need to pay for licensing and other setup costs

Cloud computing has low operating cost costs such as system maintenance

Cloud computing has low training costs

Cloud computing eliminates the cost of upgrading the system

Overall cloud computing reduces our total cost of operation

Complexity

Do you think cloud computing is complex to use?

(Answer to these questions is Likert-type scale ranging from strongly agree to strongly disagree)

Working with cloud computing is complicated

It takes too long to learn how to use the cloud computing

In general cloud computing is very complex to use

Compatibility with firm's internal operation and systems

Do you think cloud computing is compatible with your company's internal operation and systems?

(Answer to these questions is Likert-type scale ranging from strongly agree to strongly disagree)

Using cloud computing is compatible with all aspects of my company's work

I think using cloud computing fits well with the way the company usually performs

Using cloud computing fits into our company's work style

Cloud can easily be integrated into our existing IT infrastructure

Dependent Variable (Adoption Decision of Cloud Computing)

Are you currently using any type of cloud computing in your business?

Yes

No

Likelihood of Adoption

How likely is that your firm use cloud computing within the next 12 months

(Answer to these questions is Likert-type scale ranging from unlikely to likely)

How certain are your plans to use cloud computing within the next 12 months

(Answer to these questions is Likert-type scale ranging from certain we do not have plan to certain we do have plan)

our firm's commitment to use cloud computing within the next 12 months is

(Answer to these questions is Likert-type scale ranging from weak to strong)

Appendix 2: Final Version of Questionnaire

Consent Agreement

Factors influencing the adoption of cloud computing among small businesses.

You are being asked to participate in a research study. Before you give your consent to be a volunteer, it is important that you read the following information and ask as many questions as necessary to be sure you understand what you will be asked to do.

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Purpose of the Study:
This project is being done, as part of the requirements, for a Masters degree. The main purpose of this study is to determine the factors that are important for decision makers of SMEs (Small and Medium-sized Enterprises) when deciding whether to adopt cloud computing or not. This research is not industry specific. SMEs from various industries can participate in this study. This questionnaire should be filled out by IT decision makers of Small or Medium firms. The target population of this study are IT decision makers of SMEs.

Description of the Study:
You are asked to participate in an online survey. This online survey consists of simple and easy to understand questions. Some of the questions may have more than one item to be answered. We are trying to capture your opinion about cloud computing and factors influencing your intention to adopt it. This online survey will not take more than 20 minutes to complete. The answer to most of the question is a five-point likert scale.

Risk of discomfort:
This online questionnaire takes about 20 minutes of your time. The nature of the survey (online survey) may make you uncomfortable. We ask you to stop doing the survey, whenever you feel uncomfortable or bored. You may not wish to answer some questions. You can skip any question you wish and still complete the survey. You may also withdraw from completing the survey at any time, by simply closing your browser, and your data will not be saved.

Benefits of the study:
The result of this study may be used to accelerate the diffusion of cloud computing among SMEs. SMEs play an important role in each economy; they have a significant contribution to each economy's GDP. Therefore, any kind of technology or strategy that helps SMEs, may improve the whole economy as well. Identifying the factors that are important for SMEs, may allow cloud providers to adjust their systems based on the needs and demands of their clients (SMEs), which is very favorable for small Businesses. These are practical contribution of this study. On the

other hand, the results of this study may shed some light on understanding the process of adopting cloud computing by SMEs. These results are favorable for academia as well. Please note that we cannot guarantee any direct benefit to any individual participants.

Confidentiality:
This online survey is anonymous. No personal question, other than your age group and education level will be asked.

Incentives to Participate:
If you agree to participate in this online survey, and finish the survey you will be paid by Empanel Online Inc. Please note that while you are free to stop participating at any time, you cannot receive full benefit if you stop. The amount, type and time of the payment depend on your contract with Empanel Online Inc. It can be in the form of Cash, gift cards or Charitable donation.

Voluntary nature of participation
Participation in this study is voluntary. Your choice of whether or not to participate will not influence your future relations with Ryerson University and Empanel Online Inc. If you decide to participate, you are free to withdraw your consent and to stop your participation at any time without penalty or loss of benefits to which you are allowed. At any particular point in the study, you may refuse to answer any particular question or stop participation altogether. If you feel uncomfortable or bored at any time during the survey, you can stop doing the survey.

