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A General Framework for Cloud Computing Adoption in Organizations: A Systematic Literature Review

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Abstract

Cloud computing (CC) has come a long way from when the term was first coined in the early 2000's to where it is now. Its increasing maturity, the benefits that come with it and the relative advantage it has over traditional in-house systems has made it an attractive proposition for organizations. However, it being a relatively new phenomenon coupled with its perceived risks and challenges discourages adoption. This uncertainty is further exacerbated by cloud computing's lack of standards and the relative lack of general and comprehensive cloud adoption frameworks in literature. This trade-off between benefits and risks has subsequently created a dilemma for organizations on how to approach cloud adoption. Hence, what factors should organizations consider when adopting cloud computing? This study aims to fill this research gap by proposing a general framework for organizations and identify factors which should be considered when adopting cloud computing.

An initial literature review of technology adoption models was carried out to design a framework which would serve as a chassis for the factors retrieved from the systematic literature review. The resulting model was heavily based on the Technological-Organizational-Environmental model (TOE) and the Diffusion of Innovations model (DOI) which are models commonly used to explain technology adoption. The systematic literature review was used to retrieve the cloud adoption factors.

51 primary studies out of a total of 1623 papers were found relevant and were retained for analysis. This yielded a total of 194 unique tertiary adoption factors. 65 technological factors, 64 organizational factors, 61 environmental factors, and 4 individual factors. These factors were then classified into unifying themes called secondary factors. There was a total of 26 secondary factors; 9 technological factors, 7 organizational factors, 8 environmental factors, and 2 individual factors. The study found technological factors to be the most significant factors affecting adoption, while individual factors had the least significance. Specifically, relative advantage, top management support, compatibility, and complexity were found to be the most significant factors affecting cloud computing adoption.

Keywords

Cloud computing, Cloud, Cloud computing adoption, Technology adoption, Diffusion of innovations, TAM, TOE, DOI

Supervisor

Dr. Dorina Rajanen

Foreword

First and foremost, I want to thank God who made the completion of this thesis a possibility. I am also most grateful to my supervisor Dr. Dorina Rajanen, her insightful inputs, feedbacks and her belief in the research topic were vital to the completion of this thesis. So, thank you for your kind approach, for your time, and for your patience; it was a pleasure working with you. I would also like to thank Professor Netta Iivari for her comprehensive review of the thesis. Special thanks go to my family, who remained an infallible support system to me during this research process. Your motivational words of encouragement helped make the completion of this thesis possible.

Mark Twain once said, "I have never allowed my schooling interfere with my education". This quote reflects well on what has been a difficult process, one that has left me rich with experience and equipped me with the necessary tools needed to succeed after my studies. Completing the thesis was a long and draining process for me, it required me to dig deep within myself and has subsequently helped me learn things about myself which I did not know. I am therefore grateful to the University of Oulu for the role it played in facilitating my education.

Isaac Ogunlolu

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Contents

1. Introduction

Organizations are continuously exploring ways to reduce costs and operate more efficiently. They are constantly aiming to remain competitive within their respective industries by utilizing relevant tools to achieve their goals and information technology is one of such tool (Johansson et al., 2015). An organization's competitiveness and survival is attributed to its ability to adapt innovations that give a competitive edge and improve the quality, reduce the cost, and improve the efficiency of its business processes (Trigueros-Preciado et al., 2013). Furthermore, there is a need to continuously increase capacity, reduce costs and increase organizational agility; these are recognized as the primary drivers that have motivated organizations to adopt cloud computing. It is safe to say that the emergence of cloud computing fulfills organizational needs and helps organizations achieve their goals (Erl et al., 2013).

Cloud computing (CC) represents a paradigm shift in the way information technology resources and services are delivered (Sabi et al., 2016). Cloud computing is especially attractive to organizations due to its many advantages which include the high-performance capabilities it offers, its low entry costs, ubiquitous access, flexibility, availability, and scalability (Zhang, Cheng & Boutaba 2010). Organizations employing cloud computing can outsource core activities and infrastructure related to information technology (IT) needed to do business (Gide & Sandu, 2015). This eliminates the need for organizations to set up traditional in-house IT infrastructure by instead opting to rent infrastructure, platforms and even software, effectively leading to a reduced capital expenditure. Furthermore, cloud computing's pay-as-you-go pricing model enables organizations to save money and maximize the IT resource(s) in use simultaneously. Contrastingly, on premise IT resources are expensive and are either over utilized or under-utilized. Additionally, organizations, specifically small and medium sized enterprises (SME), gain access to sophisticated IT resources freeing organizations of the need for large infrastructural expenses; both small and large organizations can therefore save money on capital expenditure, this frees up funds for other capital investments (Alkhater et al., 2014; Gide & Sandu, 2015). The apparent fit between cloud computing and organizations is further magnified by Borgman et al. (2013) who stated that cloud computing technology provides a dynamic environment that is fitted to meet the organization's need. It should however be noted, that cloud computing is by no stretch a silver bullet and this is mainly due to performance, security and trust issues (Khalid, 2010; Oliveira et al., 2014).

Nevertheless, irrespective of these issues cloud computing continues to increase in popularity and consequently the number of adopters. Albeit, since cloud computing is by no means a novel technology it is curious why the rate of adoption does not match the hype that comes with the technology. Perhaps there is a grey area and a level of uncertainty when it comes to its adoption. Oliveira et al. (2014) citing literature stated that notwithstanding the advantages of cloud computing, organizations are not in a rush to adopt the technology. They cited the disruptive nature of the technology, lack of maturity, lack of industry standards, and related risks and costs as reasons for the misfit between the hype and the actual adoption. Therefore, the resulting question is, what factors should be considered before adopting cloud computing? The low risk nature of cloud computing adoption does not necessarily differentiate it from other technologies in the sense that cloud computing adoption just like any other technology is a recipe for disaster if there is no correlation between the factors being considered and what the organization really needs. This paper's motivation stems from the need to know what factors organizations should consider before adopting cloud computing. Hence, the research question *"what factors should be considered when adopting cloud computing?"*.

The aim of this research is to provide new knowledge to literature by attempting to validate and complement previous body of knowledge. Few studies have explained cloud computing from an organizational perspective (Oliveira et al., 2014). Also, previous attempts made to address the factors that affect CC adoption have not been explicit enough and have always been focused on adoption within a specific niche - governments, SMEs, large organizations, etc. (Thong, 1999; Chong et al., 2009; Wang et al., 2010; Low, Chen & Wu, 2011; Gide & Sandu, 2015; MacLenna & Van Belle 2013). This paper theorizes that there should be a more generalized adoption framework for cloud computing irrespective of the adopter. First, a literature review of technology and innovation adoption models and theories was carried out with the aim to understand the theoretical background of technology adoption in organizations and to subsequently provide a generic CC adoption model. Second, a systematic literature review of empirical studies on CC adoption was carried out to extract relevant and specific CC adoption factors which would then be used to saturate the generic model and consequently update it.

The rest of the paper is structured in the following way; Chapter 2 describes cloud computing, and its characteristics, various deployment models, goals and benefits, and the risks and challenges of cloud computing. Chapter 3 describes the research question and explains the research methods used for this study. Chapter 4 contains a literature review of innovation adoption models and the preliminary adoption model is presented. Chapter 5 shows the complete procedure of the systematic literature review. The results extracted from the systematic literature review are illustrated in Chapter 6, while findings are discussed in Chapter 7. Chapter 8 contains a conclusion to the study, the limitations and a proposal on future research direction.

2. Cloud Computing

Cloud computing since its inception has been defined in numerous ways. However, a simple definition is that CC is a means to store and access data and programs via the internet instead of the data being stored on one's computer drive; concluding that the cloud is just a metaphor for the internet (pcmag.com, 2016). An alternative definition was given by the US National Institute of Standards and Technology (NIST) who are tasked with developing standards and guidelines for providing adequate information security for all agency operations and assets in the United States. They defined cloud computing as a model used to enable ubiquitous, convenient, on-demand network access to a shared pool of computing resources which are configurable. These resources can include: networks, servers, storage, applications, and services which can be provided on demand and released with very little administrative effort or service provider interaction (Mell & Grance 2012).

2.1 Characteristics of Cloud Computing

Cloud computing possesses five fundamental characteristics namely: rapid elasticity, on-demand self-service, resource pooling, broad network access, and measured service (Mell & Grance 2012).

Rapid elasticity: Rapid elasticity can also be called dynamic resource provisioning (Zhang, Cheng & Boutaba, 2010) and scalability (Smith et al 2014). This is a very vital feature of cloud computing as it enables cloud users to use and release resources based on need. This is enabled by the cloud's ability to automatically shrink and expand based on demand (Smith et al., 2014; Mell & Grance, 2012)

On-demand self-service: This feature is also known as self–organizing according to Zhang, Cheng & Boutaba (2010). As the name implies, consumers unilaterally acquire computer resources such as network storage, applications and server time as needs arises (Mell & Grance, 2012; Zhang, Cheng & Boutaba, 2010). This enables consumers to manage their resource consumption according to their own needs. Furthermore, cloud computing's automated resource management feature helps service providers to respond efficiently to rapid changes in service demand, leading to high agility (Zhang, Cheng & Boutaba, 2010).

Resource pooling: Computing resources which are dynamically assigned and reassigned based on demand are also continuously pooled to serve multiple customers simultaneously. Cloud consumers generally don't know the physical location of the resource being used and usually do not realize that the resource which can be network bandwidth, storage, memory, processing power etc. is being simultaneously used by other consumers (Mell and Grance, 2012; Zhang, Cheng and Boutaba, 2010).

Broad (Ubiquitous) network access: Cloud services are ubiquitous and can therefore be accessed using any device connected to the internet; the internet in this case serves as a service delivery mechanism. Devices used to assess cloud services could be a workstation, a personal computer, a laptop, a table, or a mobile phone. The accessing device could be a mobile phone, a tablet, a laptop or a workstation (Zhang, Cheng & Boutaba 2010).

Measured service: Cloud computing's pricing model is comparable to the pricing model utilized in the use of electricity. It involves a pay per use model with the pricing scheme based on the service being delivered and the resource being used (Zhang, Cheng & Boutaba 2010). This pricing model is achieved by including a metering capability at some level of abstraction appropriate to the type of service being provided. Additionally, "resource usage can be monitored, controlled, and reported, providing transparency for both the provider and consumer of the utilized service" (Mell & Grance, 2012).

2.2 Cloud Delivery Models

As illustrated in Figure 1 below, cloud computing has three service models or layers which are hierarchically structured. They include Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS). The infrastructure layer provides the base upon which other services are delivered. This is due to its architecture which is structured as such that each layer provides services to the layer above (Zhang, Cheng & Boutaba, 2010).

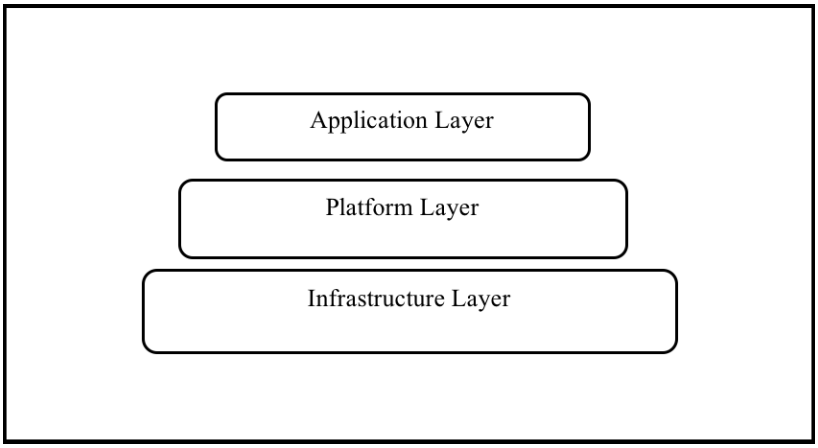

Figure 1. Cloud Service Layers.

Software as a Service (SaaS): SaaS is the most visible cloud computing layer and it provides on-demand applications over the internet (Masiyev et al., 2012). This feat is achieved via the underlying cloud infrastructure. The service providers are in this case responsible for managing, configuring and controlling this infrastructure. An interface, usually a web browser is needed to use this service (Mell & Grance, 2012). A few examples of SaaS applications are Gmail and Google Drive by Google, Office 365 by Microsoft, Salesforce.com etc.

Platform as a Service (PaaS): PaaS is the middle layer of the cloud's service model's hierarchy architecture. This layer provides resources like operating systems support and frameworks for software development (Zhang, Cheng & Boutaba, 2010). Furthermore, PaaS also known as cloudware (Khalid, 2010) can also be defined as a model that can be used to launch operating systems and other services directly into the internet without installations; in other words, hardware independent applications can be developed by software developers using these frameworks (Masiyev et al., 2012). In simpler terms, consumers can deploy created or prepackaged applications onto the cloud by using the platform frameworks or packages supported by the service provider. These frameworks can include libraries, tools, services, programming languages etc. (Mell & Grance, 2012). It should be noted that while the consumer has no control over the underlying infrastructure, they however can control the deployed applications and even configure the environment within which it is being hosted. Examples of PaaS services include Windows Azure by Microsoft, App Engine by Google, Coghead, Pipes by Yahoo, and Dapper.net (Khalid, 2010; Zhang, Cheng & Boutaba. 2010).

Infrastructure as a Service (IaaS): This layer is the base upon which the whole cloud environment is built and just as the name implies it involves on-demand provisioning of infrastructural resources (Zhang, Cheng & Boutaba, 2010). At this layer, hardware are provisioned as services which can include networking equipments, cooling equipments, firewalls, storage and even data centers (Masiyev et al., 2012). Examples of IaaS services include Amazon's Elastic Compute Cloud, Go Grid, and Flexiscale (Zhang, Cheng & Boutaba,2010).

2.3 Cloud Deployment Models

Various deployment models are utilized to deploy cloud services to consumers who choose the deployment model to be used based on their technical requirements, their business requirements and their operational requirements (Masiyev et al., 2012). The various deployment models include private clouds, public clouds, hybrid clouds and community clouds; each model has benefits and drawbacks (Mell & Grance 2012; Zhang, Cheng & Boutaba, 2010).

Public Clouds: As the name implies, cloud infrastructure is generally offered to the public. Public clouds can be used to host applications at reasonable prices and require no initial infrastructural investments from the consumers. With public clouds, the cloud providers solely bear the risks (Zhang, Cheng & Boutaba, 2010). Public clouds can be owned and operated by business organizations, academic institutions, and government organizations (Mell & Grance 2012).

Private Clouds: Some organizations set up private clouds - also known internal clouds for the organization's exclusive usage (Zhang, Cheng & Boutaba, 2010). When private clouds are set up, the consumers in this case are the business units within the organization (Mell & Grance, 2012). An organization could either build and manage the private cloud itself, or could outsource it to a third party, or a synergy between both could occur. The infrastructure can either be located within the organization's premises or outside of it (Mell & Grance, 2012).

Hybrid Clouds: Hybrid clouds were introduced to address the shortcomings of both private and public clouds (Zhang, Cheng & Boutaba, 2010). A hybrid cloud consists of two or more different clouds where on-demand external resources, capabilities and expertise combines and complies with the organization's internal resources and expertise. Hybrid clouds could be a mixture of either private, public or community clouds (Mell & Grance, 2012; Masiyev et al. 2012).

Community Clouds: Community clouds are a result of a synergy between specific organizations where they create clouds that are used exclusively by organizations within this community due to shared concerns or interests. Reasons for this synergy could include shared policies, shared missions, security concerns, requirements etc. Community clouds are either owned and managed by a single organization within this community or by multiple organizations. They could also outsource the creation and management of the cloud environment to a third party (Mell & Grance, 2012).

2.4 Goals and Benefits of Cloud Computing

CC is an attractive proposition to organizations due to the benefits that come with adopting it, they include:

Reduced Initial Investments and Proportional costs: Cloud computing significantly reduces or eliminates the need for initial investments in IT infrastructure. Thereby allowing organizations gain access to powerful infrastructure via leasing without having to purchase them outright. Furthermore, this allows small organizations and startups to start small and systematically increase computing resources based on their requirements. Additionally, organizations can redirect capital to focus on core business investments. Also, cloud computing's pay as you use model (measured usage) replaces capital expenditures. This proportion of paying for the resources used is more advantageous than buying infrastructure as they might either be over-utilized or underutilized (Erl et al., 2013).

Increased Scalability: Due to the ability of clouds to dynamically allocate resources, cloud consumers can use cloud resources based on demands. Cloud resources are configured to automatically deal with usage fluctuations, with the cloud shrinking with reduced usage and dramatically expanding during peak levels. Additionally, the ability of clouds to expand to meet unexpected usage demands helps avoid potential loss of business which may occur when certain usage thresholds are met (Erl et al., 2013).

Increase in Resource Availability and Reliability: Outages can be quite bad for business as it limits the time an IT resource is available to the customer. This in turn limits the usage of the IT resource and consequently its ability to generate revenue. An available IT resource is accessible to customers for longer periods of time, this is achieved through using resilient IT resources. A reliable IT resource avoids and recovers fast from unexpected events leading to downtime. Reliability in the cloud enables extensive failover support, this is possible due to its modular architecture. The ability of clouds to ensure continuous availability and reliability of IT resources leads to customers being able to access IT resources anytime leading to more business (Erl et al., 2013).

2.5 Risks and Challenges of Cloud Computing

In contrast to its goals and benefits, cloud computing's risks and challenges discourages adoption, they include:

Increased security vulnerabilities: When organizations migrate to the cloud, data security becomes a shared responsibility between the organization (consumer) and the cloud provider. Accessing IT resources remotely essentially requires the expansion of the organization's trust boundaries to include the external cloud. This expansion which usually includes a public cloud introduces security vulnerabilities. A further consequence of the overlapping trust boundary is that cloud providers have access to the consumer's data, this gives mischievous customers opportunities to attack commonly shared cloud based resources and either steal or damage sensitive business data (Erl et al., 2013).

Reduced control over resources: Compared to the amount of control organizations would have had on premise IT resources, cloud consumers generally have restricted control over cloud resources. This introduces potential risks that are linked to the way the cloud providers run their cloud environments; take for instance how reliable is the external connection between the consumer and the cloud provider or what security measures has the cloud provider put in place to ensure the integrity, confidentiality and availability of the consumer's data (Erl et al., 2013).

Limited portability between providers: Limited portability also known as vendor lock-in is another challenge cloud computing faces due to the lack of industry standards. Public cloud providers have therefore implemented various proprietary solutions, which leads to portability issues when consumers migrate from one cloud to another. Cloud consumers who are locked in with a provider and have implemented custom-built solutions that heavily depend on the provider's proprietary environment can find this especially problematic (Erl et al., 2013).

Geographical compliance and legal issues: Most cloud consumers whose data is being hosted by public clouds do not know the physical location of the IT resource they are making use of. Cloud providers usually favor setting up data centers in inexpensive and convenient locations. For organizations operating under industry or government regulations that have explicitly specified data privacy and storage policies, this can be legally problematic. A good example is the fact that some UK laws required the personal data of UK citizens to remain in the UK. Additionally, the accessibility and disclosure of data to government agencies and even to the subject of the data is necessitated by law in some countries. This might pose legal issues, as disclosing personal information infringe privacy rights. For instance, China requires transparency (providing information on individuals on demand) from every foreign IT company operating in China. Also, due to the U.S Patriot Act, personal information of individuals whose information is physically located in the US can be easily accessed (Erl et al., 2013).

