Exploring the factors influencing the adoption of Cloud computing and the challenges faced by the business

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Abstract

The popularity of Cloud computing keeps growing and everyday more businesses are starting to use Cloud services for their applications, software or infrastructure. However, a successful adoption requires a good understanding of the benefits and challenges presented by the Cloud. This study aims to explore the factors that influence the adoption of Cloud computing and the challenges a business is likely to face.

A case study of a large multinational company is constructed using information gathered from interviews with four IT managers. Because of the qualitative method and the convenience sampling technique used, the findings can only be generalized to the population studied.

The TOE framework model is used to explore the technological, organisational and environmental factors that could influence the Cloud adoption. Relative advantage, redundancy and performance are identified as the key technological factors and complexity, compatibility and security are found to be the key technological challenges faced by the business. Top management support, firm size and technological readiness are recognised as important organisational factors while competitive and trading partner pressure are identified as key environmental factors.

The factors and challenges identified in the study could be valuable for the planning stage of the adoption process. They could provide guidance for organisations that are potential Cloud adopters.

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Chapter 1 - Introduction

1.1 Background and research aims

Cloud computing popularity keeps growing across all industries. More and more businesses are starting to use Cloud services for their software, applications or infrastructure. The benefits associated with cloud computing are enormous. However, due to the rapidly evolving Cloud market and dynamic technical information, most organisations are unsure of how to proceed with the migration into the Cloud. In addition, many enterprises have pushed back on cloud computing due to security concerns (Linthicum 2013).

The Cloud adoption, as any other technology adoption, requires a thorough understanding of the potential benefits, as well as the challenges involved in the process. It is a relatively new topic and there has not been much academic research on its adoption. Most researchers have focused on the security issues of the Cloud but very few have examined the underlying factors and challenges that Cloud adoption entails. Therefore, this study aims to answer the following question:

"What are the factors influencing the adoption of Cloud computing and what are the challenges faced by the business?"

By answering the question this study aims to identify the factors influencing a decision to adopt Cloud computing services, investigate the challenges businesses face and use the findings to provide guidance on the steps that they can take in order to successfully adopt this technology.

1.2 Organisation of the study

The study adopts an exploratory qualitative research method. A case study of a large multinational manufacturing company is examined and data is collected in the form of semi-structured interviews.

The study is structureed in the form of 7 chapters including this introduction chapter. Chapter 2 presents a review of the literature, which sets the foundations by explaining Cloud computing and identifying some of the most common adoption drivers and

concerns from the literature. Chapter 3 evaluates models used in previous research on similar topics and reveals the framework model chosen for this study. This is followed by Chapter 4, which is concerned with the research design. Findings from the interviews are presented in Chapter 5, which is followed by an analysis of the findings and their linkages to the literature review, in Chapter 6. Finally, Chapter 7 gives a summary and a conclusion of the findings and provides a recommendation for further research.

Chapter 2 - Literature review

2.1 Cloud computing definition

The term *Cloud computing* has become widely popular in recent years. There is a large number of studies on this topic but still there is no universal definition of what Cloud computing is; different researchers define it in different ways. One of the most accurate definitions is the one suggested 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 and Grance 2011)

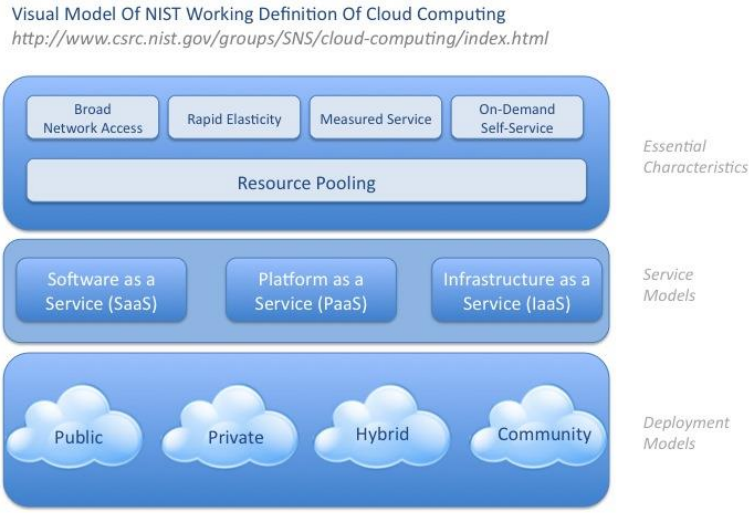

Figure 1 Visual Model of NIST Working Definition of Cloud Computing (Mell and Grance 2011)

The following sub-section highlights the essential characteristics of Cloud computing.

2.2 Essential characteristics

The model proposed by NIST (2011) consists of five essential characteristics that need to exist for the IT environment to be considered a Cloud. They are *on-demand self-service, broad network access, resource pooling, rapid elasticity* and *measured service.*

On-demand self-service refers to the expectations of Cloud computing consumers for on-demand, instant access to resources. Customers must be able to request, customise, pay and use services without any human interaction (Mell and Grance 2011). This characteristic enables the service-based and usage-driven features found in mainstream clouds (Erl, Mahmood and Puttini 2013).

Broad network access indicates that Cloud services should be widely accessible. According to Erl, Mahmood and Puttini (2013) support for a range of devices, protocols and interfaces may be required.

Resource pooling means that Cloud customers are using a multi-tenant model, which consists of merged computing resources. A variety of physical and virtual resources are assigned in accordance with customer demand. The resources could include storage, processing, memory, and network bandwidth (Mell and Grance 2011).

Rapid elasticity refers to the ability of a cloud to balance the available IT resources, depending on the runtime conditions or as agreed by the cloud consumer and provider (Erl, Mahmood and Puttini 2013). The consumer is provided with a wide variety of resources that can be changed in any quantity at any time (Mell and Grance 2011).

Measured service represents the ability of a cloud platform to measure the usage of the IT resources that have been used by a consumer. Based on the measurements, the consumer is charged only for the resources used or the time they have been used for (Erl, Mahmood and Puttini 2013).

In conjunction with the essential characteristics as identified by NIST (Erl, Mahmood and Puttini 2013) suggest that *resiliency* has emerged as another significant aspect of Cloud computing, which, because of its common level of support needs to be included

as a common cloud characteristic. Resilient computing is a form of failover that distributes redundant implementations of IT resources across physical locations.

IT resources can be preconfigured so that if one becomes deficient, processing is automatically handed over to another redundant implementation. Within Cloud computing, resiliency can refer to redundant IT resources within the same cloud or across multiple clouds (Erl, Mahmood and Puttini 2013).

2.3 Service delivery models

According to Armbrust et al. (2009) "Cloud computing refers to both the applications delivered as services over the Internet and the hardware and systems software in the datacentres that provide those services." There are three universally accepted service delivery models. They are referred to as *Software as a Service (SaaS), Platform as a Service (PaaS)* and *Infrastructure as a Service (IaaS).*

The *Software as a Service (SaaS)* model is used for providing applications hosted as a service. According to Rittinghouse and Ransome (2010) the SaaS model is very popular with enterprise customers allowing them to use different business software applications, without the need for licensing and the complexity of installation and management, thus driving the initial cost down (Rittinghouse and Ransome 2010) (Buyya, Broberg and Goscinski 2011) (Hugos and Hulitzky 2011).