Questions about the Study:
If you have any questions about this research, please contact Ms Shima Ramezani Tehrani by Email at: shima.ramezanitehrani@ryerson.ca

If you have questions regarding your rights as a human subject and participant in this study you may contact the Ryerson University

Please choose the option that best describes your knowledge about cloud computing:
- I have no information and knowledge about cloud computing
- I have little information and knowledge about cloud computing
- I have some information and knowledge about cloud computing
- I have a good understanding about cloud computing
- I have an excellent information and knowledge about cloud computing

Are you personally involved in IT decisions making process within your organization?
- Yes
- No

How many Employees are working for your company?
- 1-10 Employees: Small company
- 11-500 Employees: Medium company
- 501+ Employees: Large Company

What is your gender?
- Male
- Female

Please specify your age range:
- 18-25
- 26-35
- 36-50
- 51-65

- 66+

What is your highest level of education?

- Less than high school
- High school Degree/ GED
- Some college
- Associate Degree
- Bachelor's Degree (BA, BS)
- Master's or Doctoral Degree (MA, MS, MEng, MEd, MSW, MBA, PhD)
- Professional Degree (MD, DDS, JD)

How many years of industry-specific work experience do you have?

- Less than 2 years
- 3 to 5 years
- 6-10 years
- 11-20 years
- More than 21 years

What type of industry your company is categorized in?

- Accommodation and Food Services
- Administrative and Support, Waste Management and Remediation Services
- Agriculture, forestry, fishing and hunting
- Arts, Entertainment and Recreation
- Construction
- Educational Services
- Finance and Insurance
- health care and Social Assistance
- Information
- Management of Companies and Enterprises
- Manufacturing
- Mining, Quarrying, and Oil and Gas Extraction
- Professional, Scientific and Technical Services
- Public Administration
- Real Estate, Rental and Leasing
- Retail Trade
- Transportation and Warehousing
- Utilities
- Wholesale Trade
- Other Services (Except Public Administration)

For how many years is your company operating in this industry?

- Less than one year
- 1 to 3 years
- 4 to 6 years
- 7 to 10 years
- More than 11 years

Is your company currently using any type of cloud computing (Software-as-a-Service, Platform-as-a-Service or Infrastructureas-a-Service) in your business?

- Yes
- No

If Yes, What type of cloud are you using?

- Software-as-a-Service (SaaS)
- Platform-as-a-Service (PaaS)

- Infrastructure-as-a-Service (IaaS)

If you are currently using any cloud computing service, are you satisfied with the service you receive from cloud provider:

- Extremely Satisfied
- Very Satisfied
- Somewhat Satisfied
- Very Unsatisfied
- Extremely Unsatisfied

If No, please answer the following questions:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree Strongly	Agree
I intend to use cloud computing in the next 12 months	o	o	o	o	o
I predict I would use cloud computing in the next 12 months	o	o	o	o	o
I plan to use cloud computing in the next 12 months.	o	o	o	o	o

What is your main source of information about cloud computing?

- Youtube
- Facebook
- Tweeter
- LinkedIn
- Business Contact
- Cloud Providers
- Other types of media such as TV and Newspapers

Level of Innovativeness:
The following three questions pertain to your level of innovativeness. Please rate the following questions from Strongly Agree to Strongly Disagree, where "Strongly Agree" means the statement totally applies to you and "Strongly Disagree" means the statement does not apply to you at all.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree Strongly	Agree
I am a kind of person who usually comes up with new ideas	o	o	o	o	o
I would rather create something new than improve something existing	o	o	o	o	o
I often take risk doing things differently	o	o	o	o	o

Cloud knowledge
The following nine questions aim to capture your familiarity with cloud computing. Please rate the following questions from Poor to strong, where "Poor" means you have little knowledge about the mentioned topic and "Excellent" means you have a very good knowledge about that topic

	Poor	Fair	Good	Very Good	Excellent
My knowledge about the underlying structure of cloud computing is:	o	o	o	o	o

My knowledge about the benefits of using cloud computing is:	o	o	o	o	o
My knowledge about cloud computing is:	o	o	o	o	o
My knowledge about the difference between cloud computing and other types of computing (e.g. in house installation) is:	o	o	o	o	o
My knowledge about various models of cloud computing (SaaS, PaaS and IaaS) is:	o	o	o	o	o
My information about different types of cloud (public, private and hybrid cloud) is:	o	o	o	o	o
My knowledge about the pricing model of cloud computing(pay-as-you-go model of payment) is:	o	o	o	o	o
In comparison to the people in similar positions I would rate my own understanding of cloud computing as	o	o	o	o	o

External Support
The following four questions aim to capture the importance of external support for your company. Please rate the following questions.