3. Research Methods

Firstly, a theoretical framework is developed based on existing models on technology adoption. The developed model provides a solid theoretical base upon which the adoption framework can be identified and analyzed. The process is expatiated upon in Chapter 4.

Secondly, a systematic literature review is carried out to review previous research on cloud computing adoption and, in the process, mine data and derive conclusions from the data. The literature review helps with extracting the variables or factors needed for making adoption decisions. The research methodologies are expatiated on in Chapters 4 and 5. Additionally, a model is developed using variables collected from the literature review. The results are used to suggest a model organizations willing to adopt cloud computing can use when making adoption decisions.

3.1 Research Question

To perform a systematic literature review, it is required to have a research question before the review commences (Boell & Cecez-Kecmanovic, 2015). Boell & Cecez-Kecmanovic (2015) also argued that to identify all literature addressing a specific topic or question, the research question should be "very specific and closely formulated". Thus, the singularity and focused nature of the research question:

What factors should be considered when adopting cloud computing?

3.2 Systematic Literature Review

As mentioned in the introduction, a systematic literature review (SLR) was used as one of the research methodologies of this thesis work. This chapter contains a general overview of the process; a more detailed documentation of the process is given in Chapter 5.

SLR is a widely-used research methodology that is used to identify, evaluate and interpret all available research pertinent to specific research questions, research areas or phenomenon of interest. SLR was originally used in the medical field, but has been adapted and made suitable for use also in software engineering research (Kitchenham, 2004) and in information systems research (Okoli, & Schabram, 2010). The importance of SLR which is to ensure that a literature review is thorough and fair cannot be understated neither can the reasons for performing SLR. Most prevalent reasons for performing SLR are: a) to summarize existing evidence pertaining to a treatment or technology, b) to pinpoint gaps in the current research and consequently suggest areas for further investigation, and c) to provide a framework to support future research activities. Additionally, SLR is also used to validate and contradict theoretical hypotheses (Kitchenham & Charters, 2007). A major disadvantage of using SLR is the considerable extra effort and time required compared to more traditional literature reviews. However, using SLR comes with significant advantages also. For instance, a well conducted SLR removes or drastically reduces the possibilities for bias (Kitchenham & Charters, 2007).

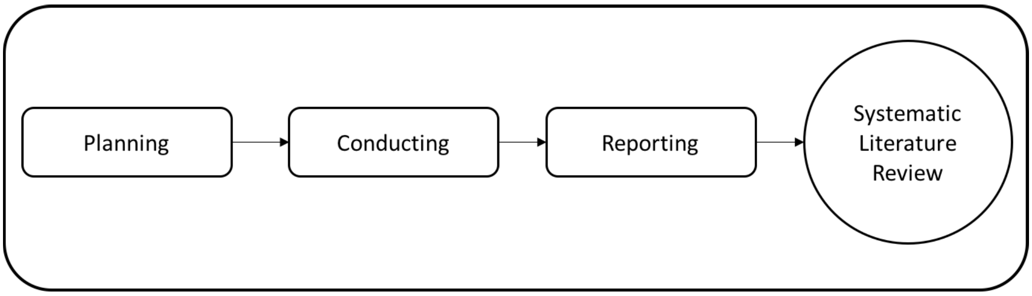

Figure 2. Systematic literature review process overview (Rai et al., 2015).

Figure 2 above shows the SLR process as illustrated by Rai et al (2015). The process is divided into three phases; the planning phase, the conducting phase, and the reporting phase. The planning phase, part of which has been covered in Chapter 1, includes stages like identifying the need for a review, specifying research question(s), and developing & evaluating a review protocol. The conducting phase which will be expatiated on in Chapter 5 includes stages like formulating a search strategy, selection of primary studies, study quality assessment, data extraction, and data synthesis. The reporting phase completes the review process. Figure 3 below shows a more detailed view of the SLR process based on Kitchenham (2004) and Kitchenham & Charters (2007) guidelines.

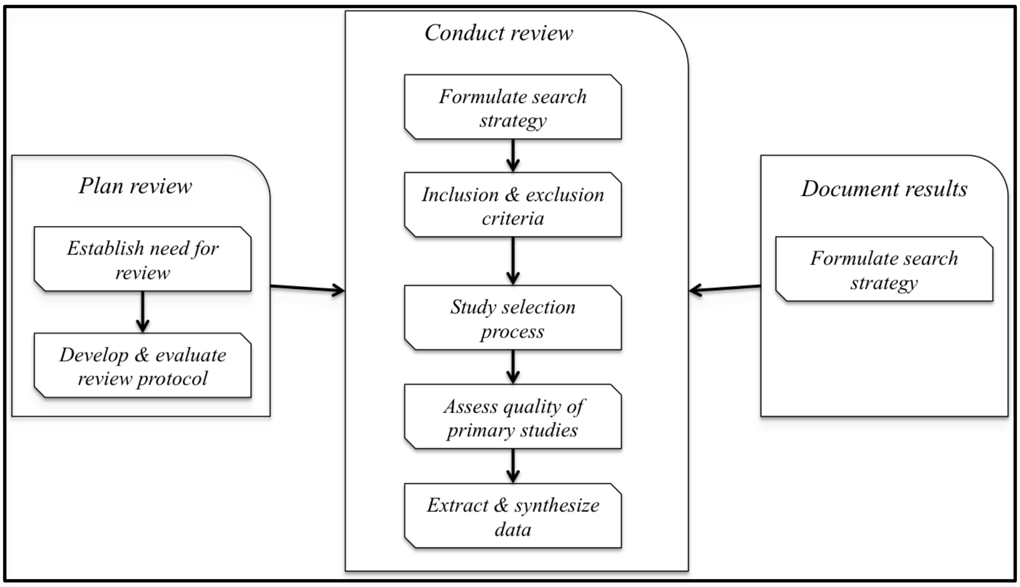

Figure 3. Detailed view of SLR process (Kitchenham 2004; Kitchenham & Charters, 2007).

4. Technology Acceptance and Adoption

Different theories in information systems research that have been used to explain technology adoption, both on the individual level and on the organizational level (Oliveira & Martins, 2011). These theories include the technology acceptance model (TAM, Davis 1989), diffusion of innovations theory (DOI, Rogers 1995), technological-organizational-environmental model (TOE, Tornatzky & Fleischer 1990), theory of planned behavior (TPB, Ajzen 1985), and the unified theory of acceptance and use of technology (UTAUT, Venkatesh et al. 2003). TAM, UTAUT and TPB use individuals as their unit of analysis, while DOI and TOE are employed on the organizational level (Oliveira & Martins, 2011; MacLenna & Van Belle 2013; Oliveira et al., 2014).

4.1 Technology Acceptance at Organizational Level

Tornatzky & Fleisher's (1990) TOE framework has been widely used across literature, due to its sound theoretical basis and strong empirical evidence (Oliveira & Martins 2011). The TOE framework posits that there are three elements of an enterprise's context which influence the adoption of a technological innovation, namely the technological, organizational, and environmental contexts. The TOE framework is based on the original work proposed by DePietro et al. (1990) in Tornatzky & Fleischer's (1990) book. The technological context refers to the availability and characteristics of the internal and external technologies relevant to the organization. The organizational context indicates measures which describe the enterprise, such as its size, slack, communication processes and managerial structure. The environmental context refers to the scene within which an enterprise does business, this includes the organization's industry, its competitors, technology support infrastructure and the organization's government dealings (Oliveira & Martins 2011). Figure 4 below is a graphical representation of the TOE model.

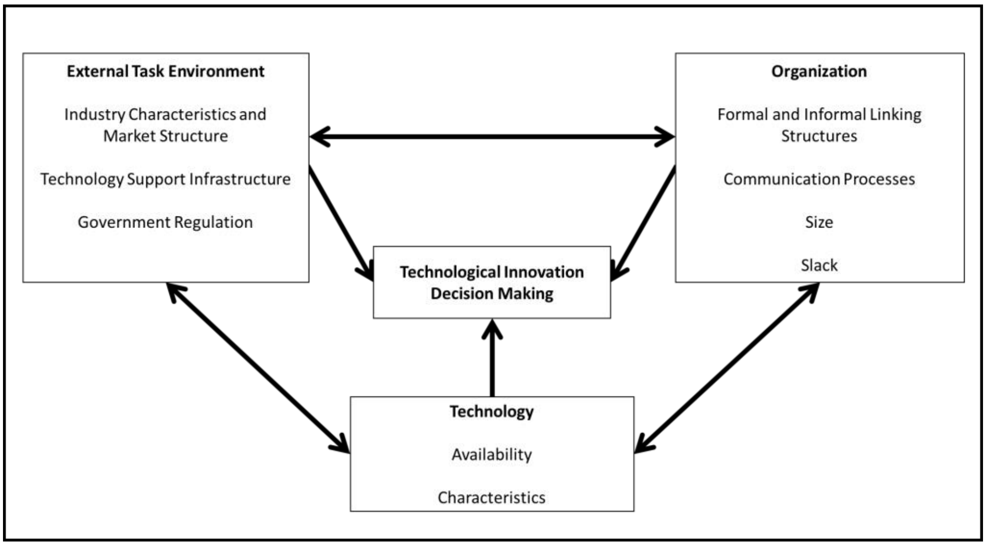

Figure 4. TOE framework (Tornatzky & Fleisher, 1990)

Zhu et al (2006) argued that the DOI theory attributes an organization's adoption of a technology to the characteristics of that technology. These characteristics, which Rogers

(1983) identifies as the precedents for adoption decisions, include relative advantage, compatibility, complexity, observability, and trialability. These characteristics fit with cloud computing and reflect reasons why an organization would adopt cloud computing. Furthermore, Tornatzky & Klein (1982) noted that relative advantage, complexity, and compatibility “have the most consistent significant relationships across a broad range of innovation types”, hence the fit with cloud computing. For instance, relative advantage which is defined as the degree to which an innovation can bring added benefits to the organization justifies why cloud computing would be considered by an organization. The same goes for compatibility: degree to which an innovation fits with existing practices and processes within the organization; complexity: measure of how easy or difficult it is to use an innovation; observability: measure of how visible the results of an innovation are; and trialability which is a measure of how much an innovation can be experimented with (Zhu et al 2006).

According to Rogers (1995), an organization’s innovativeness which indirectly relates to its ability to adopt new innovations fast, is attributed to three independent variables (Figure 5). They include an individual’s characteristics, the internal characteristics of the organizational structure, and the external characteristics of the organization. An individual’s character, usually the catalyst to the adoption of any technology, reflects an attitude towards change. The internal characteristics as observed by Rogers (1995) include centralization, complexity, formalization, interconnectedness, organizational slack, and size. Centralization is defined as the degree to which a few individuals control the system; complexity refers to the knowledge level and expertise of the members in an organization; formalization refers to the degree to which an organization makes its members’ follow rules and procedures; interconnectedness is the degree to which the different units within a social system are interpersonally networked; organizational slack refers to the amount of uncommitted resources readily available to the organization; size refers to the amount of employees working within an organization. The external characteristics refers to system openness. (Rogers, 1995; Oliveira & Martins, 2011)

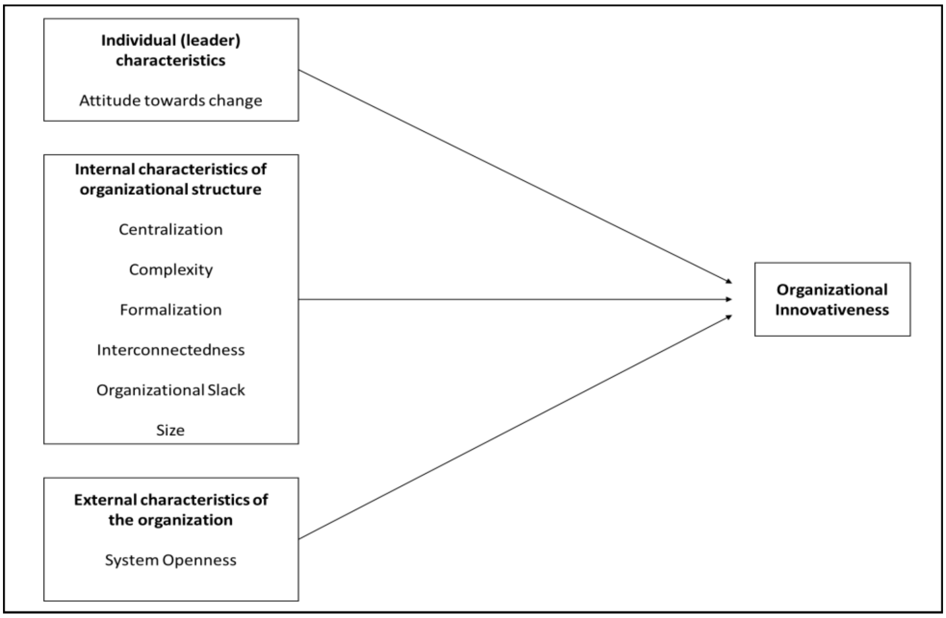

Figure 5. Organizational innovativeness according to DOI framework (Rogers, 1995; Oliveira & Martins, 2011).

The TOE framework is consistent with the DOI theory and they are commonly used together to explain innovation adoption (Oliveira & Martins, 2011; Oliveira et al., 2014). Additionally, the TOE model subsumes the five innovation attributes Rogers (1983) argues influence innovation adoption (Thomas et al 2008). This is especially true considering the plethora of studies (Thong, 1999; Chong et al., 2009; Wang et al., 2010; Gide & Sandu, 2015; Low, Chen & Wu, 2011; Zhu et al., 2006, MacLenna & Van Belle 2013) that have used both theories to explain technology adoption (see Table 1). Furthermore, and more specifically, a fusion of both models has also been widely used to explain cloud computing adoption. Low, Chen & Wu (2011) fused both models together to understand determinants of cloud computing adoption in the high-tech industry; Gide & Sandu (2015) used TOE and DOI to research key factors influencing cloud based services adoption in Indian SMEs; AlBar & Hoque (2015) also used both models to present the determinants of cloud ERP adoption in Saudi Arabia. Majority of these papers however focused on adoption within a specific context, industry, or country, few have managed to present a general cloud computing framework.

The TOE framework will serve as a solid base upon which the proposed integrative model will be developed. This is firstly due to its useful analytical framework that has been vastly used across literature to study the adoption and assimilation of different IT innovations. Secondly, it has a solid theoretical basis and consistent empirical support (Oliveira & Martins, 2011; Wang et al., 2010).

Table 1. A few studies that have used TOE and DOI

Study	Adoption	Context
Thong, 1999	Information systems	SME’s
Chong et al., 2009	C-commerce (collaborative commerce)	Electrical and electronic organizations in Malaysia
Wang et al., 2010	RFID	Manufacturing businesses in Taiwan
Low, Chen & Wu, 2011	Cloud computing	High-tech industry in Taiwan
Gide & Sandu, 2015	Cloud based services	SME’s in India
MacLenna & Van Belle 2013	SOA (service-oriented architecture)	South Africa

4.2 Technology Acceptance at Individual Level

While the TOE framework and DOI theory complement each other rather nicely, the theories which explain individual technology adoption should not be discarded. A few studies in information systems (IS) research have proposed adoption models and have tried to explain adoption, but have ignored the individual context associated with the adoption of an innovation, citing a focus on adoption from the organizational perspective as reason for this omission (Oliveira et al., 2014; Low, Chen & Wu, 2011; Jha & Bose, 2016). According to Jha & Bose (2016) individual factors are very important in determining if adopting an innovation would be successful. Furthermore, excluding individual factors leads to unbalanced and atomistic theories; therefore, research from an organizational perspective should be complemented with research from the individual perspective (Jha & Bose, 2016). Jeyaraj et al. (2006) resonated these claims by pointing out that there is a lack of integration and a lack of understanding of the linkages between individual and organizational adoption of IT. Thong (1999) recognized this by adding the characteristics of the decision makers to his proposed adoption model in addition to the technological, organizational and environmental characteristics. Furthermore, Rogers (1995) noted that the decision to either adopt or reject a technological innovation is taken based on an individual's attitude to the technology. In addition, Sun & Jeyaraj (2013) also argued that the adoption of an innovation is driven by both the innovation attributes and the individuals' characteristics. So therefore, based on this evidence from literature, individual adoption factors should also be considered for the model.

The individual factors affecting management attitude towards change and intention to adopt new technology is explained by the TAM model and its extensions (TAM2, TAM 3, UTAUT & UTAUT2). TAM proposes that system use is influenced by behavioral intention to use which is in turn influenced by the attitude of the adopter and the attitude of the adopter is directly influenced by the perceived usefulness (PU) and perceived ease of use (PEOU) of the system (Davis et al., 1989); see Figure 6. In other words, intrinsic motivation within an individual lead to the adoption of new technology. This is true of an individual, it however also applies to an organization since there is always an individual who champions the innovation (Wu & Wu, 2005).

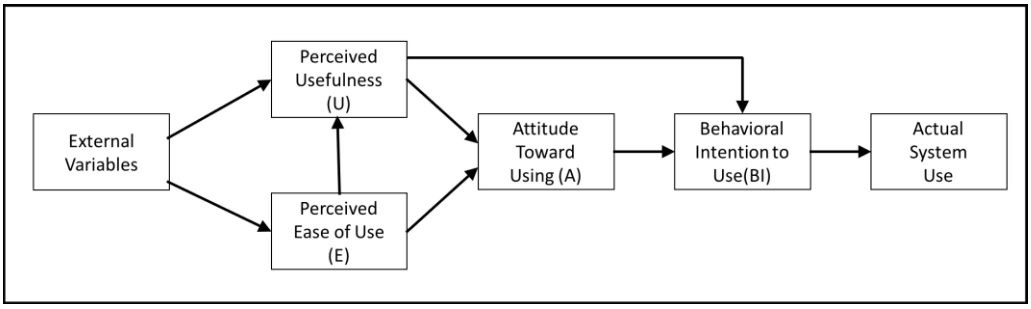

Figure 6. Technology Acceptance Model (TAM) (Davies et al., 1989).

Davis (1989) presented two variables he argued were the determinants for user acceptance of a technology. PU and PEOU according to the TAM theory are fundamental determinants of IT adoption. PU is defined as the extent to which the user of a specific technology believes it will help improve their job performance. Contrastingly, PEOU is defined as the extent to which the user of a specific technology believes its usage would be effortless.

While it is premature to start eliminating variables from the proposed integrated model, similarities between some of the constructs presented in the different models are striking, showing how much these models fit together and how interchangeable their constructs are. The prime example being the similarity between the PEOU construct in TAM and technological complexity characteristic in DOI and as noted by Davis (1989), they parallel one another quite closely. Furthermore, Wu & Wu (2005) also noted that the PU construct in TAM is synonymous to the relative advantage characteristic in DOI. TAM has been extended twice, TAM2 and TAM3. Venkatesh & Davis (2000) proposed TAM2 by seeking to expand the theory by researching and including the determinants of the original constructs PU and PEOU in the new model. They also sought to understand how the effects of the determinants evolve with increased experience of using the same system. The added constructs include subjective norm, voluntariness, image, job relevance, output quality, and result demonstrability. TAM3 (Venkatesh & Bala, 2008) further expanded the TAM2 model by researching the influence of interventions by managers to encourage system use on the known determinants of IT adoption and use. They proposed six determinants of perceived ease of use (PEOU) namely computer self-efficacy, perception of external control, computer anxiety, computer playfulness, perceived enjoyment, and objective usability.