The *Platform as a Service (PaaS)* model provides a platform for building and running web-based applications. It provides all the required services and tools to support the whole process of building, testing and delivering web applications and services without the need to install any additional software (Rittinghouse and Ransome 2010) (Hugos and Hulitzky 2011).

Infrastructure as a Service (IaaS) provides virtualised resources on demand. This model enables the A cloud infrastructure enables on-demand supplying of servers that could run different operating systems and customised software (Buyya, Broberg and Goscinski 2011) (Hugos and Hulitzky 2011) (Rittinghouse and Ransome 2010).

2.4 Cloud deployment models

There are a four deployment models that have been widely adopted, with differences in physical location and distribution. The majority of researchers have agreed that a Cloud can be classed as *public, private, community* or *hybrid*.

The *public cloud* infrastructure is usually owned by an organisation providing Cloud services and is available for public or a large industry group use (Sosinsky 2011) (Rittinghouse and Ransome 2010). Public cloud services are usually billed using the pay-as-you-go model, which means customers pay only for the time the resources were used (Molen 2010).

In contrast, the *private cloud* infrastructure is usually owned by the organisation that is using it. It may be based either on or off-premises (Sosinsky 2011). This model is considered to be more secure because the users are in control of their own data, which makes it the preferred choice over a public cloud (Baun et al. 2011).

A *community cloud* is a model where infrastructure is shared between several organisations from a particular community to serve a common function or purpose. (Sosinsky 2011) A community cloud may be managed privately or by a third party organisation (Sosinsky 2011).

The *hybrid cloud* is model that combines services from both the public and the private cloud (Baun et al. 2011). They retain their unique qualities, but are treated as one unit (Sosinsky 2011). The hybrid cloud usually relies on the public cloud resources for high demanding tasks, while the organisation's private resources run any normal operations (Baun et al. 2011) (Sosinsky 2011).

2.5 Business adoption drivers

The following subsections outline some of the most common drivers for Cloud computing adoption found in the literature.

2.5.1 Improved business agility

"Business agility is the ability of a business to adapt rapidly and cost efficiently in response to changes in the business environment." (Tsourveloudi and Valavanis 2002) With its relatively small initial cost Cloud computing can give organisations the ability to respond to business demands quicker, allowing them to deploy solutions quickly. It can also help businesses ensure their employees have instant access to critical business information, using any device anywhere (Microsoft 2010).

2.5.2 Reduced capital expenditure

Most Cloud computing offerings have adopted the pay as you go billing model, while others bill on a subscription basis. This allows customers to benefit from a reduced capital expenditure because they consume resources as a service by just paying for what they use (Rittinghouse and Ransome 2010). By sharing computing resources between several users, utilization rates are significantly improved, which means reduced infrastructure costs (Rittinghouse and Ransome 2010).

2.5.3 Increased end-user productivity and collaboration

More than ever before workers and consumers have access to Internet and various interconnected devices, thereby increasing their ability to access software when it is available as a service. With a cloud solution users can access services regardless of location or device and they can easily share information with colleagues or partners (Molen 2010). Web-based interfaces have enabled applications to become more standardised and easier to understand and use, so the user base of software applications has become more confident and willing to use them (Hugos and Hulitzky 2011).

2.5.4 Energy efficiency

Nowadays many organisations are going "green" in response to consumers' demand for more sustainable products and working environments. Clouds enable organisations to reduce power consumption and space usage by maximizing the utilization of machines while cutting down on the total number of servers required (Google 2011).

Depending on the Cloud deployment model an organisation is using, there could be no power consumption at all. For instance, if the whole infrastructure is outsourced to a Cloud provider, there would be no servers on-site.

2.5.5 Improved reliability and continuity

Business reliability and continuity is critical to all organisations as any downtime may lead to a loss of revenue or customer dissatisfaction, making a negative impact on the brand image (IBM 2013). It is suggested that Cloud can improve disaster recovery time and reliability by rapidly recovering applications on available hardware when a failure occurs. This could minimize or eliminate the impact of an outage. Any planned server downtime for common maintenance operations could be eliminated, ensuring no service disruptions to the business (VMware 2013).

2.6 Business adoption concerns

Cloud computing has been widely adopted by many organisations but it is still in its infancy and there are many challenges that need consideration. There are many issues that have not been fully resolved and new challenges keep emerging (Zhang, Cheng and Boutaba 2010). The following sub-sections outline the three most common issues faced by the business in the Cloud adoption process.

2.6.1 Data security

Security is arguably the top concern of companies when considering a move of data or computing resources to the cloud (Hugos and Hulitzky 2011). It is seen as a very complex area for both internal IT organisations and cloud service providers (Hurwitz et al. 2010). As there are three different Cloud deployment models, each one of them has their own issues. Most security concerns are related to the data transmission, data storage or third parties' access to a company's data. For example, (Subashini and Kavitha 2011) suggest that many companies are not happy with the SaaS model because it is not clear how their data is stored and secured. This is a problem because traditionally the sensitive data of an organisation resides within its own premises and is subject to its own control policies (Subashini and Kavitha 2011). On the other hand, organisations adopting the IaaS model are concerned about the data transmission between the Cloud and their on-site infrastructure.

Also, the PaaS model is considered to be more vulnerable to security breaches because of the insecure platform it provides for developers to build their own applications (Sosinsky 2011).

2.6.2 Availability

Another key risk of using cloud services, which needs consideration, is the reliance on the Internet. For example, if there are disruptions to the Internet connection, users will not be able to access applications or data on the Cloud. This is a concern that exists in the traditional IT world and needs to be considered even if an organisation is not adopting a cloud solution. According to a white paper by ISACA (2009), the cloud provider often takes responsibility for information handling, which means failure to perform to service level agreements may impact availability, which would affect critical business operations.

2.6.3 Data lock-in

Each cloud vendor has a different application model because there is still no standardization across cloud-based platforms (Molen 2010). According to Molen (2010), this creates an unnecessary complexity and results in high migration costs. The lack of compatibility between existing cloud technologies means that the Cloud provider makes the customer dependent on their services or products, and they are unable to switch suppliers without substantial switching costs.

Chapter 3 - Framework

3.1 Introduction

A thorough review of prior researchers' findings indicates that there are various factors that affect the adoption of Cloud computing. They can all be categorised into technological, organisational or environmental context. Therefore, the technological, organisational, environmental (TOE) framework (Tornatzky and Fleischer 1990) (Low, Chen and Wu 2011) will be used to research Cloud computing adoption.

3.2 Technology adoption theories

There are many theories used in technology adoption studies. The most used ones appear to be the technology acceptance model (TAM) (Davis, Bagozzi and Warshaw 1989) (Venkatesh and Davis 2000) (Venkatesh and Bala 2008), unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al. 2003), diffusion of innovation (DOI) (Rogers 1995) theory and the TOE framework (Tornatzky and Fleischer 1990); DOI and TOE are the only ones that view at the organisational level.

The TOE framework was found to be consistent with the DOI theory, in which (Rogers 1995) identified the internal and external characteristics of organisation and the individual characteristics of employees as drivers for organisational innovation. The TOE framework looks at the same features in its technology and organization contexts, but it also includes the environment context, which makes it the more appropriate choice to explain innovation adoption in an organisation (Oliveira and Martins 2011). Thus, this model is considered to be more complete and will be used in this study.