	Not at all Importan t	Very Unimportant	Neither Important nor Unimportant	Very Importan t	Extremely Important
For our company, receiving an excellent technical support from cloud provider is	o	o	o	o	o
For our company receiving an exceptional customer service is	o	o	o	o	o
For our company, offering customer hot-lines by cloud providers is	o	o	o	o	o
It is important for our company to receive training from cloud providers:	o	o	o	o	o

Competitive Pressure:
The following three questions aim to measure the competitive pressure in your industry. Please rate the following questions from Strongly Agree to Strongly Disagree, where "Strongly Agree" means the statement totally applies to you and "Strongly Disagree" means the statement does not apply to you at all.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree Strongl y	Agre e
It is easy for our customers to switch to another company for similar services/products without much	o	o	o	o	o

difficulty					
The rivalry among companies in the industry which my company is operating in is very intense	o	o	o	o	o
There are many products/services in the market which are different from our products but perform the same function	o	o	o	o	o

IS knowledge (Cloud specific knowledge)
The following four questions aim to capture your employees' knowledge about cloud computing. Please rate the following questions from Strongly Agree to Strongly Disagree, where "Strongly Agree" means the statement totally applies to you and "Strongly Disagree" means the statement does not apply to you at all

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree Strongl y	Agre e
All my employees have basic knowledge about Cloud computing	o	o	o	o	o
All my employees have already used cloud computing (personal use/ business purposes)	o	o	o	o	o
Having at least one employee who has formal qualification in the use of cloud computing is important for my company	o	o	o	o	o
In comparison to other companies in the same industry, my employees' understanding of cloud computing is above average	o	o	o	o	o

Information Intensity
The following three questions aim to capture your company's dependency on up to date and accurate information. Please rate the following questions from Strongly Agree to Strongly Disagree, where "Strongly Agree" means the statement totally applies to you and "Strongly Disagree" means the statement does not apply to you at all.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree Strongl y	Agre e
My company is dependent on up-to-date Information	o	o	o	o	o
It is very important for my company to access information fast, whenever we need the information	o	o	o	o	o
It is very important for my company to have access to reliable, relevant and accurate information	o	o	o	o	o

Relative advantage
The following ten questions aim to capture the relative advantage of using cloud computing for your company. Please rate the following questions from Strongly Agree to Strongly Disagree., where "Strongly Agree" means the statement totally applies to you and "Strongly Disagree" means the statement does not apply to you at all.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree Strongl y	Agre e
Using cloud computing would enable us to accomplish tasks more quickly	o	o	o	o	o
Using cloud computing would improve the quality of the work we do	o	o	o	o	o
Using cloud computing would makes it easier for us to do our job	o	o	o	o	o
Using cloud computing would enhance our effectiveness on the job	o	o	o	o	o
Using cloud computing would increase our company's productivity	o	o	o	o	o
Using cloud computing would improve our job performance	o	o	o	o	o
Cloud computing improves our operational efficiencies	o	o	o	o	o
Cloud computing would enhance our company's data storage capacity	o	o	o	o	o
Compared to traditional computing, cloud computing would make data-intensive computing faster	o	o	o	o	o
Cloud computing allows us to use the latest version of the technology	o	o	o	o	o
The pay-as-you-go model of payment makes cloud computing an attractive solution	o	o	o	o	o
Overall I think using cloud computing would be advantageous for my business	o	o	o	o	o