The second theory commonly used to explain technology adoption is the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003). Venkatesh et al. (2003) sought to integrate the "fragmented theory and research on individual acceptance of IT" by proposing a unified theory of eight different models; the theory of reasoned action (TRA), the technology acceptance model (TAM), the motivational model (MM), the theory of planned behavior (TPB), a combination of the technology adoption model and the theory of planned behavior (C – TAM-TPB), the model of PC utilization (MPCU), the innovation diffusion theory (DOI), and the social cognitive theory (SCT). As illustrated in Figure 7, UTAUT posits that there are three direct determinants of intention to use: performance expectancy, effort expectancy, and social influence; and two direct determinants of usage behavior: intention and facilitation conditions. Furthermore, voluntariness, experience, gender and age were confirmed as integral features of UTAUT and were found to have significant moderating influences (Venkatesh et al., 2003). UTAUT posits that these four major constructs (performance expectancy, effort expectancy, social influence and facilitating conditions) influence the behavioral intention of individuals to use a technology.

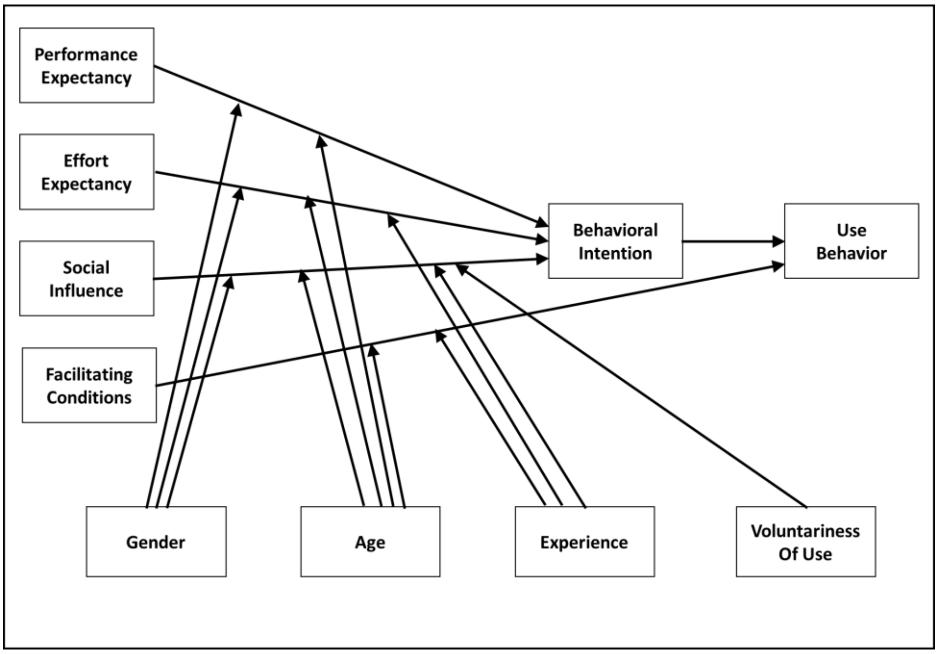

Figure 7. Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al.,2003)

Venkatesh et al. (2012) extended UTAUT to other contexts, particularly the consumer use context by adding three new constructs to the original model. UTAUT was originally developed to explain the technological use and acceptance of employees. UTAUT2 on the other hand sought to highlight the importance of hedonistic motivation, price value and habit in the use of consumer products and/or technology use (Venkatesh et al., 2012). The three constructs added are hedonic motivation, price value and habit.

4.3 Generic Adoption Model

This research aims to propose a framework for cloud computing adoption on the organizational level, although as mentioned earlier, there is always a champion who pursues the adoption of any new technology within an organization; thus, the argument to include individual factors that lead to the adoption. To remain in line with the objectives of this research, this research would not go in-depth into the individual adoption by considering the extended versions of TAM proposed along time by Venkatesh and Bala (2008), Venkatesh and Davis (2000), Venkatesh et al. (2003), and Venkatesh et al. (2012). This is because these models while being robust delve deeper into the adoption and use of technology by individuals by exploring and expatiating on the determinants of the original constructs of TAM; PU and PEOU. However, information from these models indicate that the attitude towards technology, the intrinsic and extrinsic motivation to use a technology and the individual experience with technology affects the intention to adopt and use technology. Furthermore, as mentioned earlier, the argument to include individual factors in the generic model is further backed by the works of Jha and Bose (2016), Thong (1999), Rogers (1995), Sun and Jeyaraj (2013).

Table 2 below shows an overview of all the models used in the proposed framework while the proposed framework is illustrated in Figure 8 below. The proposed framework shares striking similarities to the revised dominant paradigm of IT innovation as depicted by Jeyaraj et al. (2006) which is a result of an extensive review of literature on both individual and organizational adoption of IT in general, thereby proving the validity of the proposed model.

Table 2. Overview of the adoption models and factors used in the framework

Factor Dimension	**TOE**	**DOI**	**TAM**
Individual	-	Leader's attitude toward change	-
Technological	- Availability - Characteristics	- Relative Advantage - Complexity - Compatibility - Trialability - Observability	- Perceived Usefulness (PU) - Perceived Ease of Use (PEOU)
Organizational	- Formal & Informal Linking Structures - Communication Processes - Size - Slack	- Centralization - Complexity - Formalization - Interconnectedness -Organizational Slack - Size	-
Environmental	- Industry Characteristics and Market Structure - Technology Support Infrastructure - Government Regulation	System Openness	-

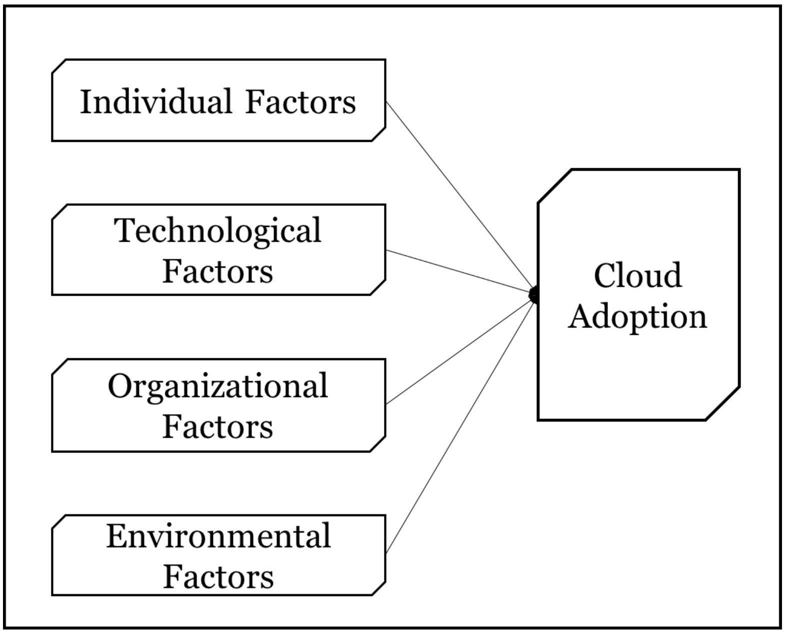

Figure 8. Proposed cloud adoption framework.

5. Systematic Literature Review

The systematic literature review is a six-stage process starting with developing a search strategy (see Figure 3). The five other stages include defining the inclusion and exclusion criteria of the primary studies, study selection process, quality assessment, data extraction, and data synthesis (Kitchenham, 2004; Kitchenham & Charters, 2007). This chapter details the process conducted for reviewing existing empirical studies on adoption of cloud computing in organizations.

5.1 Search Strategy

To uncover as much primary studies as possible, it is important to have an unbiased search strategy in place (Kitchenham, 2004). Six electronic databases were selected as sources: IEEE Xplore, ACM digital library, Scopus, Web of Science, ProQuest, and ScienceDirect. IEEE has a dedicated collection of peer reviewed articles; ACM digital is a popular database for research in computing, it contains premier computing reference and full-text publications from various publishers; Scopus has the largest abstract and citation collection of peer-reviewed literature, containing both journals and conference papers; Web of Science is a comprehensive and versatile multidisciplinary research platform; ProQuest provides a single source for scholarly journals, reports, working papers, and millions of primary sources. ScienceDirect is a good source for scientific, technical and medical research. To determine the potential volume of studies relating to a research question, preliminary searches should be carried out (Kitchenham, 2004). Each of the selected databases returned a different amount of relevant literature after preliminary searches were carried out using the search phrase “cloud computing adoption factors”. Table 3 below shows the preliminary search results from the selected databases.

Table 3. Database selection and preliminary search results as of November 2016.

Database	Reason for selection	Preliminary search result
IEEE Xplore	IEEE has a dedicated collection of peer reviewed articles on cloud computing (IEEE transactions on cloud computing). Additionally, IEEE Xplore itself has a large amount of literature on cloud computing and information technology in general.	151 articles
ACM digital library	ACM digital library contains all ACM publications – the premier computing reference publications, as well as full-text publications from other select publishers.	56 articles
Web of Science	Web of Science is a comprehensive and versatile multidisciplinary research platform	229 articles
ProQuest	ProQuest provides a single source for scholarly journals, reports, working papers, and millions of primary sources	141 articles
Scopus	Scopus is the largest abstract and citation collection of peer-reviewed literature. It contains both journals and conference papers	421 articles
ScienceDirect	A good source for scientific, technical and medical research	310 articles

The search string used in the preliminary search was derived from the research question and it included three keywords: “cloud computing”, “adoption” and “factors”. The preliminary search was especially useful in helping to refine the search strings by uncovering more keywords and consequently more search strings. For instance, cloud was derived as the alternative term to cloud computing, acceptance was derived as the alternative term to adoption and determinants the alternative term to factors (see Table 4). Furthermore, after a few iterations with all keyword combinations and consultation with the thesis supervisor, a decision was made to drop the “computing” from the “cloud computing” keyword to obtain a wider coverage of primary studies. Hence, for the final search the following search strings were employed:

- cloud adoption factors
- cloud adoption determinants
- cloud acceptance factors
- cloud acceptance determinants.

Table 4: Table showing keywords and their alternative terms

Keyword	Alternative terms
Cloud computing	OR Cloud
Adoption	OR Acceptance
Factors	OR Determinants

5.2 Inclusion and Exclusion Criteria

The inclusion and exclusion criteria are among the most important elements of a systematic literature review. They give clear instructions on how papers should be selected.

Papers were included based on the following criteria:

- The articles should be peer reviewed to guarantee quality.
- The articles should focus on "cloud computing" in general, a "cloud computing model" or a "cloud service and its adoption/acceptance".'
- No restrictions on year of publication were defined; all primary studies regardless of their year of publication were included in the review.

Papers were excluded based on the following criteria:

- Not written in English.
- Focus on just cloud computing characteristics, benefits, and models without mentioning of cloud computing adoption or intention to adopt.
- Focus on personal adoption of individuals rather than a body e.g., a group, an organization, government, etc.
- No empirical data has been collected. Papers without empirical data were excluded because the factors retrieved from literature should have been empirically collected to give credence to the derived model.

5.3 Study Selection Process

The study selection was a rigorous and exhaustive process. There were four main steps involved in the primary study selection process. The process is highlighted in Table 5 below:

Table 5. Table showing the study selection process

Process	Result	% left after exclusion
Step 1: Search as of November 2016	1623	
Step 2: Remove duplicates	928	57%
Step 3: Exclude articles based on titles and abstracts	171	10.5%
Step 4: Exclude articles based on quality assessment and full text scanning	51	3.1%

The first step was the search which included searching for articles from various databases. Specified keywords derived from the research question were used as inputs for the databases (see Section 5.1). The search yielded 1623 articles.

In step 2, the search results from step 1 were exported to RefWorks and then the duplicates were removed. After removing the duplicates, 928 articles were left. The third step involved excluding irrelevant papers based on their titles and abstracts using the inclusion and exclusion criteria defined in Section 5.2. The third step yielded 171 articles.

5.4 Quality Assessment

After the selection of literature was completed using the inclusion and exclusion criteria listed in 5.2, and after removing duplicates and articles based on titles and abstracts (Table 5), the next step was to rigorously assess the quality of the primary studies. This final step involved excluding articles based on full text scanning and quality assessment. This step is needed to minimize bias, while simultaneously maximizing both the internal and external validity of this study (Kitchenham & Charters, 2007). Furthermore, Kitchenham (2004) stressed that assessing the quality of studies provides an even more detailed inclusion and exclusion criteria. It also shows whether the differences in study results is due to the differences in quality of studies. Additionally, quality assessment serves as a tool that can be used to determine the relevance of selected primary studies. Therefore, regarding the reasons given above, an adapted version of the quality criteria checklist proposed by Kitchenham & Charters (2007) was used; see Table 6, where each item is awarded 1 when the criteria is met and 0 when not met. The checklist was adapted by picking seven questions that adequately assess the quality of papers in relation to this research process and objectives of this study which is focused on CC adoption. For a primary study to be included, a threshold score of 3.5 should be met. Primary studies with scores below 3.5 are excluded. Prior to this step, there were 171 articles left; after applying the checklist, 51 articles with empirical data were retrieved for review and data extraction (see Appendix A).

Table 6. Quality criteria checklist

No	Question	Yes or No
1	Are the aims of the research clearly stated?	
2	Is/are the research question(s) clearly stated?	
2	Is cloud computing clearly defined?	
3	Are adoption factors clearly defined?	
4	Are the variables used adequately measured?	
5	Are the data collection methods adequately described?	
6	Were negative results presented?	
7	Are problems with validity and reliability of their measures explained?	

5.5 Data Extraction

The data extraction process involves reviewing the selected primary studies with the aim of obtaining as much information as possible. Data extraction was achieved using the Nvivo software. Listed below are the steps taken to extract data from the primary studies:

- The first step included importing all 51 primary studies into Nvivo.
- For the second step, since the aim of this literature review was to extract cloud computing adoption factors from literature, four nodes - each representing the

different categories of adoption factors as illustrated in Figure 8 - were created. An additional extra node was created for factors that might be uncovered but do not belong to any categories.

- The third step is paper classification. Two classifications were created in Nvivo, they are: conference papers and journal articles. Each classification has attributes which include paper code (as coded in Appendix A, research context, research methods, publication year, theories used, and country. Each primary study was glanced through and the attributes were extracted and recorded into corresponding classifications. The classification was done to get a thorough overview of the metadata and to look for possible patterns that might arise when analyzing the information derived.

- The fourth step involves reading the primary studies and updating created nodes by dragging important information into their prospective nodes. Here, each primary study is read and factors found are coded into their respective nodes depending on the category the factors fall into. Also, a new node named "other factors" was created for factors which do not readily fall into any of the predefined categories. These factors are retrospectively reviewed and categorized into any of the predefined categories that fits best.

To extract as much data as possible from the literature and maintain a good degree of data organization, a total of six main nodes were created, 4 nodes encompassed the various factor dimensions as shown in Table 2 and two additional nodes "other factors" and "miscellaneous" were created. The other factors node was created to accommodate possible unclassified factors that might be uncovered while the miscellaneous node was created to contain non-factor but valuable data which contributes to this study.

5.6 Data Synthesis

The purpose of data synthesis is to collect and summarize the results of the primary studies included in this research (Kitchenham, 2004; Kitchenham & Charters, 2007). Due to the qualitative nature of this research, the descriptive synthesis method was applied; meaning that the results and findings are presented in tables, charts and in plain text. The primary studies were classified in Nvivo into journal papers and conference papers, this was done to gauge the quality of the papers and see if there are dramatic differences in quality. Other classifications of the studies in Nvivo were done to distinguish between study contexts, year of publication, research methods used, technology adoption theories used and country of research.

Descriptive statistics about the primary studies relevant to their classifications are presented in tables and charts. Specifically, data about publication type (conference or journal), publication years, research methods used, and the focal countries of research are described in tables and charts describing the frequency in absolute or percentage values.

Results on the adoption factors are presented in four structured tables, each table representing results on each primary factor identified in the literature review on adoption (e.g., technological, organizational, environmental, individual factors). These four tables highlight relevant information like specific factors identified from literature, the number of referenced studies, and the statistical significance and insignificance of the factors. The tables also contain a coverage ratio calculated by dividing the number of primary studies that found a specific tertiary factor to be significant by the total number of primary studies; the result is multiplied by 100 to arrive at a percentage value.

Coverage Ratio = (No. of Significant Primary Studies / Total No. of studies) x 100.

In the resulting tables, the factors are classified in primary factors, the first level factors which are the four factor dimensions described in Table 2 and illustrated in Figure 8; they are technological factors, organizational factors, environmental factors and individual factors. The specific factors identified and extracted from the reviewed literature were very numerous making it necessary to group them into smaller categories based on similarity of the aspects addressed. Thus, the specific factors encountered in the research articles reviewed are called tertiary factors or third level factors, while the grouping categories are called secondary factors, or second level factors. The secondary factors are a collection of specific tertiary factors that fall under the same theme, for instance secondary factor "complexity" include tertiary factors like complexity, simplicity, ease of use, ease of use and convenience, and technical complexity; Figure 9 below illustrates the factor hierarchy.

The specific, tertiary adoption factors found in the primary studies were coded in Nvivo into nodes which were described in the previous section; they include "technological factors", "organizational factors", "environmental factors" and "individual factors". This information was then extracted from Nvivo and collated in tables which are presented in the next chapter.

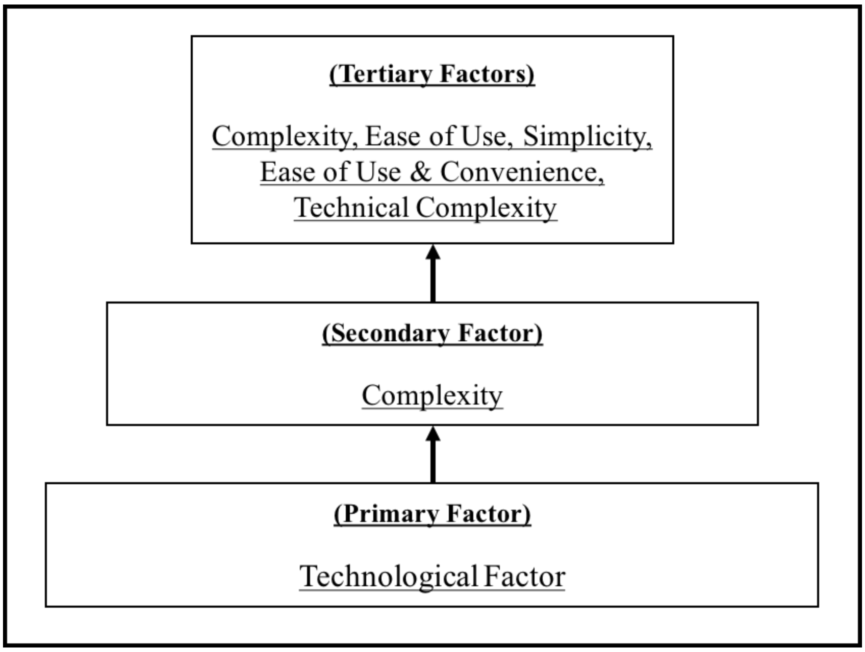

Figure 9. Hierarchy of adoption factors.