3.3 TOE framework

"The TOE framework as originally presented, and later adapted in IT adoption studies, provides a useful analytical framework that can be used for studying the adoption and assimilation of different types of IT innovation." (Oliveira and Martins 2011)

Tornatzky and Fleischer (1990) developed the TOE framework by identifying three context groups: technological, organisational and environmental. The technological context looks at the internal and external effects of a technology on the business. Organisational context looks at several attributes regarding the organisation that could affect the technology adoption. The Environmental context looks at the company's industry, competition and any other external factors.

This study will use a TOE framework model adapted by Low, Chen and Wu (2011).

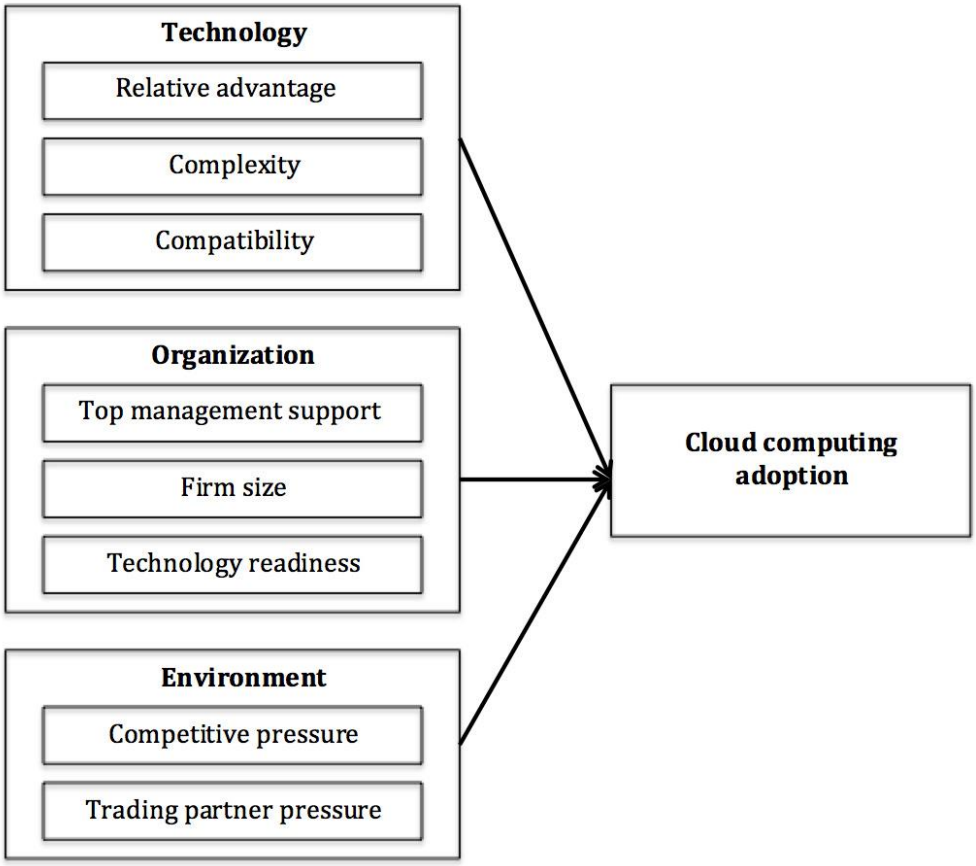

Figure 1 (Tornatzky and Fleischer 1990)'s TOE framework model adapted by (Low, Chen and Wu 2011)

3.3.1 Technology context

The TOE model adapted by (Low, Chen and Wu 2011) suggests three technological predictors of Cloud computing adoption – *relative advantage*, *complexity* and *compatibility*. *Relative advantage* discusses the degree to which a technological factor is seen as providing greater benefit to the business (Rogers 1983). New technologies often take long to be understood by users, therefore implementing Cloud computing could be a long and slow process because of its *complexity*. Compatibility, on the other hand, refers to the degree the new technology fits the existing values, practices and needs of a company (Rogers 1983).

3.3.2 Organisational context

Organisational context proposes another three attributes – *top management support*, *firm size* and *technological readiness*. *Top management support* is essential for providing the resources needed to adopt a new technology (Low, Chen and Wu 2011) (Wang, Wang and Yang 2010). The *firm size* is also considered to have impact on technology adoption (Low, Chen and Wu 2011) (Pan and Jang 2008). *Technological readiness* refers to the existing infrastructure and the ability of the IT human resources to understand and adopt a new technology (Zhu, Kraemer and Xu 2006) (Oliveira and Martins 2011).

3.3.3 Environmental context

Low, Chen and Wu (2011) suggest that *competitive and trading partners pressure* are the two factors that should be looked at in the environmental context. They refer to the pressure from both competitors and trading partners on the business to stay current and adopt new technologies (Low, Chen and Wu 2011) (Oliveira and Martins 2011).

3.4 Conclusion

This chapter introduced the framework model selected for this study. Some of the more popular theories, used to explain technology adoption were reviewed and the TOE framework (Tornatzky and Fleischer 1990) adapted by Low, Chen and Wu (2011) was selected as a research framework.

Chapter 4 - Research design

4.1 Introduction

This chapter outlines the research objectives and strategy, the purpose of the research, the research approach and the method that was used to collect data. Described are the population studied and the sampling procedure used. Generalization and ethical principles are also reviewed.

4.2 Research objectives

The research question this study aims to answer is *"What are the factors influencing the adoption of Cloud computing and what are the challenges faced by the business?"* Based on the literature review the following objectives have been set out in order to achieve the above aim:

1. Identify and evaluate the technological factors and challenges that could impact the Cloud adoption

2. Identify and evaluate the organisational factors and challenges that could impact the Cloud adoption

3. Identify and evaluate the environmental factors and challenges that could impact the Cloud adoption

4.3 Research strategy

This study will use a *case study* research strategy. A case study can provide a reasonable explanation of a real world example, exploring significant features of the case in question (O'Hara et al. 2011). It was chosen as a research strategy because it allows for in-depth study and analysis of the chosen sample. The case study will be on a large multinational manufacturing and services company, which is present in the United Kingdom and have adopted Cloud computing services.

Conducting interviews with four IT managers and the personal observation of the author will be used to construct the case study. The population and sample of this research will be discussed later in section 4.6 Data collection method. A major

criticism of the case study approach is that it is not possible to generalize because it is focused on a single case (O'Hara et al. 2011).

4.4 Research purpose

The purpose of a research can be *exploratory*, *descriptive* or *explanatory* (Babbie 2011).

The purpose of *descriptive* research is to describe situations and phenomena, while *explanatory* research serves to explain things. (Babbie 2011) They both need propositions, which means the author needs to make a hypothesis, on the basis of literature findings and any other evidence, speculating what they expect the research outcome to be. (Rowley 2002)

The purpose of this study is to explore the adoption process by identifying the factors that should be considered and the challenges faced by the business. The research question indicates an *exploratory* purpose. Exploratory research is usually conducted to explore a topic, which is new or has not been clearly defined (Babbie 2011). The objective of an exploratory research is to identify key issues and variables by reviewing and analysing available literature (Guimaraes 2011). It could include descriptive elements but goes beyond this to identify and explore the underlying causes. (Babbie 2011)

4.5 Research approach

There are two types of research approach – *quantitative* and *qualitative*.