Complexity

The following four questions aim to capture your opinion about the complexity of cloud computing. Please rate the following questions from Strongly Agree to Strongly Disagree, where "Strongly Agree" means the statement totally applies to you and "Strongly Disagree" means the statement does not apply to you at all.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree Strongl y	Agre e
Working with cloud computing is complicated, it is difficult to understand what is going on	o	o	o	o	o
It takes too long to learn how to use the cloud computing to make it worth the effort	o	o	o	o	o
Learning to operate the cloud computing system is easy for me	o	o	o	o	o

It takes too much time for me if I want to use cloud computing to do my normal duties	o	o	o	o	o
If you are still reading this, please select strongly agree	o	o	o	o	o
In general cloud computing is very complex to use	o	o	o	o	o

Compatibility

The following four questions aim to capture your opinion about the compatibility of cloud computing. Please rate the following questions from Strongly Agree to Strongly Disagree, where "Strongly Agree" means the statement totally applies to you and "Strongly Disagree" means the statement does not apply to you at all.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree Strongly	Agree
I think using cloud computing fits well with the way our company usually performs	o	o	o	o	o
Using cloud computing fits into our company's work style	o	o	o	o	o
Using cloud computing is compatible with our company's norms and culture	o	o	o	o	o
Cloud can easily be integrated into our existing IT infrastructure	o	o	o	o	o
Cloud computing is NOT compatible with other systems that we are using	o	o	o	o	o
In order to use cloud computing we do NOT need to technically change anything	o	o	o	o	o
Using cloud computing is compatible with all aspects of our work	o	o	o	o	o

Security and Privacy:

The following questions aim to capture your opinion about security and privacy of cloud computing. Please rate the following questions from Strongly Agree to Strongly Disagree, where "Strongly Agree" means the statement totally applies to you and "Strongly Disagree" means the statement does not apply to you at all.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree Strongly	Agree
Cloud computing provides a secure Service	o	o	o	o	o
Cloud providers' servers and data centers are secure	o	o	o	o	o
The media that is used to transmit our data to cloud	o	o	o	o	o

providers' data center is secure					
Cloud providers maintain the privacy of our data we are using	o	o	o	o	o
Cloud providers maintain the confidentiality of our data	o	o	o	o	o
Overall I do not have any concern about the security and privacy of cloud computing services	o	o	o	o	o

Trialability

The following four questions aim to capture your opinion about the trialability of cloud computing. Please rate the following questions from Strongly Agree to Strongly Disagree, where "Strongly Agree" means the statement totally applies to you and "Strongly Disagree" means the statement does not apply to you at all.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree Strongl y	Agre e
I have a great deal of opportunity to try various types of cloud computing	o	o	o	o	o
Cloud computing is available to me to adequately test run various applications	o	o	o	o	o
Before deciding whether to use any cloud computing service, I would able to properly try them out	o	o	o	o	o
I am permitted to use cloud computing on a trial basis long enough to see what it could do	o	o	o	o	o
I am permitted to use cloud computing on a trial basis long enough to see what it could do	o	o	o	o	o

Cost

The following questions aim to evaluate the costs associated with cloud computing. Please rate the following questions from Strongly Agree to Strongly Disagree, where "Strongly Agree" means the statement totally applies to you and "Strongly Disagree" means the statement does not apply to you at all.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree Strongl y	Agre e
Cloud computing decreases our capital expenditure	o	o	o	o	o
Cloud computing decreases the investment in new infrastructure	o	o	o	o	o
Cloud computing eliminates the cost of licensing new software	o	o	o	o	o
Deployment process of cloud computing involves a negligible amount of time and effort	o	o	o	o	o

Cloud computing eliminates the cost of upgrading the system	o	o	o	o	o
Cloud computing decreases the cost of system maintenance	o	o	o	o	o
Cloud computing decreases our IT costs (such as IT personnel)	o	o	o	o	o
Cloud computing decreases our operating cost	o	o	o	o	o
Training process takes a lot of time and effort	o	o	o	o	o
All our employees need to be trained in order to use the cloud	o	o	o	o	o
Cloud computing has low training Costs	o	o	o	o	o
Cloud computing has high training Costs	o	o	o	o	o
The overall cost of using cloud computing is less than the cost of installing or developing a technology in0020house	o	o	o	o	o

Conclusion
Thank you for participating in this survey. Please click next to close the survey!

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