6. Results

This chapter contains the description of the results derived from the systematic literature review. It also contains brief analyses of the results presented. More in depth analysis of the results are presented in chapter 7.

6.1 Study Classification

In total, 51 papers were included in this study for analysis. There were 27 journal articles making up for 53% of the primary studies and 24 conference papers making up the remaining 47%; see Figure 10. The publication years of the primary studies varied across the 2000s and curiously enough while there were no publication year restrictions in the search strategy, the oldest article found on cloud computing adoption in organizations was published in 2011. Figure 11 shows the publication year's variation (see also Appendix B). A possible explanation for this variation could be cloud computing's relative newness having only emerged in 2006 (Erl et al., 2013), although, it should be noted that cloud computing is not an entirely novel innovation since it has roots in grid computing.

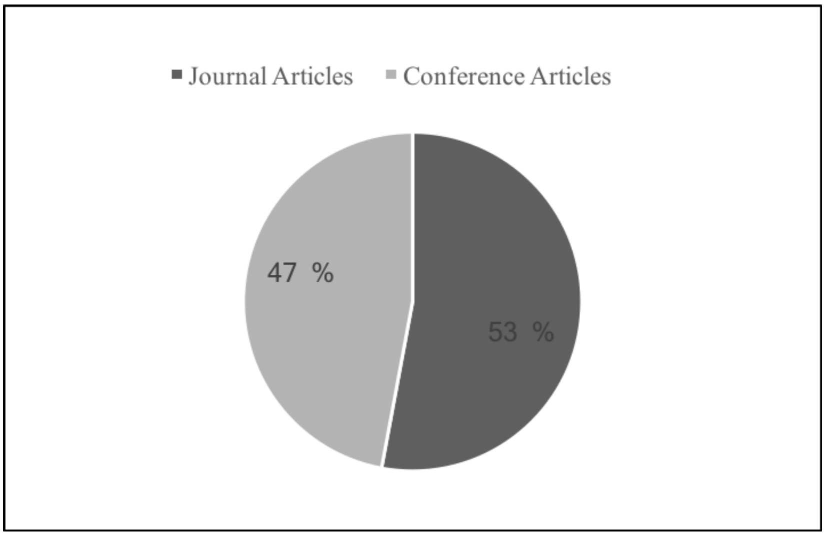

Figure 10. Classification of primary studies.

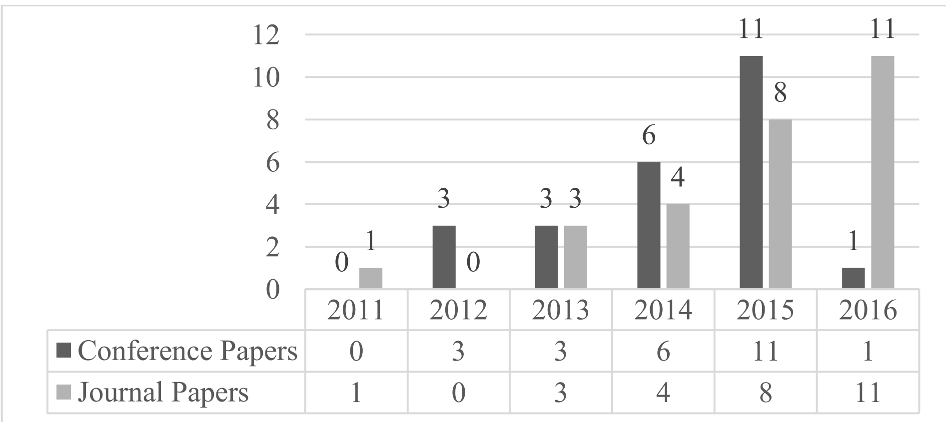

Figure 11. Primary study publication years.

The general applicability of this study is influenced and enhanced by the primary studies used in this research due to the diversity of the research contexts, research methods used, and countries where data was collected. As shown in Figure 12, survey was the most common method used to collect empirical data. Thirty-four papers out of the fifty-one papers used surveys while eleven papers used interviews. Also, a mixture of research methods was also utilized by two papers, one paper used interviews and surveys to collect data while the other used case studies and interviews.

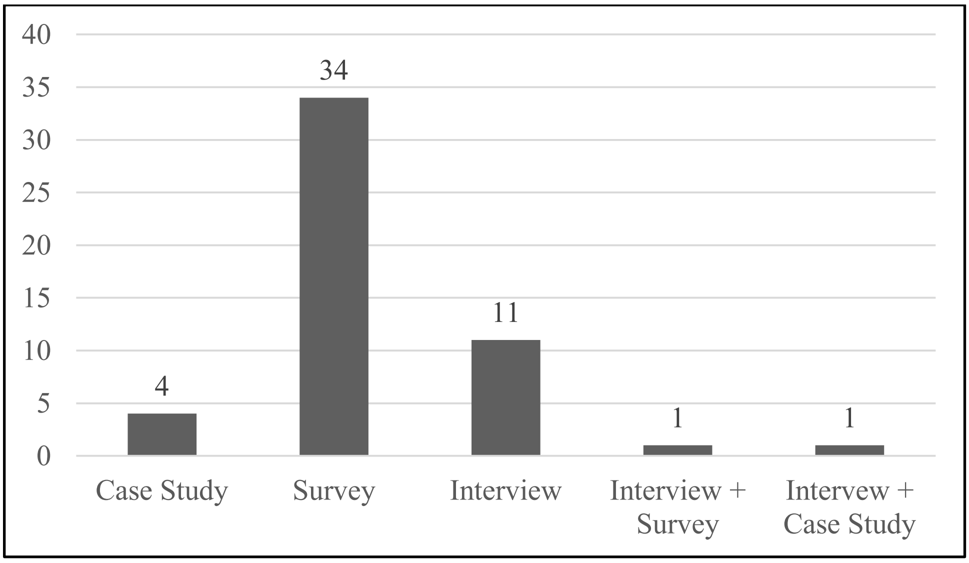

Figure 12. Research method distribution of primary studies.

Continuing in terms of general applicability, the study contexts of the primary studies spans various industries, countries and governments as shown in Tables 7 and 8.

Table 7. Study contexts in primary studies.

Study Context	**No of Studies**
Country	4
Government, municipality, region	2
Public Sector	2
Education	4
Organizations	24
SMEs	9
Industry: Oil and Gas, High-tech, Hospitals, Machinery, Manufacturing and Services, Science and Technology Institutions.	1

The study contexts in Table 7 refer to the environment analyzed within which the study is carried out. Four articles explored cloud adoption within the whole country, for instance Akar & Mardikyan (2016) (R1) and Alameye & Getahun (2015) (R2); R1 studied the factors affecting the adoption of cloud computing in Turkey while R2 developed a cloud readiness assessment framework for a developing country like Ethiopia. A total of six articles researched cloud computing adoption in governments, municipals and regions. Four articles used education as its research setting. Cloud adoption was also researched within the oil and gas industry, high-tech industry, hospital, machinery industry, manufacturing and services industry, and science and technology institutions. Organizations and SME's were the most researched contexts with twenty-four and nine articles each, respectively. Data was collected from many different countries, which further adds solidity to the general applicability of the proposed adoption model. Seven articles didn't state which country they collected their data from. Six articles each collected data from India and Saudi Arabia, five articles collected data from Taiwan. Two articles sent online questionnaires to organizations worldwide, data was also collected by two articles each from Australia, China, England, South Africa, and Turkey. One paper collected data from the EU, another one collected data from the UK and another from Africa; the remaining articles each collected data from Austria, Ethiopia, Germany, Ghana, Iraq, Jordan, Malaysia, Nigeria, Oman, Portugal, Singapore and the USA.

6.2 Technological Factors

Tornatzky & Fleishers (1990) defined the technological context influencing the adoption of technology in an organization as the availability and characteristics of the internal and external technologies relevant to the organization. All in all, 65 unique technological factors were retrieved from literature as shown in Table 9 below. The specific, tertiary factors were summarized into nine secondary factors, namely compatibility, relative advantage, complexity, security, cost, trialability, privacy, reliability, and other innovation characteristics.

Relative advantage, compatibility, complexity and security all appear to have the most influence on the adoption of cloud computing. Though complexity mostly has a negative effect on cloud computing, it is nevertheless highly significant and should be considered when adopting cloud computing. Other innovation or technological characteristics is a collection of all attributes, characteristics and benefits related to the innovation which is cloud computing in this case. Amongst the factors listed under other innovation characteristics, availability and observability has the most influence on cloud computing. Cost and trialability both have medium coverage among adoption factors albeit significant influence on cloud computing adoption while privacy, trust and reliability have the least influence in terms of coverage ratio according to the literature review findings.

6.3 Organizational Factors

Tornatzky & Fleisher (1990) stated that the organizational context refers to the measures which describe the organization. A total of 64 unique tertiary factors and seven secondary factors were extracted from literature as elicited in Table 10 below. The organizational factors are top management support, technology readiness, organizational size and structure, organizational culture, internal expertise, other organizational factors, and lack of control. Top management support is the most significant organizational factor, this shows how paramount top management support is to cloud computing adoption. Some articles listed technology readiness as a technological factor, while others listed it as an organizational factor. Since the technological factor is centered around the characteristics of the technology itself, it was therefore decided that technology readiness was an organizational factor. Technological readiness is the second most significant factor closely followed by organizational size, organizational culture, internal expertise, other organizational factors, and lack of control has the least significance on CC adoption.

6.4 Environmental Factors

The environmental context is the scene within which an organization does business (Tornatzky & Fleisher, 1990). A total of 61 specific tertiary factors were uncovered from the primary studies; this total was then summarized into eight secondary factors. Competitive and trading partner pressure although being the most referenced factor was also the most neutral factor with it being significant and not significant in equal measures. Nevertheless, it remains the most significant environmental factor. Legislation and regulations is the second most significant factor followed by trust, external expertise, national infrastructure and physical location.

Table 9. Technological factors

Secondary factor	Tertiary factors	No. of tertiary factors	No. of studies	Significant	Insignificant	Coverage ratio
Relative Advantage	Relative Advantage, Perceived Benefits, Perceived Usefulness, Usefulness	4	39	R2 - R12, R15, R18, R19, R20 R24-R27, R29- R33, R34a, R36a, R38- R41, R43, R45- R48, R50,	R23, R28, R34b, 49	71%
Compatibility	Compatibility, Technical Compatibility, Functionality Fit, Task-Technology Fitness, Business Activity Cloud Fitness, Job Relevance[1], Incompatibility	7	39	R2, R4 - R10, R15 - R18, R20, R24 - R26, R32, R33, R34b, R35 R36, R38, R39, R40, R42, R43, R48- R50	R3, R12, R23, R28, R29, R30, R34a, R41, R45, R46, R47	57%
Complexity	Complexity, Simplicity, Ease of Use & Convenience, Ease of Use, Technical Complexity	5	33	R2, R4, R6, R8 - R10, R15, R18, R20, R22, R23, R25, R28, R30, R32, R33, R34b, R36, R38, R39, R43, R45, R46, R48- R50	R5, R7, R12, R29, R31, R34a, R40, R47	51%
Security	Security, Security Threat, Data Concern, Fear of Data Loss, Vulnerability, Security Risk, Risk	7	29	R1, R4, R6, R7, R16, R17, R19, R20 - R22, R25, R26, R28, R32, R33, R38 - R41, R43 - R45, R48	R8, R14, R30, R34a, R34b, R37a, R37b, R47	45%

[1] Job Relevance falls under compatibility; it is defined as the degree to which an individual perceives than an innovation is applicable to his or her job (Opitz et al., 2012; R35).

Cost	Cost, Cost Savings, Total Costs of Ownership, Hard Financial Analysis, Soft Financial Analysis, Sunk Cost and Satisfaction with Existing Systems, Cost Effectiveness	7	17	R1, R3, R4, R8, R14, R16, R20, R21, R22, R25, R28, R30, R34a, R38, R43	R34b, R37a, R37b, R47	29.4%
Trialability	Trialabilty	1	14	R7 - R10, R15, R20, R32, R33, R38, R39, R43, R50	R36, R47	23.5%
Reliability	Reliability, Service Outages	2	11	R1, R6, R7, R15, R16, R17, R20 - R22, R24, R44		22%
Privacy	Privacy, Privacy Concerns, Confidentiality, Data Privacy	4	12	R6, R7, R20, R22, R24, R37, R39, R40, R44, R46	R14, R47	20%
Other Innovation Characteristics	Technological Characteristics, Availability, Availability and Support, Customization, Application Specificity, Integration, Migration Time, Observability, Observable Results, Results Demonstrability, Cloud Benefits, Capacity, Performance, Adaptability, Portability, Interoperability, Standards for API, Increased Traceability, Auditability, Accessibility, Production Timeliness, On Demand Service, Scalability, Pay per Use , Output Quality, Energy Efficiency, Meet Environmental Standards, Virtualization	28	20	R1, R2, R6, R7, R15, R16, R21, R24, R25, R28, R32, R33, R35, R36, R38- R40, R43, R49, R50		39%

Table 10. Organizational factors

Secondary factor	Tertiary factors	No. of tertiary factors	No of studies	Significant	Insignificant	Coverage ratio
Top Management Support	Top Management Support, Executive Support, IT Manager's Support, Executive's Attitude, Top Management Team Participation, Top Management's Intention to Adopt New Innovation, Support of Senior Managers.	7	34	R2-R14, R17, R18, R26-R31, R34b, R37a, R40, R41, R42, R44, R45, R48- R51	R23, R34a, R37b, R46	63%
Technology Readiness	Technology Readiness, Organization's IT Resource, IT Infrastructure, Organizational Readiness, IT Resource, Adequate Resource, Organizational Systems, Facilitating Conditions, Effort Expectation, Technological Availability, IT Department Budget, Business Case & Budget.	12	23	R2, R4, R5, R6, R7, R8, R17, R18, R23, R24, R26, R28, R34, R39, R40, R41, R43, R44,	R3, R29, R31, R48, R50	35.3%
Organizational Size and Structure [2]	Organizational Size, Firm Scope, Organizational Structure, Managerial Structure, Degree of Centralization	5	20	R4, R6 - R10, R20, R21, R26, R29, R31, R34a, R34b, R40, R49	R12, R17, R23, R24, R41, R43	29.4%
Organizational Culture	Culture, Innovativeness, Attitude Towards Using Technology, Absorptive Capacity, Attitude Towards Change, Formalization, Employee Mobility, Awareness, Training, Sharing and Collaboration, Business Flexibility and Agility, Image, Voluntariness of Use.	13	17	R3, R7, R10, R11, R13, R14 R15, R18, R20, R21, R22, R32, R33, R38, R39	R26, R43	29.4%
Internal Expertise	Employee's Knowledge, Experience, Internal Expertise, Technology Competence, IT Expertise of Business Users, Organization Process Innovation and Design Capacity, Prior Experience & Familiarity, Perceived Technical Competence, Personnel Skills and Experience, Competence of Employees.	11	15	R3, R4, R9, R10, R17, R20, R21, R24, R28, R30, R35, R47, R49	R12	25.5%
Lack of Control	Loss of Control, Lack of Control, Fear of Losing Control, Loss of Control over Data and Systems	4	5	R16, R20, R21, R32, R33		10%
Other Organizational Factors	Organization Strategies, Focus on Core Competencies, Insufficient Service Quality Guarantee, Quality of Service, Strategic Value, Need, End-User Satisfaction, Critical Business Processes, Business Requirement, Focus on Key Business Processes, Information Intensity, Lack of Transparency.	12	11	R1, R2, R4, R15, R17, R20, R21, R24, R36, R49	R47	20%

[2] Organizational size and structure are fused together due to their correlative relationship. Usually an organization's size has effect on the structure within the organization

Table 11. Environmental factors

Secondary factor	Tertiary factors	No. of tertiary factors	No of studies	Significant	Insignificant	Coverage ratio
Competitive and Trading Partner Pressure	Competitive Pressure, Trading Partner Pressure, Competitive and Trading Partner Pressure, Business Eco-System Partner Pressure, Competition Intensity, Peer Pressure, Competitor Pressure, Perceived Industry Pressure, Mimetic Pressure, Coercive Pressure, Social Influence, Competitive Intensity, Subjective Norm, Partner's Pressure, External Pressure, Market Competition Pressure	16	36	R3, R4, R5, R8, R12, R13, R17, R18, R23, R26, R29, R30, R31, R35, R39, R41, R44, R49, R50	R6, R7, R9, R10, R15, R24, R28, R34a, R34b, R37a, R37b, R38 R40, R42, R43, R45, R46, R47, R51	37.3%
Legislation and Regulations	Legislation and Regulations, Regulations, Government Policy, Government Policy and Regulation, Government Policy Support, Regulatory Environment, Legal Issues, Regulatory Support, Regulatory Framework, Regulation Compliance, Normative Pressures, Laws and decrees, Political Matters, Legal Environment	14	31	R1, R4, R6, R7, R17, R19, R20, R21, R30, R32, R33, R36, R38, R42, R43, R44, R49	R3, R8, R12, R14, R24, R28, R31, R34a, R34b, R40, R41, R45, R46, R51	33.3%
Trust	Trust, Vendor Credibility, Provider's Reputation, Relationship with Service Providers, Lack of Vendor Trust	5	12	R6, R7, R11, R16, R17, R21, R27, R40, R43, R49	R14, R48	20%
External Expertise	External Expertise, External Support, Supplier Efforts, External Computing Support, Service Provider's Support, Supplier Computing Support, Vendor Support, Supplier Availability, Cloud Computing Services Provider, Service Provider's Ability	10	10	R1, R3, R7, R8, R9, R10, R19, R20, R26	R47	18%
National Infrastructure	Network Connectivity, Region's Broadband Infrastructure, Internet bottleneck, Internet Reliability, Country-based Infrastructure, Inadequate Telecom Services, Region's Power Supply Infrastructure, Infrastructure, National Infrastructure	9	9	R2, R8, R17, R20, R21, R24, R37, R38, R40		18%
Physical Location	Physical Location, Data Center Location, Geo-Restriction & Uncertainty.	3	5	R7, R6, R9, R10,R49		10%
Vendor Lock-in	Vendor Lock-in	1	4	R20, R24, R45	R46	6%
Industry Properties	Industry, Market Scope, Industry Characteristics and Market Structure	3	3	R7, R9, R10		6%

6.5 Individual Factors

An argument was made in Chapter 4 on the importance of including individual factors into the research model. After browsing through the primary studies, it was apparent that there was a severe lack of research into the impact of individual factors on cloud computing adoption on the organizational level. This factor category should not be confused with organizational personnel related factors like top management support, internal expertise, and organizational culture; neither should it be taken as a literal representation of any singular adoption factor. The factors in this category specifically relates to an individual within the organization with enough influence and power to make adoption decisions on behalf of the whole organization. Only four individual factors were recognized and only seven studies referenced, accounting for a meager total coverage of 14% of the primary studies.

Table 12. Individual factors

Secondary Factor	Tertiary Factors	No of Tertiary Factors	No of Studies	Significant	Insignificant	Coverage Ratio
Decision Maker's Technology Experience	Decision Maker's Cloud Knowledge, IT Knowledge	2	3	R47, R48	R3	4%
Decision Maker's Innovativeness	CIO Innovativeness, Decision Maker's Innovativeness	2	4	R10	R3, R28, R47	2%

6.6 Suggested Cloud Computing Adoption Model

The total number of tertiary factors retrieved from literature highlights the importance of performing this literature review. It also highlights how obsolete and incomplete the original TOE framework was. Although the initial plan was to improve on the TOE framework which was the basis of the research model, the number of tertiary factors retrieved was however not anticipated. Also, in addition to the technological, organizational and environmental factors, the individual factors have been added. Figure 13 below presents the suggested cloud computing adoption model based on the results of the literature review.