A *quantitative* approach deals with data that can be measured, and is usually based on numbers, such as scientific measurements, economic data or other data statistics. Aliaga and Gunderson (2000) define quantitative research as "explaining phenomena by collecting numerical data that are analysed using mathematically based methods". This approach makes use of research tools such as experiments and surveys, and all of the collected data is counted or quantified (Creswell 2003).

It is useful for gathering information from large groups of people and is considered to be more cost and time efficient. One of its major limitations is that it often produces predictable and insignificant findings because of the restriction on the variables

(Burns 2000). It also fails to take account of people's interpretations and meanings (Burns 2000).

In contrast, a *qualitative* approach is more concerned with data that cannot be measured, such as people's opinions, descriptions or observations (Walliman 2013). This study will use a qualitative research approach. It does not include numbers or quantifying of information; instead, it will be based on interviews and observations made by the author (Creswell 2003). Creswell (2003) says "qualitative research is useful when a concept or phenomenon needs to be understood because little research has been done on it". The purpose of this study was to answer the question *"What are the factors influencing the adoption of Cloud computing and what are the challenges faced by the business?"* Given the fact that Cloud computing is a relatively new topic and there has not been much research done on it, the qualitative approach was chosen for reaching the research objectives of this study, because of its nature to provide an in-depth understanding of the research problem (Walliman 2013).

Analysis of prior research on similar topics has provided the theoretical framework and direction for the primary research in this study. A major limitation of the qualitative research is the problem of adequate reliability and validity. Also, the subjective nature of the qualitative data makes it difficult to apply conventional standards of reliability and validity (Burns 2000).

4.6 Data collection method

The interview is a common method of gathering data in qualitative research (O'Hara et al. 2011). It was chosen as a research tool for this study because interviews are more personal than questionnaires, thus allowing the interviewer to connect with the interviewee and gain a better understanding of the participant's environment. An interview could be structured, which resembles a questionnaire with very strict formal questions, semi-structured, which allows for more periods of interaction and the questions are not so formal, and unstructured, which is more like a discussion, with no formal questions (Horn 2012).

Telephone semi-structured interviews were used in this study. Telephone interviews were chosen instead of face to face, because of geographical reasons. This allowed the author to interview people from different parts of the United Kingdom and United

States, thus getting a better understanding of the multinational organisation. Semi-structured format was chosen because it allowed the author to keep the interviews less formal by interacting with the participants, and structure the questions into three contexts – technology, organisational and environmental, fitting the TOE framework.

4.6.1 Population and sample

A population can be defined as the set of individuals, items or data from which a sample is taken (Horn 2012). The population of this study can be defined as all businesses that are potential adopters of Cloud computing.

Sampling is the method of choosing participants to be involved in a study. (Horn 2012) Because of time or cost limitations, it is impossible to gather information from everyone or everything in a population. Instead, it is easier to find and use a subset of that population i.e. a sample. There are two possible sampling methods – probability and non-probability sampling (Horn 2012). The first uses a form of random selection from pre-selected samples, and the second does not use random selection.

A non-probability technique, called convenience sampling, was used for choosing the research participants for this study. This method is based on choosing samples depending on availability or accessibility (Horn 2012). Convenience sampling was used because of the relatively small cost and time required to carry on the research and the accessibility of the chosen sample. Four IT managers from a large multinational manufacturing and services company were chosen to represent the case study of the organisation.

4.6.2 Generalization

Because of the nature of qualitative research, convenience sampling and the relatively small sample size, the findings generated from primary research cannot be generalized to the wider population. Instead, they could provide a foundation for further research.

4.6.3 Ethical principles

Ethical principles were considered prior to conducting the primary research and the appropriate actions were taken. The checklist, provided by the Faculty of Arts,

Computing, Engineering and Sciences at Sheffield Hallam University was submitted and approved. It can be found in the appendix.

The research involved the use of human subjects in the form of semi-structured interviews. Detailed information regarding the study was given to all participants and their informed consent was gained prior to conducting further research. Anonymity and privacy of all participants were respected, thus their identities and the identity of the company studied will remain anonymous in this study. To ensure confidentiality, the company will be referred to as "company X" and the interview participants will be referred to as Participant 1 (P1), Participant 2 (P2), Participant 3 (P3) and Participant 4 (P4).

4.7 Conclusion

This chapter outlined that this research will be an exploratory study, and a qualitative research approach will be used. The research objectives that are going to guide the research were introduced and the strategy was described. A case study of a large multinational manufacturing and services company will be used as an example to explore and understand the factors that influenced the decision to adopt Cloud computing services, and the challenges it faced. In order to construct the case study interviews will be conducted with four IT managers from the studied company and their responses, together with the author's personal observations, will be analysed, using the TOE framework. The population was identified as all organisations that are potential adopters of Cloud computing and the method of sampling was described as convenience sampling technique. It was explained that generalization could not be made because of the nature of the research method and the size of the sample. Finally, the ethical principles were considered.

Chapter 5 - Findings

5.1 Introduction

This chapter presents the findings of the conducted primary research. It was conducted in the form of semi-structured interviews with four IT managers from a large multinational manufacturing and services company, which will be referred to as "company X". The company and participants were selected, using the convenience sampling technique. The company was chosen, as a suitable unit because it has adopted external Cloud computing services and is in the process of creating its own Cloud. The four participants were chosen because they are all closely involved in the process. They have the essential technical knowledge and are responsible for the decision-making process in the company; therefore this makes them an appropriate source of information for the purpose of this research. They will be referred to as Participant 1 (P1), Participant 2 (P2), Participant 3 (P3) and Participant 4 (P4).

Participant 1 is a Solution Development & Integration Manager. He has been very closely involved with the research and evaluation of the different Cloud solutions. He was chosen as a participant for this study because of his experience with different Cloud providers and their products, and his involvement in the process of choosing the most appropriate solution for company X.

Participant 2 is an IT Service Delivery Manager. He is responsible for the support and integration of any IT solutions at company X. He was chosen because of his close involvement with the integration of Cloud services at the studied company.

Participant 3 is a Network Service Delivery Manager, responsible for any changes to the network infrastructure at company X. He was asked to participate because of his understanding of the effects on the company's infrastructure made by the adoption of Cloud services.

Participant 4 is a Global Video Conferencing Manager. He is closely involved in the integration of Cloud services for the use of Video Conferencing.

He was selected to participate because of his different point of view as a user of the adopted Cloud services.

Information gathered from these interviews was used, together with the author's personal observations, to construct a case study of the organisation, which provided an overview of the factors that influenced their decision and the challenges they faced in the process of adopting Cloud computing services.

The interview questions were derived from the TOE framework model chosen for this study. Three major areas were explored: technology, organisational and environmental.

5.2 Technology context

The first area that was explored is technology. As suggested by the TOE framework model (Tornatzky and Fleischer 1990) (Low, Chen and Wu 2011), the participants were asked to evaluate each of the three attributes. In order to look beyond the boundaries set by the model, they were also asked to identify any other technological factors that they had to consider at company X.

5.2.1 Relative advantage

The first factor suggested by the TOE framework was relative advantage. It refers to the degree to which a technological factor is seen as providing greater benefit to the business (Rogers 1983). Participants were asked: *"Do you think adopting Cloud services has given company X relative advantage over its competitors?"* They all responded positively, confirming that adopting Cloud services has allowed their organisation to keep up to speed with their competitors and potentially gain a competitive advantage.