It was established in Chapter 4 that the intent to adopt originates from an individual; due to the characteristics of the decision maker or innovator within an organization. Additionally, thinking from an organizational point of view, before adopting any technology the organization needs to perceive it as being useful and helpful in helping it achieve its goals. This is the first phase of every adoption process, it is kick-started via individual factors. After this comes the technological, organizational and environmental considerations. A positive conclusion from these considerations would usually lead to adoption.

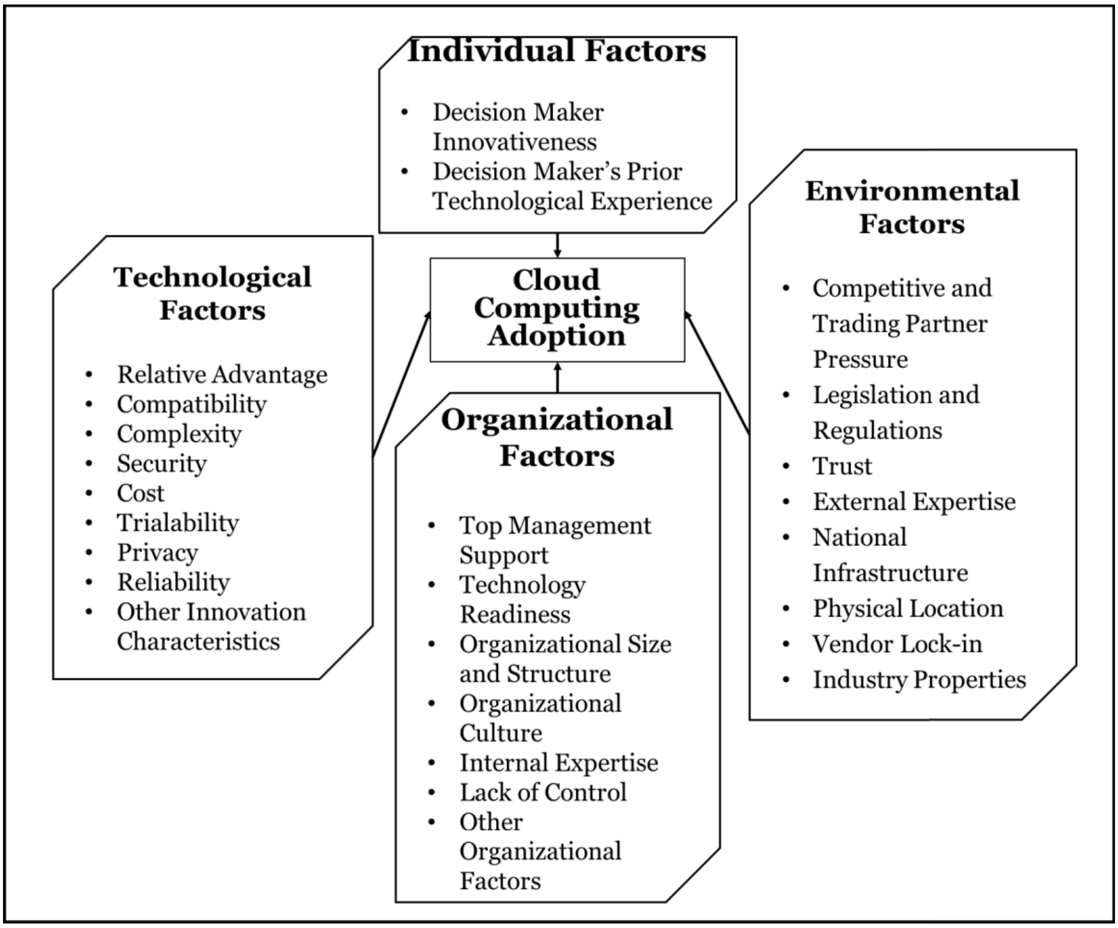

Figure 13. Final cloud computing adoption model

7. Discussion

This chapter aims to analyze the results presented in the previous chapter. All primary adoption factors would be analyzed in 4 sub-chapters.

7.1 Individual Factors

Individual factors had the least coverage amongst the primary factors, only 14% of the primary studies covered individual factors. Furthermore, the total coverage ratio of the individual factors was just 6%. To put this into perspective, vendor lock-in and industry which were both the least significant environmental factors also have a 6% coverage ratio. This shows a significant gap in literature on the research into the impact individual factors has on adoption. Compared to other primary factors and considering the level of evidence found from literature, an argument to remove individual factors from the model would be valid. However, the need for the inclusion of individual factors was established in Chapter 4. Therefore, however insignificant the evidence from literature is, the evidence is still there. Multiple research papers have researched the personal adoption of cloud computing over the years, surprisingly though, research into the role individuals play in the adoption of cloud computing within organizations is severely lacking. More research on the impact of individual factors on adoption should be carried out.

Four tertiary factors were retrieved from literature; these were summarized into two secondary factors. They are; 1) decision maker's prior technology experience which includes tertiary factors like decision maker's cloud knowledge, and IT knowledge and 2) decision maker's innovativeness which includes tertiary factors like CIO innovativeness and decision maker's innovativeness. Referring to Table 2 which presented the factors used in the proposed model, it is evident that none of these secondary factors correlates with the information that was presented in Table 2. New knowledge has therefore been synthesized from literature via the systematic literature review that was carried out. Perhaps one could argue that the leader's attitude towards change from the DOI theory is close to the decision maker's innovativeness factor. Alharbi et al. (2016) (R3), theorized based on results from literature that the innovativeness of decision makers considerably influences the decision to adopt cloud computing in healthcare organizations and that individual factors are main obstacles to the successful implementation of cloud computing in Saudi Arabian healthcare organizations. However, their results showed that the individual factors were the least important of all the factors and that the decision maker's innovativeness does not influence cloud computing adoption in Saudi Arabian healthcare organizations. This finding is consistent with Lian et al. (2014) (R28), who theorized that the chief information officer (CIO) innovativeness plays an important role in the adoption of cloud computing in Taiwan hospitals but their results showed that CIO innovativeness does not influence adoption. Both studies used hospitals as their research context which raises the question, is there a relationship between the significance of the decision maker's innovativeness and the context within which they operate? Contrastingly, Alshamaila et al. (2013) (R10), found that the innovativeness of the decision maker played a significant role in on organizations willingness to adopt cloud computing within small and medium sized enterprises (SME's). This view was resonated by Thong (1999) who found the CEO's innovativeness to be positively associated with the adoption of information systems in small businesses. To therefore answer the question asked earlier about the relationship between the significance of the decision maker's innovativeness and the context they operate in, while there is not enough data from the literature to categorically give a definitive answer, nonetheless there seems to be a trend. This might be due to the flexibility of SMEs.

The second tertiary individual factor is the decision maker's technology experience which includes tertiary factors like decision maker's cloud knowledge and IT knowledge. Thong (1999) found that CEO's who are knowledgeable about a technology are more likely to adopt them. Also, out of nine other factors Tehrani & Shirazi (2014) (R47) found the decision maker's technology knowledge to be the only factor that influences cloud computing adoption. Furthermore, Wahsh & Dhillon (2015) (R48) found the IT knowledge of the decision makers as significant to the adoption of cloud computing for E-government implementation. These findings from literature proves that the decision maker's innovativeness and the decision maker's technology knowledge are both vital to cloud adoption within organizations.

7.2 Technological Factors

The primary studies covered technological factors more than any other primary factor and understandably so, as these factors explain and highlight the characteristics of the innovation which in this case is cloud computing. While lots of new factors were retrieved from literature a significant number of factors remained from the original TOE and DOI theories as shown in Table 2. Relative advantage, compatibility, complexity, trialability and other innovation characteristics are all secondary factors that remained from the models. Availability and Observability were fused into other innovation characteristics which includes a total of twenty-eight tertiary factors, twenty-six of them newly retrieved from literature. Also, security, cost, privacy and reliability are all new secondary factors retrieved from literature. Relative advantage emerged as the most significant technological factor and the most significant factor overall with a coverage ratio of 71%, this is consistent with results presented by Tashkandi & Al-Jabri (2015) (R45). This is followed by compatibility and complexity with 57% and 51% coverage ratio respectively. Security, other innovation characteristics and cost follow with 49%, 39% and 29.4% coverage ratios respectively. Trialability, reliability and privacy have the least significance on cloud computing adoption.

The importance of technological factors to cloud computing adoption cannot be understated as evident in the number of tertiary technological factors retrieved and their average coverage ratio. This finding correlates with the findings of Thong (1999) who found technological factors to have a major effect on adoption of information systems. Furthermore, the combination of relative advantage, compatibility and complexity, three factors from the original TOE and DOI models emerged as the most referenced technological factors; this is also supported by Thong (1999) who listed relative advantage, compatibility and complexity as the three essential attributes that influences adoption.

Perceived usefulness was assimilated by relative advantage due to both being synonymous. Correspondingly, perceived ease of use was assimilated by complexity due to both being synonymous (Wu & Wu, 2005). Other innovation or technological characteristics include the collection of the properties related to the innovation which do not fit with any predefined secondary factor and are not on the tertiary level significant enough to qualify as a secondary factor.; twenty-eight technological characteristics were retrieved from literature as tertiary adoption factors. The number of technological characteristics retrieved in addition to the relative advantage cloud computing provides explains why technological factors are the most significant factors which affect adoption.

7.3 Organizational Factors

This primary factor went through the most drastic transformation as shown by the results presented in Table 10, comparing Tables 2 and 10 highlights these changes. A few secondary factors from the original models made it into the final model. A total of seven secondary adoption factors were retrieved from literature, six of which are new; only organizational size and structure was presented in the original model as organizational size. Although, a few tertiary factors presented in the original models were assimilated by the newly created secondary factors. Formalization and centralization, were both absorbed by organizational culture and organizational size and structure respectively. Formalization falls under organizational culture because it is a measure of how organizations write and file communications and procedures (Kinuthia, 2015; R26), and that relates to the pre-existing culture in place within the organization. Centralization on the other hand refers to the decision-making structure within an organization (Kinuthia, 2015; R26); the level of centralization depends on the organization’s size, hence the reason why centralization was absorbed by organizational size and structure. The new factors retrieved from literature are top management support, technological readiness, organizational culture, internal expertise, lack of control, and other organizational factors.

Top management support was the most significant organizational factor with a significance ratio of 63%, this is consistent with the results presented by Weerd et al. (2016). Results also showed how important it is for organizations to be ready to accommodate the technology by having the resources for it. The organization’s size and its culture are both equally significant and as noted in section 7.1, there seems to be a correlation between an organization’s size and cloud computing adoption. SMEs for instance are more flexible due to their decentralized nature and lack of bureaucracy, they are therefore more likely to adopt cloud computing (Al-Mascati & Al-Badi, 2016; R8). However, the same argument can be made for large organizations who due to slack resources can easily afford to adopt cloud computing; usually in conjunction with their own private cloud.

An organization’s culture can also have a significant bearing on cloud computing adoption. Take for example, innovativeness and attitude towards change, both tertiary factors within the secondary factor organizational culture. They highlight how the culture within an organization can have a bearing on adopting cloud computing. An organization that is innovative and has a positive attitude towards change is more likely to adopt cloud computing. Furthermore, it is obvious that adopting cloud computing must align and support an organization’s strategy. Also, while the configurations and maintenance of the cloud environment is handled by the cloud support, it is however important for the adopting organization to possess internal expertise to help with navigating issues that come with cloud computing. Therefore, the prior experience of employees with cloud computing is a factor that should be considered before adopting cloud computing.

7.4 Environmental Factors

The results also show environmental factors as critical to cloud computing adoption. Eight secondary environmental factors were retrieved from literature, six of which are new factors and are not included in the original model as shown in Table 2. Legislation and regulation factor was included in the original model as government regulation, national infrastructure is synonymous with technology support infrastructure while industry properties factor was included in the original model as industry characteristics and market structure. Competitive and trading partner pressure, trust, external expertise, physical location, and vendor lock-in were all new secondary factors retrieved from literature.

The results show that the most significant environmental secondary factors, specifically competitive and trading partner pressure factor, and legislation and regulations factor were found to be both significant and insignificant in relatively equal measures. This points to a correlative relationship between cloud computing adoption and the environment within which it is being adopted; this correlation should be researched further. Similarly, the results show a correlation between the secondary factor national infrastructure with developing or under-developed countries. This is evident in the countries in which studies that cited national infrastructure as a factor were carried out. A few examples of studies that cited national infrastructure as a factor include: Ethiopia (Alameye & Getahun, 2015; R2), Oman (Al-Mascati & Al-Badi, 2016; R8), Turkey (Güner & Sneiders, 2014; R21) and Malaysia (Qian et al., 2016; R37). This perfectly shows how incomplete the original technology adoption models are and shows the need to adapt them before using them to explain the adoption of various innovations. Cloud computing is notoriously dependent on the national infrastructure of the country within which it is being adopted. A stable power supply, fast internet networks and a functional telecommunications network are needed for implementing cloud computing (Sabi et al., 2015; R38).

The role of the service provider and the need for the service provider to allay the issues adopters have with cloud computing cannot be understated; this is highlighted by the following secondary environmental factors namely: trust, external expertise, physical location, and vendor lock-in. Cloud service providers need to earn the trust of the adopter by being credible, and by being readily available to provide external support when needed. Furthermore, cloud service providers should educate organizations and be as transparent as possible as to where their data are being stored and what methods and techniques are being used. This would go a long way to allay whatever fears organizations might have when adopting cloud computing.

8. Conclusion

The singular objective of this research work based on the research question was to find the factors which affect cloud computing adoption in organizations and then propose an adoption framework which will act as a blueprint for organizations looking to adopt cloud computing. To achieve this objective, a literature review of technology adoption models was carried out resulting in an initial adoption framework. Furthermore, a systematic literature review was used to extract the factors from 51 primary sources, this yielded a surprisingly vast number of factors. These factors were then categorized into three hierarchical groups, namely: primary factors, secondary factors and tertiary factors. Primary factors are the adoption factors dimensions, they include technological factors, organizational factors, environmental factor, and individual factors. The results of the literature review indicate that technological factors are the most important adoption factors. Secondary factors are second level factors found from literature, they encapsulate the tertiary factors which are the similarly themed factors explained by a specific secondary factor.

The study found a total of 194 unique tertiary factors; 65 technological factors, 64 organizational factors, 61 environmental factors and 4 individual factors. The study also found technological factors to be the most relevant primary factor or dimension when adopting cloud computing. Furthermore, relative advantage, top management support, compatibility, and complexity with coverage ratios of 71%, 63%, 57%, and 51% respectively, were found to be the most significant adoption factors. The model was then completed by adding the retrieved factors.

8.1 Contributions to Research and Practice

Numerous studies have proposed various adoption frameworks, but very few studies have aimed to address the adoption of cloud computing across multiple contexts by proposing a general cloud adoption framework for organizations. Also, there was a severe lack of research into the impact of individuals on cloud computing adoption within organizations. This study endeavored to fill both gaps by proposing a general adoption framework and highlighting the important role individuals play on cloud computing adoption within organizations. While there is need for further research into cloud computing adoption, this thesis has taken the first step in filling that gap by making tangible and concrete contributions to literature. In terms of a concrete contribution, a scientific article has been redacted from this thesis and submitted to an upcoming international conference on information systems (ICIS 2017), see submitted manuscript in Appendix C.

Organizations also benefit from this study in terms of the practical application of the adoption model introduced in this study. Organizations looking to adopt cloud computing can apply the model by considering every factor elicited, effectively making adoption decisions easier and faster. Furthermore, after initially adopting cloud computing, organizations can also use the model and the results presented in this study to mitigate potential difficulties that might arise during the adoption process. Non-adopters and potential CC adopters can also benefit from this study by using the model and results to make decisions on whether adopting cloud computing is the best decision for their organization. Coincidentally, this model can also be applied to other innovations, not just cloud computing. This is made possible by the combination of the model being developed from widely used technological adoption models like TOE, DOI and TAM and the factors retrieved from literature.

The results presented in this study is further substantiated by drawing parallels between the description of cloud computing given in Chapter 2 and the results of this study. The five fundamental characteristics (rapid elasticity, on-demand self-service, resource pooling, ubiquitous network access, and measured service) of cloud computing presented in Chapter 2 were reflected by the technological factors retrieved from literature. This proves that an organization's decision to adopt cloud computing ultimately comes down to the technology itself, giving weight to the result that technological factors are the most significant factors. Additionally, this also shows why the relative advantage cloud computing offers is the most significant adoption factor. Furthermore, a few factors retrieved from literature have similarities with the cloud computing benefits and challenges highlighted in Chapter 2. For instance, reduced initial investments and proportional costs is reminiscent of secondary factor cost while increase in resource availability and reliability is reminiscent of tertiary factor availability and secondary factor reliability. Also, retrieved factors like security, lack of control, vendor lock-in, and physical location are explained by the cloud computing's risk and challenges which are increased security vulnerabilities, reduced control over resources, limited portability between providers, and geographical compliance and legal issues.

8.2 Future Research Suggestions

The results of this study show that there is a pronounced need for more research into the adoption of cloud computing within organizations. Specifically, more research into the impacts of individuals on adoption should be carried out. Also, the various relationships and correlations between different factors should be explored and explained. Research into the application of this model to CC adoption within organizations could also be carried out and reported, the model can be subsequently improved based on results derived from its application. Furthermore, a streamlined or an adapted version of this model can be developed and used to explain the adoption of other innovations.

8.3 Threats to Validity and Study Limitations

Selection bias posed the biggest threat to the validity of this study. This is firstly due to the need to eliminate every study that focused on the individual adoption of cloud computing, this potentially lets studies with relevant information slip through. Secondly, a retrospective search revealed a few articles that should have been included in the study. This was however mitigated by considering these studies when analyzing and discussing the results from the SLR.

A few limitations can be recognized from this study, specifically in terms of the research methodology and the results. Firstly, Kitchenham (2004) suggested that the selection of primary studies should be carried out by more than one researcher. However, although discussions were held with the supervisor about the primary studies, the ultimate decisions to either include and exclude studies were made exclusively by the author; furthermore, the primary studies were not inspected by the supervisor. This subjective approach might have led to the exclusion of a few important studies, resulting in the loss of potentially valuable data. Secondly, access to articles was an issue as the author could not gain access to a few studies when searching for the primary studies due to download restrictions on some of the articles. Another limitation is the possibility that the search terms used in the search strategy may have been too generic and did not retrieve all relevant articles pertaining to the research question. For instance, in retrospect, keywords like IaaS, SaaS, and PaaS could have been derived as alternatives to cloud computing and included in the search strings, potentially offering wider coverage

In terms of the results, the number of factors retrieved made classifying the tertiary factors into secondary factors a daunting task. A lot of the factors retrieved were not categorized into any primary factor categories in literature, the author had to therefore decide where each unclassified tertiary factor fits best relying solely on their definitions. This was a completely subjective approach, one which is open to various interpretations depending on the researcher. Therefore, replicating this study could yield slightly different categorizations and subsequently slightly different results.

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Appendix A. References of Primary Studies

No.	Reference
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R2	Alemeye, F., & Getahun, F. (2015, September). Cloud readiness assessment framework and recommendation system. In *AFRICON, 2015* (pp. 1-5). IEEE.
R3	Alharbi, F., Atkins, A., & Stanier, C. (2016). Understanding the determinants of cloud computing adoption in Saudi healthcare organizations. *Complex & Intelligent Systems, 2*(3), 155-171.
R4	Ali, O., Soar, J., Yong, J., McClymont, H., & Angus, D. (2015). Collaborative Cloud Computing Adoption in Australian Regional Municipal Government: An Exploratory Study. *Computer Supported Cooperative Work in Design (CSCWD), 2015 IEEE 19th International Conference on,* 540-548.
R5	Al-Jabri, I. M. (2014). The perceptions of adopters and non-adopters of cloud computing: Application of technology-organization-environment framework, 250-257. *The Fourteenth International Conference on Electronic Business & The First Global Conference on Internet and Information Systems (2014).* 250 -257.
R6	Alkhater, N., Chang, V., Wills, G., & Walters, R. (2015). Towards an integrated conceptual model for cloud adoption in Saudi Arabia. *Proceedings of ESaaSA 2015 - 2nd International Workshop on Emerging Software as a Service and Analytics, In conjuction with the 5th International Conference on Cloud Computing and Services Science - CLOSER 2015*. 80-85.
R7	Alkhater, N., Wills, G., & Walters, R. (2015). Factors affecting an organization's decision to adopt cloud services in Saudi Arabia. *IEEE 3rd International Conference on Future Internet of Things and Cloud*, 553 -557.
R8	Al-Mascati, H., & Al-Badi, A. H. (2016). Critical success factors affecting the adoption of cloud computing in oil and gas industry in Oman. *3rd MEC International Conference on Big Data and Smart City*. 187-193.
R9	Alshamaila, Y., Papagiannidis, S., & Li, F. (2012). Cloud computing adoption: An exploratory study. *8th International Conference on Web Information Systems and Technologies (WEBIST)*. 518-524.
R10	Alshamaila, Y., Papagiannidis, S., & Li, F. (2013). Cloud computing adoption by SMEs in the north east of England. A multi-perspective framework. *Journal of Enterprise Information Management, 26*(3), 250-275.
R11	Bharadwaj, S. S., & Lal, P. (2012). Exploring the Impact of Cloud Computing Adoption on Organizational Flexibility: A Client Perspective. Proceedings of 2012 1ntemational conference of Cloud Computing, Technologies, Applications & Management. 121 – 131.
R12	Borgman, H. P., Bahli, B., Heier, H., & Schewski, F. (2013). Cloudrise: Exploring cloud computing adoption and governance with the TOE framework. *System Sciences (HICSS), 2013 46th Hawaii International Conference on System Sciences,* 4425-4435
R13	Cohen, J. F., Mou, J., & Trope, J. (2014). Adoption of cloud computing by South African firms: The role of institutional forces, absorptive capacity, and top

	management. *ACM International Conference Proceeding Series,* 30-37.
R14	Dahiru, A. A., Bass, J. M., & Allison, I. K. (2014). Cloud computing adoption in sub-Saharan Africa:An analysis using institutions and capabilities. *International Conference on Information Society (i-Society 2014),* 98-103.
R15	Das, S., & Dayal, M. (2016). Exploring determinants of cloud-based enterprise resource planning (ERP) selection and adoption: A qualitative study in the Indian education sector. *Journal of Information Technology Case and Application Research, 18*(1), 11-36.
R16	Faasen J., Seymour L.F., Schuler J. (2013) SaaS ERP Adoption Intent: Explaining the South African SME Perspective. *In: Poels G. (eds) Enterprise Information Systems of the Future. Lecture Notes in Business Information Processing, vol 139. Springer, Berlin, Heidelberg,* 35-47.
R17	Fu, H., & Chang, T. (2016). An analysis of the factors affecting the adoption of cloud consumer relationship management in the machinery industry in Taiwan. *Information Development, 32*(5), 1741-1756.
R18	Gangwar, H., Date, H., & Ramaswamy, R. (2015). Understanding determinants of cloud computing adoption using an integrated TAM-TOE model. *Journal of Enterprise Information Management, 28*(1), 107-130.
R19	Gangwar, H., & Date, H. (2016). Critical factors of cloud computing adoption in organizations: An empirical study. *Global Business Review, 17*(4), 886-904.
R20	Garg, R., & Stiller, B. (2015). Factors affecting cloud adoption and their interrelations. *In Proceedings of the 5th International Conference on Cloud Computing and Services Science (CLOSER-2015)*, 87-94.
R21	Güner, E. O., & Sneiders, E. (2014). Cloud computing adoption factors in turkish large scale enterprises. *In Pacific Asia Conference on Information Systems, PACIS 2014.*
R22	Gupter, P., Seetharaman, A., & Raj, J. R. (2013). The usage and adoption of cloud computing by small and medium businesses. *International Journal of Information Management 33 (2013)*. 861– 874.
R23	Gutierrez, A., Boukrami, E., & Lumsden, R. (2015). Technological, organizational and environmental factors influencing managers' decision to adopt cloud computing in the UK. *Journal of Enterprise Information Management, 28*(6), 788-807.
R24	Hsu, P., Ray, S., & Li-Hsieh, Y. (2014). Examining cloud computing adoption intention, pricing mechanism, and deployment model. *International Journal of Information Management 34 (2014)*, 474–488.
R25	Hwang, B., Huang, C., & Yang, C. (2016): Determinants and their causal relationships affecting the adoption of cloud computing in science and technology institutions, Innovation. *Innovation: Management, Policy & Practice, 2016.*
R26	Kinuthia, J. N. (2015). Technological, organizational, and environmental factors affecting the adoption of cloud enterprise resource planning (ERP) systems. *2015 Americas Conference on Information Systems, AMCIS 2015*.
R27	Lal, P., & Bharadwaj, S. S. (2016). Understanding the impact of cloud-based services adoption on organizational flexibility. *Journal of Enterprise Information Management,* Vol. 29 (4) pp. 566 – 588.

R28	Lian, J. W., Yen, D. C., & Wang, Y. T. (2014). An exploratory study to understand the critical factors affecting the decision to adopt cloud computing in Taiwan hospital. *International Journal of Information Management*, *34*(1), 28-36.
R29	Low, C., Chen, Y., & Wu, M. (2011). Understanding the determinants of cloud computing adoption. *Industrial Management and Data Systems, 111*(7), 1006-1023.
R30	Martins, R., Oliveira, T., & Thomas, M. A. (2016). An empirical analysis to assess the determinants of SaaS diffusion in firms. *Computers in Human Behavior, 62*, 19-33.
R31	Martins, R., Oliveira, T., & Thomas, M. A. (2015). Assessing organizational adoption of information systems outsourcing. *Journal of Organizational Computing and Electronic Commerce, 25*(4), 360-378.
R32	Morgan, L., & Conboy, K. (2013). Factors affecting the adoption of cloud computing: An exploratory study. *ECIS 2013 - Proceedings of the 21st European Conference on Information Systems*.
R33	Morgan, L., & Conboy, K. (2013). Key Factors Impacting Cloud Computing Adoption, IEEE Vol. 46(10).
R34	Oliveira, T., Thomas, M., & Espadanal, M. (2014). Assessing the determinants of cloud computing adoption: An analysis of the manufacturing and services sectors. *Information and Management, 51*(5), 497-510.
R35	Opitz, N., Langkau, T. F., Schmidt, N. H., & Kolbe, L. M. (2012). Technology acceptance of cloud computing: Empirical evidence from german IT departments. *System Science (HICSS), 2012 45th Hawaii International Conference on,* 1593-1602.
R36	Polyviou, A., & Pouloudi, N. (2015). Understanding cloud adoption decisions in the public sector. *48th Hawaii International Conference on System Sciences, 2015-March* 2085-2094.
R37	Qian, L. Y., Baharudin, A. S., & Kanaan-Jebna, A. (2016). Factors affecting the adoption of enterprise resource planning (ERP) on cloud among small and medium enterprises (SMES) in penang, malaysia. *Journal of Theoretical and Applied Information Technology, 88*(3), 398-409.
R38	Sabi, H. M., Uzoka, F. -. E., Langmia, K., & Njeh, F. N. (2016). Conceptualizing a model for adoption of cloud computing in education. *International Journal of Information Management, 36*(2), 183-191.
R39	Safari, F., Safari, N., & Hasanzadeh, A. (2015). The adoption of software-as-a-service (SaaS): Ranking the determinants. *Journal of Enterprise Information Management, 28*(3), 400-422.
R40	Şener, U., Gökalp, E., & Erhan Eren, P. (2016). Cloud-based enterprise information systems: Determinants of adoption in the context of organizations. *Information and Software Technologies: 22nd International Conference, ICIST 2016*, pp 53-66.
R41	Senyo, P. K., Effah, J., & Addae, E. (2016). Preliminary insight into cloud computing adoption in a developing country", J*ournal of Enterprise Information Management, 29* (4), 505 – 524.
R42	Shao, M., Peng, L., & Li, Y. (2015). A study on enterprise technology adoption of SaaS. *2015 12th International Conference on Service Systems and Service Management (ICSSSM),* 1-6.
R43	Stieninger, M., & Nedbal, D. (2014). Diffusion and acceptance of cloud computing in SMEs: Towards a valence model of relevant factors. *Proceedings of the Annual Hawaii International Conference on System Sciences,* 3307-3316.

R44	Sulaiman, H., & Magaireah, A. I. (2014). Factors affecting the adoption of integrated cloudbased e-health record in healthcare organizations: A case study of Jordan. *International Conference on Information Technology and Multimedia (ICIMU),* 102-107.
R45	Tashkandi, A. N., & Al-Jabri, I. M. (2015). Cloud computing adoption by higher education institutions in saudi arabia: An exploratory study. *Cluster Computing, 18*(4), 1527-1537.
R46	Tashkandi, A. N., & Al-Jabri, I. M. (2015). Cloud Computing Adoption by Higher Education Institutions in Saudi Arabia: Analysis Based on TOE. *International Conference on Cloud Computing* (ICCC).
R47	Tehrani, S. R., & Shirazi, F. (2014). Factors influencing the adoption of cloud computing by small and medium size enterprises (SMEs). *Human Interface and the Management of Information. Information and Knowledge in Applications and Services,* 631-642.
R48	Wahsh, M. A., & Dhillon, J. S. (2015). An investigation of factors affecting the adoption of cloud computing for E-government implementation. *IEEE Student Conference on Research and Development (SCOReD)*, 323-328.
R49	Wilson, B. M. R., Khazaei, B., & Hirsch, L. (2015). Enablers and barriers of cloud adoption among small and medium enterprises in tamil nadu. *IEEE International Conference on Cloud Computing in Emerging Markets*, 140-145.
R50	Yang, Z., Sun, J., Zhang, Yali., & Wang, Y. (2015). Understanding SaaS adoption from the perspective of organizational users: A tripod readiness model. *Computers in Human Behavior 45*, 254–264.
R51	Yigitbasioglu, O. M. (2015). The role of institutional pressures and top management support in the intention to adopt cloud computing solutions. *Journal of Enterprise Information Management, 28*(4), 579-594.

Appendix B: Publication Year Distribution

Year	Studies	No. of Studies	%
2011	R29	1	1.96%
2012	R9, R11, R35	3	5.9%
2013	R10, R12, R16, R22, R32, R33	6	11.76%
2014	R5, R13, R14, R21, R24, R28, R34, R43, R44, R47	10	19.6%
2015	R2, R4, R6, R7, R18, R20, R23, R26, R31, R36, R38, R39, R42, R45, R46, R48, R49, R50, R51	19	37.3%
2016	R1, R3, R8, R15, R17, R19, R25, R27, R30, R37, R40, R41	12	23.5%

Appendix C: Submitted Manuscript

A General Cloud Adoption Framework for Organizations

Journal:	*International Conference on Information Systems 2017*
Manuscript ID	Draft
Track:	03. Economics and Value of IS
Keywords:	Cloud computing, IT adoption, Organizational adoption, Cloud adoption, TAM, TOE, DOI, Cloud adoption factors

Abstract:	Cloud computing is an attractive proposition to organizations due to the benefits that come with adopting it. However, it being a relatively new phenomenon, its perceived risks and challenges discourages adoption. Given this trade-off between benefits and risks, there is dilemma on how to approach cloud adoption. This study aims to propose a general cloud adoption framework for organizations and to identify the factors to be considered when adopting cloud computing. A systematic literature review was used to retrieve the cloud adoption factors for the framework; 51 primary studies were retained for analysis. This yielded 194 unique adoption factors: 65 technological, 59 organizational, 66 environmental and 4 human factors. The study found technological factors to be the most significant factors affecting adoption, while human factors had the least significance. Specifically, relative advantage, top management support, compatibility, and complexity are the most significant factors affecting cloud adoption.

A General Cloud Adoption Framework for Organizations

Completed Research Paper

Introduction

Organizations are continuously exploring ways to reduce costs and operate more efficiently. They are constantly aiming to remain competitive within their respective industries by using relevant tools to achieve their goals; information technology is one of such tool (Johansson et al, 2015). An organization's competitiveness and survival is attributed to its ability to adapt innovations that give a competitive edge and improve the quality, reduce the cost, and improve the efficiency of its business processes (Trigueros-Preciado et al. 2013). Cloud computing (CC) represents a paradigm shift in the way information technology resources and services are delivered (Sabi et al. 2016). Organizations employing cloud computing can outsource core IT activities and the IT infrastructure needed to do business (Gide & Sandu, 2015). This eliminates the need for organizations to set up in-house IT infrastructure by instead opting to rent infrastructure, platforms and even software, effectively leading to a reduced capital expenditure. Furthermore, cloud computing's pay-as-you-go pricing model enables organizations to save money and at the same time maximize the IT resource(s) in use; contrastingly, on premise IT resources are either over utilized or under-utilized. Additionally, organizations, specifically SME's, gain access to sophisticated IT resources freeing organizations of the need for large infrastructural expenses; both small and large organizations can therefore save money on capital expenditure, this frees up funds for other capital investments (Alkhater et al. 2014; Gide and Sandu, 2015). The apparent fit between cloud computing and organizations is further magnified by Borgman et al. (2013) who stated that cloud computing technology provides a dynamic environment that is fitted to meet the organization's need. It should however be noted, that cloud computing is by no stretch a silver bullet and this is mainly due to performance, security and trust issues (Khalid 2010; Oliveira et al. 2014).

Nevertheless, irrespective of these issues cloud computing continues to increase in popularity and consequently the number of adopters. Albeit, since cloud computing is by no means a novel technology it is curious why the rate of adoption does not match the hype that comes with the technology. Perhaps there is a grey area and a level of uncertainty when it comes to its adoption. Oliveira et al. (2014) citing literature stated that notwithstanding the advantages of cloud computing, organizations are not in a rush to adopt the technology. They cited the disruptive nature of the technology, lack of maturity, lack of industry standards, and related risks and costs as reasons for the misfit between the hype and actual adoption. Therefore, the resulting research question is, *what factors should be considered before adopting cloud computing?* The low risk nature of cloud computing adoption does not necessarily differentiate it from other technologies in the sense that cloud computing adoption just like any other technology is a recipe for disaster if there is no correlation between the factors being considered and what the organization really needs. This paper's motivation stems from the need to know what factors organizations should consider before adopting cloud computing.

The aim of this research is to provide new knowledge to research by attempting to validate and complement the previous body of knowledge on cloud computing adoption. Few studies have explained cloud computing from an organizational perspective (Oliveira et al. 2014). Also, previous attempts made to address the factors that affect cloud computing adoption have not been explicit enough and have always been focused on adoption within a specific niche - governments, SMEs, large organizations, etc. (Thong 1999; Chong et al. 2009; Wang et al. 2010; Low et al. 2011; Gide and Sandu, 2015; MacLenna and Van Belle 2013). This paper theorizes that there should be more generalized adoption framework for cloud computing irrespective of the adopter. First, a review of technology and innovation adoption models and theories was carried out with the aim to understand the theoretical background of adoption of technology in organizations and provide a generic model of cloud computing adoption. Second, a systematic literature review of empirical studies on CC adoption was carried out to extract relevant and specific cloud computing adoption factors which would then be used to saturate the generic model and consequently update it.

Cloud Computing

Cloud computing since its inception has been defined in numerous ways. However, a simple definition is that cloud computing is a means to store and access data and programs via the internet instead of the data being stored on one's computer drive; concluding that the cloud is just a metaphor for the internet (pcmag.com,2016). An alternative definition was given by the US National Institute of Standards and Technology (NIST) who are tasked with developing standards and guidelines for providing adequate information security for all agency operations and assets in the United States. They defined cloud computing as a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources which can include: networks, servers, storage, applications, and services; that can be provided on demand and released with very little management effort or service provider interaction (Mell and Grance, 2012).

Cloud computing possesses five fundamental characteristics namely: rapid elasticity, on-demand self-service, resource pooling, broad network access, and measured service (Mell and Grance 2012). These characteristics reflect benefits that cloud computing bring to organizations by enabling to adjust their costs and investments in technology according to their needs regarding the computing resources (Zhang, Cheng and Boutaba 2010, Smith et al. 2014, Mell and Grance 2012, Erl et al. 2013), and the service demand and supply (Zhang et al. 2010). These technological benefits result further in competitive advantage in terms of resource management, agility, decreasing costs (Zhang et al. 2010), as well as higher customer satisfaction determined by the improvement in pricing and transparency of service with respect to resource monitoring (Mell and Grance, 2012).

Thus, CC is an attractive proposition to organizations due to the benefits that come with adopting it; however, contrastingly, cloud computing's risks and challenges discourages adoption, due to increased security vulnerabilities, reduced control over resources, limited portability between providers, and geographical compliance and legal issues (Erl et al. 2013). Given this trade-off between benefits and risks that decision makers have to solve when considering CC adoption, and the standby position assumed by some organizations as shown in the literature (see Oliveira et al. 2014), this study aims to provide knowledge on the factors that determine CC adoption and should be considered when adopting CC.

Technology Adoption Models

Different theories in information systems research have been used to explain technology adoption, both on the individual level and on the organizational level (Oliveira and Martins 2011, MacLenna and Van Belle 2013, Oliveira et al. 2014). Among the theories applied to individual adoption the most utilized are the technology acceptance model (TAM, Davis 1986), the theory of planned behavior (TPB, Ajzen 1985), and the unified theory of acceptance and use of technology (Venkatesh et al. 2003, Venkatesh et al. 2012). At the organizational level, the most applied theories are the diffusion of innovations theory (DOI, Rogers 1995) and the technological-organizational-environmental model (TOE, Tornatzky and Fleischer 1990).

Technology Acceptance at Organizational Level

Technological-Organizational-Environmental Model (TOE)

Tornatzky and Fleisher's (1990) TOE framework has been widely used across literature, due to its sound theoretical basis and strong empirical evidence (Oliveira and Martins 2011). The TOE framework posits that there are three elements of an enterprise's context which influence the adoption of a technological innovation, namely the technological, organizational, and environmental contexts. The technological context refers to the availability and characteristics of the internal and external technologies relevant to the organization. The organizational context indicates measures which describe the enterprise, such as its size, slack, communication processes and managerial structure. The environmental context refers to the scene within which an enterprise does business; this includes the organization's industry, its competitors, technology support infrastructure and the organization's government dealings (Oliveira and Martins 2011).