Participant 1: "Our company is a large provider and consumer of both internal and external Cloud serviced offerings. We have adopted SaaS, IaaS and PaaS. Using Cloud services helps us reduce the potential bubble cost of starting any new contract and means we get our return quicker." (P1 2013. pers. comm.)

Participant 2: "Using a fully built, pre-configured online service helps the organisation reduce the cost and time of starting new projects or contracts" (P2 2013. pers. comm.).

Participant 3: "Adopting Cloud services have eliminated the need for buying new physical devices, giving us a cost advantage when we are starting new projects." (P3 2013. pers. comm.)

Participant 4: "This cost advantage has allowed company X to keep up with its competitors" (P4 2013. pers. comm.)

5.2.2 Complexity

The next attribute suggested by the TOE framework model was complexity. Participants were asked: *"Did you see complexity of the Cloud adoption process as a challenge?"* All participants confirmed that it was one of the key challenges they had to face.

Participant 1: "The existing solutions are maturing to natively take advantage of Cloud services and the growing popularity of the Cloud is pushing the providers to make their solutions easier to integrate and use." (P1 2013. pers. comm.).

Participant 2: "With all vendors working differently, it can get really difficult at times" (P2 2013. pers. comm.)

Participant 3: "The complexity of integrating different Cloud services with the existing infrastructure could be a real challenge" (P3 2013. pers. comm.).

Participant 4: "Integrating new services is always a complex process." (P4 2013. pers. comm.)

5.2.3 Compatibility

The next question was *"Was compatibility of the Cloud with existing infrastructure seen as a factor in the decision-making process?"* Once again, everyone responded positively, identifying this as another key challenge.

Participant 1: "All vendors have to be considered when making a decision because the business has to find the most appropriate provider and ensure compatibility with its own environment" (P1 2013. pers. comm.).

Participant 2: “Finding a suitable solution is a difficult and long process, because vendors do not clearly state what their solutions are compatible with” (P2 2013. pers. comm.)

Participant 3: “ Cloud providers are gradually transforming their products to be more compatible. If a provider is not flexible in their support for customer platforms that will reduce the number of potential customers they have” (P3 2013. pers. comm.).

Participant 4: “Compatibility of existing infrastructure is always an issue that requires careful examination.” (P4 2013. pers. comm.)

5.2.4 Other technological factors

Considering the limitations set by the adopted TOE framework model, the participants were asked: *“What other technological factors were considered before making a final decision to adopt Cloud services at company X?”* The participants identified redundancy and performance as another key factors and security as a major challenge.

5.2.4.1 Redundancy

Participant 4: “Redundancy of the existing infrastructure had to be considered, as we could have ended up in a situation, where we had to pay for depreciation of equipment that was not used” (P4 2013. pers. comm.).

5.2.4.2 Performance

Participant 1: “ When we outsource, the whole service stack is outsourced so we no longer have control over any performance tweaks other than the SLA we sign up to. Also, connecting the company to a Cloud service can sometimes be a major performance bottleneck in itself” (P1 2013. pers. comm.).

Participant 2: “Services downtime depends on the service provider and it is outside our control” (P2 2013. pers. comm.).

5.2.4.3 Security

Participant 1: “The best way to deliver an efficiently priced cloud service is to have it fully software based. This means that the physical separation, used in the past as the best method of security, has gone.” (P1 2013. pers. comm.).

Participant 2: “We now need to trust the Cloud provider and our own internal IT staff to ensure that the security of our data is kept in line with expectations” (P2 2013. pers. comm.).

Participant 3: “With the vendor having full control over the Cloud solutions, the IT department sometimes do not have enough privileges to ensure everything is protected” (P3 2013. pers. comm.).

Participant 4: “It is unclear where the data is stored and how it is kept safe by the vendor” (P4 2013. pers. comm.).

5.3 Organisational context

The next explored area was the organisational context. The model suggested top management support, firm size and technological readiness as the three key attributes. Participants were asked to evaluate each one of them and identify any other organisational factors that they had to consider at company X.

5.3.1 Top management support

The participants were asked: *“Was top management support a factor in the adoption process at company X?”* All responses identified top management support as a crucial factor in the adoption process and would ultimately impact the decision.

Participant 1: “If we want to deliver a new service that uses technology, which falls into what are known as “disruptive technologies” then we would not be able to go any further than a PoC stage without a buy-in from our organisations’ top management team” (P1 2013. pers. comm.)

Participant 2: “We need to present them with a valid business case in order to get approval for any of our projects.” (P2 2013. pers. comm.)

Participant 3: “We needed an agreement from the top management in order to start the project. The number of benefits offered by Cloud services made the decision a lot easier and we had their full support.” (P3 2013. pers. comm.).

Participant 4: “Without the support from top management we cannot start any project.” (P4 2013. pers. comm.)

5.3.2 Firm size

The next question asked was: *“Do you think the firm size could impact the adoption decision?”* Everyone responded positively, identifying firm size as a factor. Cloud was found to be more difficult to adopt in large companies.

Participant 1: “It’s relatively easier for small companies to adopt Cloud services. The cost of investing in new hardware can be daunting for them. The Cloud eliminates that cost by providing a rent on demand model.” (P1 2013. pers. comm.).

Participant 2: “For large companies who have already placed large investments in data centres, servers and applications the choice is not so clear-cut.” (P2 2013. pers. comm.).

Participant 3: “It is more difficult in larger organisations, such as our company, because depending on the business requirement it may be cheaper for us to host a solution internally, instead of spending time and resources on investigating the sustainability of a particular Cloud service.” (P3 2013. pers. comm.)

Participant 4: “Larger companies have more users to worry about” (P4 2013. pers. comm.).

5.3.3 Technological readiness

The next factor suggested by the TOE framework model was technological readiness. It refers to the existing infrastructure and the ability of the IT human resources to understand and adopt a new technology (Zhu, Kraemer and Xu 2006) (Oliveira and Martins 2011). The participants were asked: *“Was technological readiness seen as a factor when you made the decision to adopt Cloud services?”* They all confirmed that technological readiness is a factor that had to be considered before they made a final decision.

Participant 1: “The adoption of any new technology into a mature internal service of a large enterprise can be a daunting and long winded task. We had many factors and obstacles to consider.” (P1 2013. pers. comm.).

Participant 2: “We already had the understanding because the services offered as “Cloud services” are not new to us. The term “Cloud” is to a certain degree a marketing buzz word used for hundreds of different service offerings delivered over the Internet.” (P2 2013. pers. comm.).

Participant 3: “As IT managers, we need to ensure we can take all the buzz and hype and then pull out the key information and services that is right for our business.” (P3 2013. pers. comm.).

Participant 4: “We had to make sure we had the resources in place before a decision was made.” (P4 2013. pers. comm.)

5.3.4 Other organisational factors

Again, because of the limitations set by the TOE framework the participants were asked the following question: *“What other organisational factors were considered before making a final decision to adopt Cloud services at company X?”* The only factor identified was the lack of control of the IT department, which cloud lead to potential internal conflicts.

5.3.4.1 Potential internal conflicts

Participant 1: “Different business groups are usually not informed that if they are using Cloud services they need to contact the Cloud provider for support. It is natural for them to seek assistance from the IT department” (P1 2013. pers. comm.).

Participant 3: “If a business unit goes off and works independently there might be a conflict between the IT department and the group using the third party Cloud solution.” (P3 2013. pers. comm.).