Diffusion of Innovations Theory (DOI)

According to the DOI theory, an organization's adoption of a technology depends on the characteristics of that technology defined by five attributes: relative advantage, compatibility, complexity, observability, and trialability (Rogers 1983). These characteristics fit with cloud computing and reflect reasons why an organization would adopt cloud computing. Furthermore, Tornatzky and Klein (1982) noted that relative advantage, complexity, and compatibility "have the most consistent significant relationships across a broad range of innovation types", hence the fit with cloud computing. For instance, relative advantage which is defined as the degree to which an innovation can bring added benefits to the organization justifies why cloud computing would be considered by an organization. The same goes for compatibility: degree to which an innovation fits with existing practices and processes within the organization; complexity: measure of how easy or difficult it is to use an innovation; observability is a measure of how visible the results of an innovation are; and trialability which is a measure of how much an innovation can be experimented with (Zhu et al. 2006). In addition, Rogers (1995) stated that an organization's innovativeness is attributed to three independent variables, namely: individual's characteristics, the internal characteristics of the organizational structure and the external characteristics of the organization. An individual's character, usually the catalyst to the adoption of any technology, reflects an attitude towards change. The internal characteristics as observed by Rogers (1995) include centralization, complexity, formalization, interconnectedness, organizational slack, and size. The external characteristics refer to openness of the organization (Rogers 1995, Oliveira and Martins 2011).

Combining TOE and DOI

The TOE framework is consistent with the DOI theory and they are commonly used together to explain innovation adoption (Oliveira and Martins 2011, Oliveira et al. 2014). Additionally, the TOE model subsumes the five innovation attributes Rogers (1983) argues influence innovation adoption (Thomas et al 2008). This is especially true considering the plethora of studies (Thong 1999, Chong et al. 2009, Wang et al. 2010, Gide and Sandu 2015, Low et al. 2011, Zhu et al. 2006, MacLenna and Van Belle 2013) that have used both theories to explain technology adoption. Furthermore, and more specifically, a fusion of both models has also been widely used to explain cloud computing adoption. Low, Chen and Wu (2011) fused both models together to understand determinants of cloud computing adoption in the high-tech industry; Gide and Sandu (2015) used TOE and DOI to research key factors influencing cloud based services adoption in Indian SME's; AlBar and Hoque (2015) also used both models to present the determinants of cloud ERP adoption in Saudi Arabia. Majority of these papers however focused on adoption within a specific context, industry, or country, few have managed to present a general cloud computing framework. The TOE framework will therefore serve as a solid base upon which the proposed integrative model will be developed. This is firstly due to its useful analytical framework that has been vastly used across literature to study the adoption and assimilation of different IT innovations. Secondly, it has a solid theoretical basis and consistent empirical support (Oliveira and Martins 2011, Wang et al. 2010).

Technology Acceptance at Individual Level

While the TOE framework and DOI theory complement each other rather nicely, the theories which explain individual technology adoption should not be discarded. According to Jha and Bose (2016) human factors are very important in determining if adopting an innovation would be successful. Furthermore, excluding human factors leads to unbalanced and atomistic theories; therefore, research from an organizational perspective should be complemented with research from the individual perspective (Jha and Bose 2016). Jeyaraj et al. (2006) resonated these claims by pointing out that there is a lack of integration and a lack of understanding of the linkages between individual and organizational adoption of IT. Thong (1999) recognized this by adding the characteristics of the decision makers to his proposed adoption model in addition to the technology, organizational and environmental characteristics. Furthermore, Rogers (1995) noted that the decision to either adopt or reject a technological innovation is taken based on an individual's attitude to the technology. In addition, Sun and Jeyaraj (2013) also argued that the adoption of an innovation is driven by both the innovation attributes and the individuals' characteristics. So therefore, based on these evidence from literature, individual adoption factors should also be considered for the model.

Technology Acceptance Model (TAM)

TAM proposes that system use or adoption is influenced by behavioral intention to use which is in turn influenced by the attitude of the adopter towards using the system. Further, attitude is directly influenced by the perceived usefulness (PU) and perceived ease of use (PEOU) of the system (Davis et al. 1989). In other words, intrinsic motivation within an individual leads to the adoption of new technology. This is true of an individual; it however also applies to an organization since there is always an individual who champions the innovation (Wu and Wu 2005).

Thus, according to the TAM theory, PU and PEOU are fundamental determinants of IT adoption. PU is defined as the extent to which the user of a specific technology believes it will help improve their job performance. Contrastingly, PEOU is defined as the extent to which the user of a specific technology believes its usage would be effortless. These two factors, PU and PEOU, are similar with the relative advantage and complexity in DOI as also noted by Wu and Wu (2005).

Theorized adoption model

This paper aims at proposing a framework for cloud computing adoption on the organizational level, although as mentioned earlier, there is always a champion who pursues the adoption of any new technology within an organization; thus, the argument to include human factors that lead to the adoption. To remain in line with the objectives of this research, this paper would not go in-depth into the individual adoption by considering the extended versions of TAM proposed along time by Venkatesh and Bala (2008), Venkatesh and Davis (2000), Venkatesh et al. (2003), Venkatesh et al. (2012). This is due to the fact that these models while being robust delve deeper into the adoption and use of technology by individuals by exploring and expatiating on the determinants of the original constructs of TAM; PU and PEOU. However, we retained from these models that the attitude towards technology, the intrinsic and extrinsic motivation to use a technology, and the individual experience with technology are affecting the intention to use and the adoption of technology. Also, as earlier mentioned the inclusion of human factors is further backed by the works of Jha and Bose (2016), Jeyaraj et al. (2006), Thong (1999), Rogers (1995), Sun and Jeyaraj (2013).

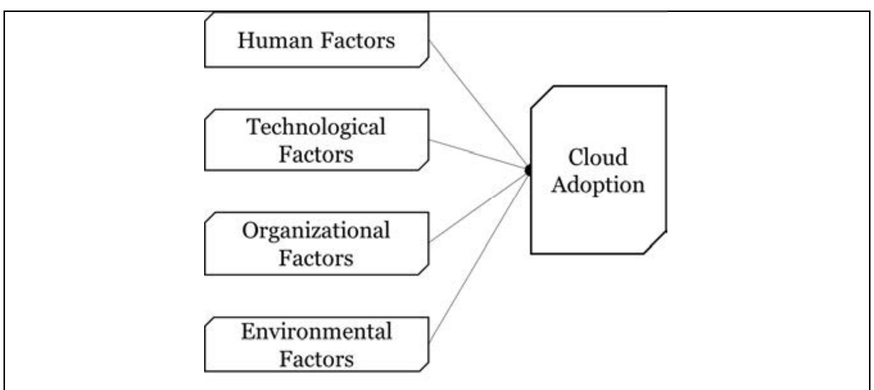

Figure 1. Generic Cloud Adoption Model

Systematic Literature Review Approach

A systematic literature review (SLR) was carried out on empirical studies on cloud computing adoption in order to identify specific factors that are determining organizations to adopt cloud computing. The SLR followed the guidelines by Kitchenham (2004) and consisted of six steps: defining the search strategy (1), defining the inclusion and exclusion criteria (2), select the primary studies based on search strategy and defined criteria (3), quality assessment (4), data extraction (5), and data synthesis (6) (Kitchenham 2004, Kitchenham and Charters 2007).

Search Strategy

To uncover as much primary studies as possible, it is important to have an unbiased search strategy in place (Kitchenham 2004). Six electronic databases were selected as sources: IEEE Xplore, ACM digital library, Scopus, Web of Science, ProQuest, and ScienceDirect. To determine the potential volume of studies relating to a research question, preliminary searches were carried out using the search phrase "cloud computing adoption factors". The search string used in the preliminary search was derived from the research question and it included three keywords: "cloud computing", "adoption" and "factors". The preliminary search was especially useful in helping to refine the search strings by uncovering more keywords and consequently more search strings. For instance, cloud was derived as the alternative term to cloud computing, acceptance as the alternative term to adoption and determinants the alternative term to factors. Furthermore, after some iterations with all the combinations of search terms, a decision was made to drop the "computing" from the "cloud computing" keyword in order to obtain a wider coverage of primary studies. Hence for the final search the following search strings were employed: "cloud adoption factors", "cloud adoption determinants", "cloud acceptance factors", and "cloud acceptance determinants".

Study Selection Process

The actual search and selection was performed in November 2016. Table 1 shows the steps and results of the search and selection of primary studies. For steps 3 and 4 the following inclusion and exclusion criteria were applied.

Papers were included based on the following criteria:

- The articles should be peer reviewed to guarantee quality.
- The articles should focus on "cloud computing" in general, a "cloud computing model" or a "cloud service and its adoption/acceptance".
- No restriction on year of publication was defined; thus all primary studies regardless of their year of publication were included in the review.

Papers were excluded based on the following criteria:

- Not written in English.
- Focus on just cloud computing characteristics, benefits, models without mentioning of cloud computing adoption or intention to adopt.
- Focus on personal adoption of individuals rather than a body e.g., a group, an organization, government, etc.
- No empirical data has been collected.

Study Selection Process and Result	
Process	**Result**
Step1: Search as of November 2016	1623
Step 2: Remove duplicates	928
Step 3: Exclude articles based on titles and abstracts	171
Step 4: Exclude articles based on quality assessment and full text scanning	51

Table 1. Study Selection Process

Results

For systematic review, 51 primary studies were retained (see Table 2). The papers were first classified by study contexts, year of publication, research methods used, technology adoption theories used and country of research Then each paper was reviewed with respect to adoption factors by identifying specific factors into each of the four categories of factors defined in the generic CC adoption model in Figure 1; the factors' significance based on the empirical evaluation in the primary studies was also marked. The specific factors identified and extracted from the reviewed literature were very numerous making it necessary to group them into smaller categories based on similarity of the aspects addressed. Thus, the specific factors encountered in the research articles reviewed are called tertiary factors or third level factors, while the grouping categories are called secondary factors, or second level factors. The secondary factors are a collection of specific tertiary factors that fall under the same theme, see Figure 2. Primary factors are the first level factors corresponding to the four factor dimensions illustrated in the generic CC adoption model in Figure 1; technological factors, organizational factors, environmental factors and human factors.

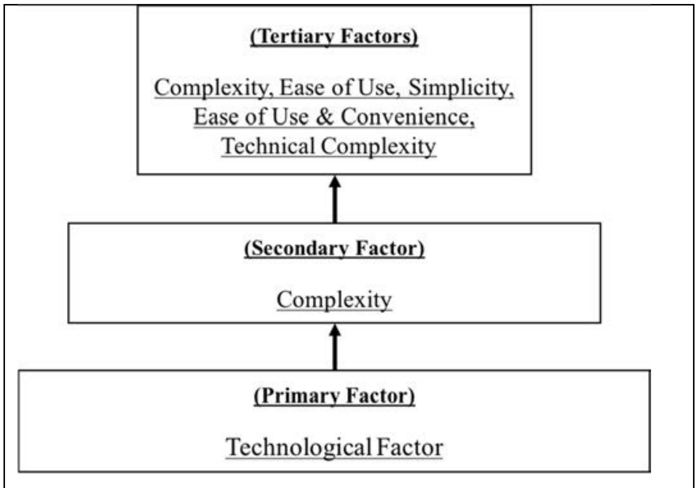

Figure 2. Factor Hierarchy

Based on whether a specific factors was found statistically significant or not in a primary study, a coverage ratio is calculated by dividing the number of primary studies that found a specific tertiary factor to be significant by the total number of primary studies; the result is multiplied by 100 to arrive at a percentage value.

Coverage Ratio = (No. of Significant Primary Studies / Total No. of studies) x 100.

In the following, the results of the literature review are presented by primary factors into four structured tables (Tables 3-6). Each table show specific factors identified form literature (tertiary factors), the unifying factor (secondary factors), the Id's of the primary studies, the significance in the primary studies, and the coverage ratio.

Discussion

Technological Factors

The primary studies covered technological factors more than any other primary factor and understandably so, as these factors explain and highlight the characteristics of the innovation which in this case is cloud computing (see Table 3). While lots of new factors retrieved from literature were novel relative to the DOI and TOE models, a large number of factors can be traced back to the these two theories. Relative advantage, compatibility, complexity, trialability and innovation characteristics are secondary factors identified as well in the models. Availability and Observability were fused into innovation characteristics construct, which includes a total of twenty-eight tertiary factors, twenty-six of them newly retrieved from literature. Security, cost, privacy and reliability are all new secondary factors retrieved from literature. Relative advantage emerged as the most significant technological factor and the most significant factor overall with a coverage ratio of 71%, this is consistent with results presented by Tashkandi and Al-Jabri (2015) (R45). This is followed by compatibility and complexity with 57% and 51% coverage ratio respectively. Security, innovation characteristics and cost follow with 49%, 39% and 29.4% coverage ratios respectively. Trialability, reliability and privacy have the least significance on cloud computing adoption.

Referenced primary studies (Id, reference)			
R1	Akar, E., & Mardiyan, S. (2016). Analyzing factors affecting the adoption of cloud computing: A case of turkey. *KSII Transactions on Internet and Information Systems, 10*(1), 18-37.	R2	Alemeye, F., & Getahun, F. (2015, September). Cloud readiness assessment framework and recommendation system. In *AFRICON, 2015* (pp. 1-5). IEEE.
R3	Alharbi, F., Atkins, A., & Stanier, C. (2016). Understanding the determinants of cloud computing adoption in Saudi healthcare organizations. *Complex & Intelligent Systems, 2*(3), 155-171.	R4	Ali, O., Soar, J., Yong, J., McClymont, H., & Angus, D. (2015). Collaborative Cloud Computing Adoption in Australian Regional Municipal Government: An Exploratory Study. *Computer Supported Cooperative Work in Design (CSCWD), 2015 IEEE 19th International Conference on,* 540-548.
R5	Al-Jabri, I. M. (2014). The perceptions of adopters and non-adopters of cloud computing: Application of technology-organization-environment framework, 250-257. *The Fourteenth International Conference on Electronic Business & The First Global Conference on Internet and Information Systems (2014).* 250 -257.	R6	Alkhater, N., Chang, V., Wills, G., & Walters, R. (2015). Towards an integrated conceptual model for cloud adoption in Saudi Arabia. *Proceedings of ESaaSA 2015 - 2nd International Workshop on Emerging Software as a Service and Analytics, In conjuction with the 5th International Conference on Cloud Computing and Services Science - CLOSER 2015.* 80-85.
R7	Alkhater, N., Wills, G., & Walters, R. (2015). Factors affecting an organization's decision to adopt cloud services in Saudi Arabia. *IEEE 3rd International Conference on Future Internet of Things and Cloud,* 553 -557.	R8	Al-Mascati, H., & Al-Badi, A. H. (2016). Critical success factors affecting the adoption of cloud computing in oil and gas industry in Oman. *3rd MEC International Conference on Big Data and Smart City.* 187-193.
R9	Alshamaila, Y., Papagiannidis, S., & Li, F. (2012). Cloud computing adoption: An exploratory study. *8th International Conference on Web Information Systems and Technologies (WEBIST).* 518-524.	R10	Alshamaila, Y., Papagiannidis, S., & Li, F. (2013). Cloud computing adoption by SMEs in the north east of England. A multi-perspective framework. *Journal of Enterprise Information Management, 26*(3), 250-275.
R11	Bharadwaj, S. S., & Lal, P. (2012). Exploring the Impact of Cloud Computing Adoption on Organizational Flexibility: A Client Perspective. Proceedings of 2012 1ntemational conference of Cloud Computing, Technologies, Applications & Management. 121- 131.	R12	Borgman, H. P., Bahli, B., Heier, H., & Schewski, F. (2013). Cloudrise: Exploring cloud computing adoption and governance with the TOE framework. *System Sciences (HICSS), 2013 46th Hawaii International Conference on System Sciences,* 4425-4435
R13	Cohen, J. F., Mou, J., & Trope, J. (2014). Adoption of cloud computing by South African firms: The role of institutional forces, absorptive capacity, and top management. *ACM International Conference Proceeding Series,* 30-37.	R14	Dahiru, A. A., Bass, J. M., & Allison, I. K. (2014). Cloud computing adoption in sub-Saharan Africa:An analysis using institutions and capabilities. *International Conference on Information Society (i-Society 2014),* 98-103.
R15	Das, S., & Dayal, M. (2016). Exploring determinants of cloud-based enterprise resource planning (ERP) selection and adoption: A qualitative study in the Indian education sector. *J. of Inf. Tech. Case and Application Research, 18*(1), 11-36.	R16	Faasen J., Seymour L.F., Schuler J. (2013) SaaS ERP Adoption Intent: Explaining the South African SME Perspective. *In: Poels G. (eds) Enterprise Information Systems of the Future. Lecture Notes in Business Information Processing, vol 139. Springer.*
R17	Fu, H., & Chang, T. (2016). An analysis of the factors affecting the adoption of cloud consumer relationship management in the machinery industry in Taiwan. *Information Development, 32*(5), 1741-1756.	R18	Gangwar, H., Date, H., & Ramaswamy, R. (2015). Understanding determinants of cloud computing adoption using an integrated TAM-TOE model. *Journal of Enterprise Information Management, 28*(1), 107-130.
R19	Gangwar, H., & Date, H. (2016). Critical factors of cloud computing adoption in organizations: An empirical study. *Global Business Review, 17*(4), 886-904.	R20	Garg, R., & Stiller, B. (2015). Factors affecting cloud adoption and their interrelations. *In Proc. of the 5th Int'l Conf. on Cloud Computing and Services Science (CLOSER).*
R21	Güner, E. O., & Sneiders, E. (2014). Cloud computing adoption factors in turkish large scale enterprises. *In Pacific Asia Conference on Information Systems, PACIS 2014.*	R22	Gupter, P., Seetharaman, A., & Raj, J. R. (2013). The usage and adoption of cloud computing by small and medium businesses. *International Journal of Information Management 33 (2013).* 861– 874.
R23	Gutierrez, A., Boukrami, E., & Lumsden, R. (2015). Technological, organizational and environmental factors influencing managers' decision to adopt cloud computing in the UK. *Journal of Enterprise Information Management, 28*(6), 788-807.	R24	Hsu, P., Ray, S., & Li-Hsieh, Y. (2014). Examining cloud computing adoption intention, pricing mechanism, and deployment model. *International Journal of Information Management 34 (2014),* 474–488.
R25	Hwang, B., Huang, C., & Yang, C. (2016): Determinants and their causal relationships affecting the adoption of cloud computing in science and technology institutions, Innovation. *Innovation: Management, Policy & Practice, 2016.*	R26	Kinuthia, J. N. (2015). Technological, organizational, and environmental factors affecting the adoption of cloud enterprise resource planning (ERP) systems. *2015 Americas Conference on Information Systems, AMCIS 2015.*