5.4 Environmental context

The last area of exploration was the environmental context. The suggested attributes were competitive and trading partner pressure.

Once again, the participants were asked to evaluate them and identify any other environmental factors that they had to consider at company X.

5.4.1 Competitive and trading partner pressure

All participants were asked: *"Did competitive pressure or trading partner pressure make an impact on your decision to adopt Cloud services?"* They all confirmed that competitive and trading partner pressure were both key factors that identified the need to adopt Cloud services.

Participant 1: "At the moment the Cloud is seen as one of the "buzz" technologies and there is a lot of pressure, both internally and externally, to replace old legacy services with Cloud services" (P1 2013. pers. comm.).

Participant 2: "We have to keep up with our competitors." (P2 2013. pers. comm.).

Participant 3: "Our closest partners already have their own private Cloud solutions in place and this puts even more pressure on us." (P3 2013. pers. comm.).

Participant 4: "There is competitive pressure for customer services to be made easier by using Cloud offerings." (P4 2013. pers. comm.)

5.4.2 Other environmental factors

Again, because of the limitations set by the TOE framework the participants were asked the following question: *"What other environmental factors were considered before making a final decision to adopt Cloud services at company X?"* The only factor identified was environmental efficiency, with P1 and P4 seeing Cloud as a greener solution, and P3 disagreeing.

5.4.2.1 Environmental efficiency

Participant 1: "There is both internal and external pressure on being a "greener" business by making more sustainable products and providing a better working environment. Cloud services are seen as a "greener solution" by the business" (P1 2013. pers. comm.).

Participant 4: "A Cloud service, such as video conferencing, allows our employees to travel less, which means less carbon emissions." (P4 2013. pers. comm.).

Participant 3: “When the business is using third party solutions, we do not know where their data centre is and what amount of power they use” (P3 2013. pers. comm.)

5.5 Conclusion

This chapter presented the findings collected from interviews with four IT managers from company X. All eight attributes suggested by the TOE framework model (Tornatzky and Fleischer 1990) (Low, Chen and Wu 2011) were confirmed to be significant factors or challenges in the adoption of Cloud computing. Another five key factors emerged from the interviews – redundancy, performance, security, potential internal conflicts and environmental efficiency.

The findings will be discussed in more detail in the next chapter.

Chapter 6 - Discussion

6.1 Introduction

The aim of this chapter is to provide an overview of the study and discuss the findings and their linkages to the existing literature in order to determine whether they support or contradict one another.

A review of previous studies on this or similar topics was conducted in order to find a suitable technology adoption model. The TOE framework (Tornatzky and Fleischer 1990) was found to be best suited for this research and three context groups were identified: technological, organisational and environmental. The framework was used to conduct primary research and present the findings in Chapter 5. A case study research strategy was adopted and the purpose of the study was defined as exploratory, using qualitative research method. A case study of a large multinational manufacturing and services company was used to examine the factors and challenges faced by its IT management. Interviews were conducted with four IT managers in order to gain a better understanding of the company’s situation. The organisation and interview participants were chosen using the convenience sampling technique, which made it unable for this study to generalise the findings to a wider population than the

one studied. Findings from the interviews indicated that the organisation is using all three service delivery models available, which confirms it is a good example to study.

In order to discuss the findings and their linkages to the literature the three contexts of the TOE framework (Tornatzky and Fleischer 1990) will be used.

6.2 Technology context

First, the technology context is examined in order to achieve objective *1.Identify and evaluate the technological factors and challenges that could impact the Cloud adoption.* The TOE framework used in this study suggested three technological factors – relative advantage, complexity and compatibility (Low, Chen and Wu 2011). Another three key technology factors emerged from the interview findings - redundancy, performance and security.

Relative advantage

In order to understand if the adoption of Cloud computing can give relative advantage to a business and whether that is a factor or not, the participants were asked: *"Has adopting Cloud services given company X relative advantage over its competitors?"*

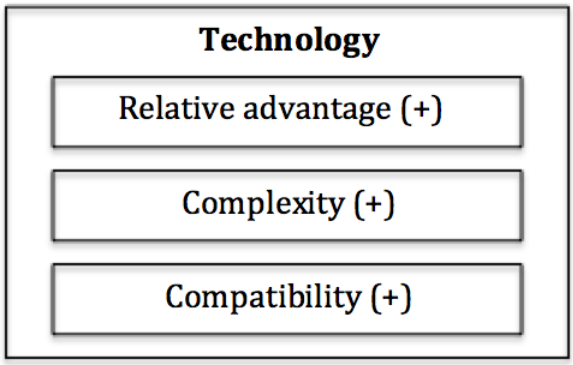

Figure 2 Confirmed technological factors from TOE framework

The findings were consistent with the information found in the literature, identifying this as a factor and confirming that adoption of Cloud computing services could give a competitive and cost advantage to a business. The review of the literature suggested that improved business agility (Tsourveloudi and Valavanis 2002) and reduced capital

expenditure (Rittinghouse and Ransome 2010) provided by the Cloud are potential adoption drivers. The interview findings confirmed that, by indicating the agility of the Cloud and the relatively small set-up cost for starting new projects as key for allowing the organisation to keep up with its competitors and respond quicker to business demands.

Complexity

Complexity was examined next. The participants were asked: *"Did you see complexity of the Cloud adoption process as a challenge?*

The participants identified this to be one of the major challenges faced by the IT management at company X.

According to P3, different business units tend to have different requirements, which usually means there is a need for integration of more than one Cloud solution. This was observed to make the adoption process more complex and with several areas that the IT management had to sense check before they could consider the adoption of any Cloud service. However, P1 suggested that the growing popularity of the Cloud is pushing the providers to make their solutions easier to integrate and use. In contrast, there was no information regarding the complexity of Cloud computing in the reviewed literature. Based on probability and considering the findings, complexity will be seen as a challenge.

Compatibility

Compatibility with existing infrastructure was found to be another major challenge identified by the participants. They were asked: *"Was compatibility of the Cloud with existing infrastructure seen as a factor in the decision-making process?"*

The findings revealed that company X, similarly to most large organisations, has its own infrastructure, which, according to all participants, makes the integration of Cloud services a difficult process. The participants identified this as a challenge because vendors do not clearly state the compatibility of their products, which makes the process of finding a suitable solution very long and difficult. The literature suggested that compatibility with another Cloud platforms is also an issue, referring to the data lock-in as one of the adoption concerns (Molen 2010). The findings are consistent with the literature, suggesting that every Cloud provider has its own way of

doing things. The literature expands the compatibility issue beyond the existing infrastructure by including the compatibility with another Cloud platforms and providers. Based on probability, the compatibility will be considered a challenge in the adoption process.

Other technological factors

Considering the limitations set out by the TOE framework, the participants were asked: *"What other technological factors were considered before making a final decision to adopt Cloud services at company X?"*

Redundancy

The findings identified redundancy of the existing infrastructure as a factor. According to P4, existing infrastructure may become redundant while the business is still required to keep paying depreciation for it. The cost of using multiple Cloud offerings could also be very high; therefore, he suggested that in some cases paying for and using the existing infrastructure could be a more efficient option. There is nothing in the literature about this problem but it was recognized as an important factor at company X and based on probability, it is reasonable to say that any cost of the existing infrastructure needs to be considered before making a final decision to adopt Cloud services.

Performance

Another factor that emerged from the interviews was performance. The literature review established some of the key strengths of the Cloud to be its reliability and continuity, because there is no need for downtime and because of its improved disaster recovery (VMware 2013). The findings identified that the services downtime depends on the service provide and it is outside the customer's control. This does not necessarily mean that the information gathered from the literature is incorrect. One possible reason is that the literature is describing a fully Cloud based environment and the organisation studied in this research is using both Cloud and traditional infrastructure. Availability was also established as a key concern in the literature

because of the potential disruptions to the business operations (ISACA 2009). The findings were more concerned with the actual network performance and the inability to upgrade the physical components. Based on the findings and the literature review, it is fair to say that performance is a factor that needs consideration by the business.

Security

Security emerged as the top concern of the business from both the literature (Hugos and Hulitzky 2011) and the interview findings. It was identified as a very complex area for both Cloud service providers and their customers. (Hurwitz et al. 2010) Findings are consistent with this statement.

All participants identified that security is still a major problem for company X.

P2 explained that provider and customer are required to work together in order to ensure the data is secured on both sides. It was also suggested that the internal staff might not have enough privileges to ensure everything is protected. Findings revealed that there is still no universal solution that could be applied to all organisations and this is backed up by the literature to indicate that security is the biggest challenge in the adoption of Cloud computing services.

6.3 Organisational context

The organisational context is examined in order to achieve objective *2. Identify and evaluate the organisational factors and challenges that could impact the Cloud adoption*. Prior research has suggested that the characteristics of a business are important in the decision-making process. Top management support, firm size and technological readiness were suggested as the key organisational factors (Low, Chen and Wu 2011) (Wang, Wang and Yang 2010). Interview findings identified the potential internal conflicts as another factor.

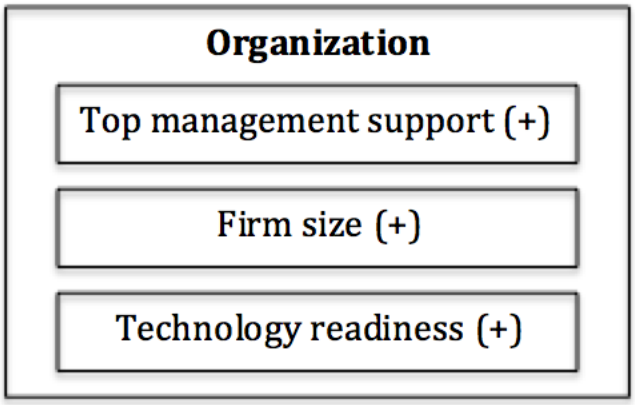

Figure 3 Confirmed organisational factors from TOE framework

Top management support

In order to evaluate if top management is a factor, the participants were asked: *"Was top management support a factor in the adoption process at company X?"*

Top management support was identified as a very important factor. P1 explained that without the support of top management any project could only reach a business plan stage. It was identified by all participants that an approval of the top management is required in order to get project funding.

This discovery is consistent with previous research findings. They found top management support to be critical for creating a supportive climate and providing the resources needed for adopting new technologies (Wang, Wang and Yang 2010). This goes to prove that without the support of top management a Cloud services adoption would be impossible. Therefore, it is reasonable to consider top management support as an important factor in the adoption process.

Firm size

In order to determine if there was a correlation between the firm size and the decision to adopt Cloud services, the participants were asked: *"Do you think the firm size could impact the adoption decision?"*

Some studies have suggested that large companies tend to adopt more innovations and have greater flexibility and ability to take risks (Pan and Jang 2008). The findings do not support this statement. All participants were unanimous that it would be easier for small companies to adopt Cloud services. P1 explained that the pay-as-you-go Cloud

model provided by most vendors removes the high cost of investing in own infrastructure, which suits small businesses. The findings identified that large companies tend to have large investments in their own data centres and infrastructure, which means they would be less willing to adopt external Cloud services. It was suggested that large companies might prefer to host their own private cloud instead of adopting Cloud services from a third party provider. This indicates that the size of the business could influence the adoption decision. Therefore it will be considered a factor.

Technological readiness

Review of prior research found the existing infrastructure of the organisation and the ability of the IT staff to understand and adopt a new technology to be a key adoption factor (Zhu, Kraemer and Xu 2006) (Oliveira and Martins 2011). In order to evaluate this, the participants were asked: *"Was technological readiness seen as a factor when you made the decision to adopt Cloud services?"* The findings confirmed that technological readiness is important. P2, P3 and P4 all said that they had to examine if company X had the essential resources (both human and infrastructure) in place first.

However, Cloud computing was not considered to be much different from the traditional infrastructure, with P2 suggesting this as the reason for their understanding of the new technology. P3 explained that their knowledge played a key part in the adoption process, because they had to deliver a clear and concise statement to their project sponsors. This indicates that technological readiness should be seen as a factor in the adoption process.

Other organisational factors

Considering the limitations set out by the TOE framework, the participants were asked: *"What other organisational factors were considered before making a final decision to adopt Cloud services at company X?"*

Potential internal conflicts

The only concern that emerged from the interviews was potential internal conflicts between different business units. P3 explained that the IT department does not have control over third party solutions and cannot respond as quickly as expected when a problem arises. It was suggested that conflicts could arise between business units that

use a Cloud solution by a third party provider and the IT department. The literature review did not find anything related to this and it is not a situation that is likely to happen if the top management is involved in the decision making process.

If a Cloud solution is used only by certain business units the top management will be responsible for making the necessary policies or processes to follow in the event of a problem. Therefore, this will not be considered as a key factor in the adoption decision.

6.4 Environmental context

Finally, the environmental context is examined in order to achieve objective *3.Identify and evaluate the environmental factors and challenges that could impact the Cloud adoption*. Competitive and trading partner pressure were the two environmental factors suggested in previous studies (Low, Chen and Wu 2011). Another factor that emerged from the interview findings was environmental efficiency.

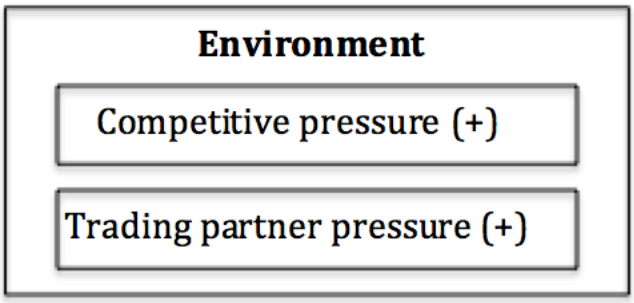

Figure 4 Confirmed environmental factors from TOE framework

Competitive and trading partner pressure

It was established from previous researchers that competitive and trading partner pressure refer to the level of pressure felt by the business from competitors within the industry or trading partners responsible for IT design and implementation (Low, Chen and Wu 2011) (Oliveira and Martins 2011). The participants were asked: *"Did competitive pressure or trading partner pressure make an impact on your decision to adopt Cloud services?"* Findings from the interviews confirmed that if the competitors or partners are already using Cloud solutions it puts more pressure on the business to respond quickly by adopting the technology. Review of previous research also found that when companies have been influenced by convincing power, such as

financial motivations, they tend to adopt new technologies quicker (Low, Chen and Wu 2011). The findings are consistent with this statement. They indicated that Cloud is seen as a more cost effective model and this has led to a quicker adoption decision. Considering the findings, it is reasonable to say that competitive and trading partner pressure is a factor that could influence the adoption decision.

Other environmental factors

Considering the limitations set out by the TOE framework, the participants were asked: *"What other environmental factors were considered before making a final decision to adopt Cloud services at company X?"*

Environmental efficiency

The findings suggested that there is both internal and external pressure on businesses being "greener". The literature review established Cloud's energy efficiency as one of the key adoption drivers. Cloud was found to enable organisations to reduce power consumption by cutting down on the total number of servers required (Google 2011). The findings are inconsistent with this statement. P1, P2 and P3 disagreed that Cloud is a "greener" solution. According to P3, even if the business itself is not using additional resources for running these services, there is still a large power usage somewhere in the vendor's premises. The participants suggested that large companies, such as the one examined in this study, which use Cloud services combined with their own infrastructure do not see this as a "greener" solution because they still have to use the same amount of servers and power to run their own data centres. According to them, it could be considered "greener" for a small or medium business that does not have its own infrastructure because this will eliminate any power usage from the business' side. In contrast, P4 responded positively, seeing Cloud services as a "greener" solution. According to him, using Cloud services could be seen as a green alternative not because of the power usage, but because of the other benefits it provides, such as video conferencing. The environmental efficiency is a factor that is highly subjective, therefore it will not be considered as a factor in the adoption decision.

6.5 Conclusion

This chapter discussed the primary research findings and their linkages to the literature. The three contexts suggested by the TOE framework model were examined in order to achieve objectives 1, 2 and 3. In order to answer the last two research questions each attribute was discussed and seven were identified as factors that could influence the adoption decision – relative advantage, redundancy, performance, top management support, firm size, technological readiness, and competitive and trading partner pressure. This gives an answer to the following research question: *"What factors should a business consider when making a decision to adopt Cloud computing?"* Another three attributes were identified as challenges that a business may face – complexity, compatibility and security, thus giving an answer to the last research question: *"What are the challenges a business is likely to face when adopting Cloud computing?"* Two attributes were not seen as important enough to have any effect on the adoption decision – potential internal conflicts and environmental efficiency. More detailed conclusions of the research will be made in the next chapter.

Chapter 7 - Conclusion

7.1 Objectives evaluation

The purpose of this study was to answer the question "*"What are the factors influencing the adoption of Cloud computing and what are the challenges faced by the business?"*

In order to answer this question a few steps were taken. First, in order to help the reader get a better understanding of the topic, a literature review provided a definition of Cloud computing and its various types and characteristics; common adoption drivers and concerns were reviewed. A review of previous research on similar topics revealed several technology adoption theories. They were evaluated and the TOE framework (Tornatzky and Fleischer 1990) (Low, Chen and Wu 2011) was found to be most suitable for this study, as it identified three major contexts to be explored – technology, organisational and environmental.

Using the TOE framework model, three objectives were set out in order to answer the research question. To achieve them, interviews were conducted with four IT managers from a large multinational organisation. The information obtained from the interviews was used to construct a case study of company X and examine the factors and challenges faced by the IT management in the process of adopting Cloud services.

1. Identify and evaluate the technological factors and challenges that could impact the Cloud adoption

The technological factors suggested by the TOE framework model were relative advantage, complexity and compatibility. Another three factors emerged from the interviews - redundancy, performance and security. It was established that adopting Cloud services could give a business relative advantage over its competitors and cost advantage, through the benefits they provide i.e. improved business agility and reduced capital expenditure. Complexity of the Cloud was found to be a major challenge in the adoption process, but it should be noted that the Cloud solutions are getting less complex with the development of the technology.

Compatibility was identified as another challenge, that a business is likely to face. Two compatibility issues were recognised – compatibility with existing infrastructure and compatibility with other Cloud solutions. The research established redundancy as a factor. The findings suggested that any costs of the existing infrastructure has to be considered before a final decision to adopt Cloud computing can be made, because sometimes using the existing infrastructure could be the more efficient option. Performance was another issue that was identified as a factor. The findings suggested it needs consideration because adopting Cloud services could affect the network performance and availability of the services is outside of the business control. Finally, security was identified as the top technological challenge.

The findings established that data security is still a major concern for the businesses that adopt Cloud services. The reason for this is the fact that it is unknown where their data is stored and how it is kept secure.

2. Identify and evaluate the organisational factors and challenges that could impact the Cloud adoption

Top management support, firm size and technological readiness were the three key organisational factors that were suggested by the model and were later confirmed by the findings and the literature. The top management support was identified as a very important element. The findings suggested that it would be impossible to adopt a new technology without the support from top management because they are responsible for providing the resources needed. Firm size was also proven to be a factor. Previous research suggested that it is easier for large companies to adopt new technologies because of their ability to take more risks. The findings opposed that by suggesting that large companies have their own infrastructure that needs consideration and it would be easier for small companies to adopt Cloud services because of the relatively small set-up cost. Either way, depending on the firm size, businesses need to consider which option would be better suited for their needs. Finally, technological readiness was also identified as a key factor that has to be considered. A company needs to assess if the existing infrastructure and IT human resources are ready to adopt Cloud computing before any decision is made.

3. Identify and evaluate the environmental factors and challenges that could impact the Cloud adoption

The environmental factors suggested by the model were competitive and trading partners pressure. The findings confirmed that they are both important factors that could influence the adoption decision in a business. They were found to be important because if a competitor or a trading partner is already using the technology, it puts more pressure on the business to keep up with them. Therefore, the pressure from competitors and trading partners could drive the need for adoption in a business.

To conclude, this study identified eight factors that potential Cloud adopters should look at. They are relative advantage, redundancy, performance, top management support, firm size, technological readiness and competitive and trading partner pressure. They were all found to have an effect on the decision and the study recommends that a business should look at them in order to assess the Cloud adoption process. Three major challenges were identified – complexity, compatibility and security. They were found to be of a great importance and therefore, the study would

suggest that a business should carefully consider each one of them in order to successfully adopt Cloud computing.

7.2 Research limitations

There were a number of limitations to the research. The findings cannot be generalized to a wider population than the one studied because of the nature of qualitative research. Also, the sample size was too small to provide a good representation of the population studied. The technology adoption model limits the research to three key areas, which means factors that fall outside of the boundaries of the TOE framework were not examined. The time and accessibility restrictions of the author may have had an impact on the results of the study.

7.3 Recommendations for further research

Considering the limitations to the research of this study a recommendation for further research can be made. In order to address these issues a further research could be made using a quantitative method that could examine a larger sample of the population.

Also, a different model or a combination of adoption models could be used in order to examine other factors. This would provide both a better representation of the population and a better understanding of the factors and challenges.

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Appendix A – Semi-structured interview questions

Do you think adopting Cloud services has given company X relative advantage over its competitors?

Did you see complexity of the Cloud adoption process as a challenge?

Was compatibility of the Cloud with existing infrastructure seen as a factor in the decision-making process?

What other technological factors were considered before making a final decision to adopt Cloud services at company X?

Was top management support a factor in the adoption process at company X?

Do you think the firm size could impact the adoption decision?

Was technological readiness seen as a factor when you made the decision to adopt Cloud services?

What other organisational factors were considered before making a final decision to adopt Cloud services at company X?

Did competitive pressure or trading partner pressure make an impact on your decision to adopt Cloud services?

What other environmental factors were considered before making a final decision to adopt Cloud services at company X