R27	Lal, P., & Bharadwaj, S. S. (2016). Understanding the impact of cloud-based services adoption on organizational flexibility. *Journal of Enterprise Information Management,* Vol. 29 (4) pp. 566 – 588.	R28	Lian, J. -., Yen, D. C., & Wang, Y. -. (2014). An exploratory study to understand the critical factors affecting the decision to adopt cloud computing in Taiwan hospital. *International Journal of Information Management, 34*(1), 28-36.
R29	Low, C., Chen, Y., & Wu, M. (2011). Understanding the determinants of cloud computing adoption. *Industrial Management and Data Systems, 111*(7), 1006-1023.	R30	Martins, R., Oliveira, T., & Thomas, M. A. (2016). An empirical analysis to assess the determinants of SaaS diffusion in firms. *Computers in Human Behavior, 62*, 19-33.
R31	Martins, R., Oliveira, T., & Thomas, M. A. (2015). Assessing organizational adoption of information systems outsourcing. *Journal of Organizational Computing and Electronic Commerce, 25*(4), 360-378.	R32	Morgan, L., & Conboy, K. (2013). Factors affecting the adoption of cloud computing: An exploratory study. *ECIS 2013 - Proceedings of the 21st European Conference on Information Systems.*
R33	Morgan, L., & Conboy, K. (2013). Key Factors Impacting Cloud Computing Adoption, IEEE Vol. 46(10).	R34	Oliveira, T., Thomas, M., & Espadanal, M. (2014). Assessing the determinants of cloud computing adoption: An analysis of the manufacturing and services sectors. *Information and Management, 51*(5), 497-510.
R35	Opitz, N., Langkau, T. F., Schmidt, N. H., & Kolbe, L. M. (2012). Technology acceptance of cloud computing: Empirical evidence from german IT departments. *System Science (HICSS), 2012 45th Hawaii International Conference on,* 1593-1602.	R36	Polyviou, A., & Pouloudi, N. (2015). Understanding cloud adoption decisions in the public sector. *48th Hawaii International Conference on System Sciences, 2015-March* 2085-2094.
R37	Qian, L. Y., Baharudin, A. S., & Kanaan-Jebna, A. (2016). Factors affecting the adoption of enterprise resource planning (ERP) on cloud among small and medium enterprises (SMES) in penang, malaysia. *Journal of Theoretical and Applied Information Technology, 88*(3), 398-409.	R38	Sabi, H. M., Uzoka, F. -. E., Langmia, K., & Njeh, F. N. (2016). Conceptualizing a model for adoption of cloud computing in education. *International Journal of Information Management, 36*(2), 183-191.
R39	Safari, F., Safari, N., & Hasanzadeh, A. (2015). The adoption of software-as-a-service (SaaS): Ranking the determinants. *Journal of Enterprise Information Management, 28*(3), 400-422.	R40	Şener, U., Gökalp, E., & Erhan Eren, P. (2016). Cloud-based enterprise information systems: Determinants of adoption in the context of organizations. *Information and Software Technologies: 22nd International Conference, ICIST 2016*, pp 53-66.
R41	Senyo, P. K., Effah, J., & Addae, E. (2016). Preliminary insight into cloud computing adoption in a developing country, *Journal of Enterprise Information Management, 29* (4), 505 – 524.	R42	Shao, M., Peng, L., & Li, Y. (2015). A study on enterprise technology adoption of SaaS. *2015 12th International Conference on Service Systems and Service Management (ICSSSM),* 1-6.
R43	Stieninger, M., & Nedbal, D. (2014). Diffusion and acceptance of cloud computing in SMEs: Towards a valence model of relevant factors. *Proceedings of the Annual Hawaii International Conference on System Sciences,* 3307-3316.	R44	Sulaiman, H., & Magaireah, A. I. (2014). Factors affecting the adoption of integrated cloudbased e-health record in healthcare organizations: A case study of Jordan. *International Conference on Information Technology and Multimedia (ICIMU*).
R45	Tashkandi, A. N., & Al-Jabri, I. M. (2015). Cloud computing adoption by higher education institutions in saudi arabia: An exploratory study. *Cluster Computing, 18*(4), 1527-1537.	R46	Tashkandi, A. N., & Al-Jabri, I. M. (2015). Cloud Computing Adoption by Higher Education Institutions in Saudi Arabia: Analysis Based on TOE. *International Conference on Cloud Computing* (ICCC).
R47	Tehrani, S. R., & Shirazi, F. (2014). Factors influencing the adoption of cloud computing by small and medium size enterprises (SMEs). *Human Interface and the Management of Information. Information and Knowledge in Applications and Services,* 631-642.	R48	Wahsh, M. A., & Dhillon, J. S. (2015). An investigation of factors affecting the adoption of cloud computing for E-government implementation. *IEEE Student Conference on Research and Development (SCOReD)*, 323-328.
R49	Wilson, B. M. R., Khazaei, B., & Hirsch, L. (2015). Enablers and barriers of cloud adoption among small and medium enterprises in tamil nadu. *IEEE International Conference on Cloud Computing in Emerging Markets*, 140-145.	R50	Yang, Z., Sun, J., Zhang, Yali., & Wang, Y. (2015). Understanding SaaS adoption from the perspective of organizational users: A tripod readiness model. *Computers in Human Behavior 45*, 254–264.
R51	Yigitbasioglu, O. M. (2015). The role of institutional pressures and top management support in the intention to adopt cloud computing solutions. *Journal of Enterprise Information Management, 28*(4), 579-594.		

Table 2. Referenced primary studies

Technological factors						
Secondary factor	**Tertiary factors**	**No. of tertiary factors**	**No. of studies**	**Significant**	**Insignificant**	**Coverage ratio**
Relative Advantage	Relative Advantage, Perceived Benefits, Perceived Usefulness, Usefulness	4	39	R2 - R12, R15, R18, R19, R20 R24-R27, R29- R33, R34a, R36a, R38- R41, R43, R45-R48, R50	R23, R28, R34b, R49	71%
Compatibility	Compatibility, Technical Compatibility, Functionality Fit, Task-Technology Fitness, Business Activity Cloud Fitness, Job Relevance, Incompatibility	7	39	R2, R4 - R10, R15 - R18, R20, R24 - R26, R32, R33, R34b, R35 R36, R38, R39, R40, R42, R43, R48- R50	R3, R12, R23, R28, R29, R30, R34a, R41, R45, R46, R47	57%
Complexity	Complexity, Simplicity, Ease of Use & Convenience, Ease of Use, Technical Complexity	5	33	R2, R4, R6, R8 - R10, R15, R18, R20, R22, R23, R25, R28, R30, R32, R33, R34b, R36, R38, R39, R43, R45, R46, R48- R50	R5, R7, R12, R29, R31, R34a, R40, R47	51%
Security	Security, Security Threat, Data Concern, Fear of Data Loss, Vulnerability, Security Risk, Risk	7	29	R1, R4, R6, R7, R16, R17, R19, R20 - R22, R25, R26, R28, R32, R33, R38 - R41, R43 - R45, R48	R8, R14, R30, R34a, R34b, R37a, R37b, R47	45%
Innovation Characteristics	Technological Characteristics, Availability, Availability and Support, Customization, Application Specificity, Integration, Migration Time, Observability, Observable Results, Results Demonstrability, Cloud Benefits, Capacity, Performance, Adaptability, Portability, Interoperability, Standards for API, Increased Traceability, Auditability, Accessibility, Production Timeliness, On Demand Service, Scalability, Pay per Use , Output Quality, Energy Efficiency, Meet Environmental Standards, Virtualization	28	20	R1, R2, R6, R7, R15, R16, R21, R24, R25, R28, R32, R33, R35, R36, R38- R40, R43, R49, R50		39%
Cost	Cost, Cost Savings, Total Costs of Ownership, Hard Financial Analysis, Soft Financial Analysis, Sunk Cost and Satisfaction with Existing Systems, Cost Effectiveness	7	17	R1, R3, R4, R8, R14, R16, R20, R21, R22, R25, R28, R30, R34a, R38, R43	R34b, R37a, R37b, R47	29.4%
Trialability	Trialabilty	1	14	R7 - R10, R15, R20, R32, R33, R38, R39, R43, R50	R36, R47	23.5%
Reliability	Reliability, Service Outages	2	11	R1, R6, R7, R15, R16,R17, R20 - R22, R24, R44		22%
Privacy	Privacy, Privacy Concerns, Confidentiality, Data Privacy	4	12	R6, R7, R20, R22, R24, R37, R39, R40, R44, R46	R14, R47	20%

Table 3. Technological factors

Organizational factors						
Secondary factor	**Tertiary factors**	**No. of tertiary factors**	**No of studies**	**Significant**	**Insignificant**	**Coverage ratio**
Top Management Support	Top Management Support, Executive Support, IT Manager's Support, Executive's Attitude, Top Management Team Participation, Top Management's Intention to Adopt New Innovation, Support of Senior Managers.	7	34	R2-R14, R17, R18, R26-R31, R34b, R37a, R40, R41, R42, R44, R45, R48- R51	R23, R34a, R37b, R46	63%
Organizational Size	Organizational Size, Firm Scope, Organizational Structure, Managerial Structure, Degree of Centralization	5	20	R4, R6 - R10, R20, R21, R26, R29, R31, R34a, R34b, R40, R49	R12, R17, R23, R24, R41, R43	29.4%
Organizational Culture	Culture, Innovativeness, Attitude Towards Using Technology, Absorptive Capacity, Attitude Towards Change, Formalization, Employee Mobility, Awareness, Training, Sharing and Collaboration, Business Flexibility and Agility, Image	12	17	R3, R7, R10, R11, R13, R14 R15, R18, R20, R21, R22, R32, R33, R38, R39	R26, R43	29.4%
Technology Readiness	Technology Readiness, Organization's IT Resource, IT Infrastructure, Organizational Readiness, Technology Competence, IT Resource, Adequate Resource, Organizational Systems, Facilitating Conditions, Effort Expectation, Technological Availability, IT Department Budget, Business Case & Budget.	13	24	R2, R4, R5, R6, R7, R8, R17, R18, R23, R24, R26, R28, R30, R34a, R34b, R39, R40, R41, R43, R44	R3, R29, R31, R48, R50	27.5%
Internal Expertise	Employee's Knowledge, Experience, Internal Expertise, IT Expertise of Business Users, Organization Process, Innovation and Design Capacity, Voluntariness of Use, Prior Experience & Familiarity, Perceived Technical Competence, Personnel Skills and Experience, Competence of Employees.	11	14	R3, R4, R9, R10, R17, R20, R21, R24, R28, R35, R47, R49	R12, R43	23.5%
Organization Strategies	Organization Strategies, Focus on Core Competencies, Insufficient Service Quality Guarantee, Quality of Service, Strategic Value, Need, End-User Satisfaction, Critical Business Processes, Business Requirement, Focus on Key Business Processes, Information Intensity	11	11	R1, R2, R4, R15, R17, R20, R21, R24, R36, R49	R47	20%

Table 4. Organizational factors

Environmental factors						
Secondary factor	**Tertiary factors**	**No. of tertiary factors**	**No of studies**	**Significant**	**Insignificant**	**Coverage ratio**
Competitive and Trading Partner Pressure	Competitive Pressure, Trading Partner Pressure, Competitive and Trading Partner Pressure, Business Eco-System Partner Pressure, Competition Intensity, Peer Pressure, Competitor Pressure, Perceived Industry Pressure, Mimetic Pressure, Coercive Pressure, Social Influence, Competitive Intensity, Subjective Norm, Partner's Pressure, External Pressure, Market Competition Pressure	16	36	R3, R4, R5, R8, R12, R13, R17, R18, R23, R26, R29, R30, R31, R35, R39, R41, R44, R49, R50	R6, R7, R9, R10, R15, R24, R28, R34a, R34b, R37a, R37b, R38 R40, R42, R43, R45, R46, R47, R51	37.3%
Legislation and Regulations	Legislation and Regulations, Regulations, Government Policy, Government Policy and Regulation, Government Policy Support, Regulatory Environment, Legal Issues, Regulatory Support, Regulatory Framework, Regulation Compliance, Normative Pressures, Laws and decrees, Political Matters, Legal Environment	14	31	R1, R4, R6, R7, R17, R19, R20, R21, R30, R32, R33, R36, R38, R42, R43, R44, R49	R3, R8, R12, R14, R24, R28, R31, R34a, R34b, R40, R41, R45, R46, R51	33.3%
Trust	Trust, Vendor Credibility, Provider's Reputation, Relationship with Service Providers, Lack of Vendor Trust	5	12	R6, R7, R11, R16, R17, R21, R27, R40, R43, R49	R14, R48	20%
External Expertise	External Expertise, External Support, Supplier Efforts, External Computing Support, Service Provider's Support, Supplier Computing Support, Vendor Support, Supplier Availability, Cloud Computing Services Provider, Service Provider's Ability	10	10	R1, R3, R7, R8, R9, R10, R19, R20, R26	R47	18%
National Infrastructure	Network Connectivity, Region's Broadband Infrastructure, Internet bottleneck, Internet Reliability, Country-based Infrastructure, Inadequate Telecom Services, Region's Power Supply Infrastructure, Infrastructure, National Infrastructure	9	9	R2, R8, R17, R20, R21, R24, R37, R38, R40		18%
Physical Location	Physical Location, Data Center Location, Geo-Restriction & Uncertainty, Lack of Transparency	4	6	R7, R6, R9, R10, R20, R49		12%
Lack of Control	Loss of Control, Lack of Control, Fear of Losing Control, Loss of Control over Data and Systems	4	5	R16, R20, R21, R32, R33		10%
Vendor Lock-in	Vendor Lock-in	1	4	R20, R24, R45	R46	6%
Industry	Industry, Market Scope, Industry Characteristics and Market Structure	3	3	R7, R9, R10		6%

Table 5. Environmental factors

Human factors						
Secondary factor	**Tertiary factors**	**No. of tertiary factors**	**No of studies**	**Significant**	**Insignificant**	**Coverage ratio**
Decision Maker's Technology Experience	Decision Maker's Cloud Knowledge, IT Knowledge.	2	3	R47, R48	R3	4%
Decision Maker's Innovativeness	CIO Innovativeness, Decision Maker's Innovativeness	2	4	R10	R3, R28, R47	2%

Table 6. Human factors

The importance of technological factors to cloud computing adoption cannot be understated as evident in the number of tertiary technological factors retrieved and their average coverage ratio. This finding correlates with the findings of Thong (1999) who found technological factors to have a major effect on adoption of information systems. Furthermore, the combination of relative advantage, compatibility and complexity, three factors from the original TOE and DOI models emerged as the most referenced technological factors; this is also supported by Thong (1999) who listed relative advantage, compatibility and complexity as the three essential attributes that influences adoption.

Organizational Factors

A total of six secondary organizational factors were retrieved from literature (see Table 4); only organizational size was identified in the original review of the adoption models (see section 3); the other five factors are novel constructs derived from the reviewed primary studies. A few tertiary factors presented in the original models were assimilated by the newly created secondary factors. Formalization and centralization, were both absorbed by organizational culture and organizational size respectively. The new factors retrieved from literature are top management support, technological readiness, organizational culture, internal expertise and organizational strategies. Top management support was the most significant organizational factor with a significance ratio of 63%, this is consistent with the results presented by van de Weerd et al. (2016). Results also showed how important it is for organizations to be ready to accommodate the technology by having the resources for it. The organization's size and its culture are both equally significant and there seems to be a correlation between an organization's size and cloud computing adoption. SME's for instance are more flexible due to their decentralized nature and lack of bureaucracy, they are therefore more likely to adopt cloud computing (Al-Mascati & Al-Badi, 2016; R8). However, the same argument can be made for large organizations, which due to slack resources can easily afford to adopt cloud computing; usually in conjunction with their own private cloud.

An organization's culture can also have a significant bearing on cloud computing adoption. Take for example, innovativeness and attitude towards change, both tertiary factors within the secondary factor organizational culture. They highlight how the culture within an organization can have a bearing on adopting cloud computing. An organization that is innovative and has a positive attitude towards change is more likely to adopt cloud computing. Furthermore, it is obvious that adopting cloud computing must align and support an organization's strategy. Also, while the configurations and maintenance of the cloud environment is handled by the cloud support, it is however important for the adopting organization to possess the internal expertise to help with navigating issues that come with cloud computing. Therefore, the prior experience of employees with cloud computing is a factor that should be considered before adopting cloud computing.

Environmental Factors

The results also show environmental factors as critical to cloud computing adoption (see Table 5). Nine secondary environmental factors were retrieved from literature, 6 of which are new factors and are not part of the original models. Legislation and regulation factor was included in the original TOE model as government regulation, national infrastructure is synonymous with technology support infrastructure while industry properties factor was included in the original model as industry characteristics and market structure. Competitive and trading partner pressure, trust, external expertise, physical location, lack of control and vendor lock-in were all new secondary factors retrieved from literature.

Interestingly, the results show that the most significant environmental secondary factors, specifically competitive and trading partner pressure factor, and legislation and regulations factor were found to be both significant and insignificant in relatively equal measures. This points to a correlative relationship between cloud computing adoption and the environment within which it is being adopted; this correlation should be researched further. Similarly, the results show a correlation between the secondary factor national infrastructure with developing or under-developed countries. This is evident in the countries in which studies that cited national infrastructure as a factor were carried out. A few examples of studies that cited national infrastructure as a factor include Ethiopia (R2), Oman (R8), Turkey (R21) and Malaysia (R37). This finding shows the need to take into account that there are particular factors more influential in certain study contexts or conditions compared to others, thus a cloud adoption framework should provide a complete range of factors, to enable the evaluation in different contexts. Cloud computing is highly dependent on the national infrastructure of the country within which it is being adopted. A stable power supply, fast internet networks and a functional telecommunications network are needed for implementing cloud computing (Sabi et al. 2015; R38). The role of the service provider and the need for the service provider to allay the issues adopters have with cloud computing cannot be understated; this is highlighted by the following secondary environmental factors namely: trust, external expertise, physical location, lack of control and vendor lock-in. Cloud service providers need to earn the trust of the adopter by being credible, and by being readily available to provide external support when needed. Furthermore, cloud service providers should educate organizations and be as transparent as possible as to where their data are being stored and what methods and techniques are being used. This would go a long way to allay whatever fears organizations might have when adopting cloud computing.

Human Factors

Human factors had the least coverage amongst the primary factors, only 14 % of the primary studies covered human factors (see Table 6). Furthermore, the total coverage ratio of the human factors was just 6%. This shows a significant gap in literature on the research into the impact human factors has on adoption. Compared to other primary factors and considering the level of evidence found from literature, an argument to remove human factors from the model would be valid. There is still proof, however insignificant this is. Multiple research papers have researched the personal adoption of cloud computing over the years, surprisingly though, research into the role of individuals in the adoption of cloud computing within organizations is severely lacking. More research on the impact of human factors on adoption should be done.

Four tertiary factors were retrieved from literature; these were summarized into two secondary factors. They are; 1) decision maker's prior technology experience which includes tertiary factors like decision maker's cloud knowledge, and IT knowledge and 2) decision maker's innovativeness which includes tertiary factors like CIO innovativeness and decision maker's innovativeness. Alharbi et al. (2016) (R3), theorized based on results from literature that the innovativeness of decision makers considerably influences the decision to adopt cloud computing in healthcare organizations and that human factors are main obstacles to the successful implementation of cloud computing in Saudi Arabian healthcare organizations. However, their results showed that the human factors were the least important of all the factors and that the decision maker's innovativeness does not influence cloud computing adoption in Saudi Arabian healthcare organizations. This finding is consistent with Lian et al. (2014) (R28), who theorized that the CIO innovativeness plays an important role in the adoption of cloud computing in Taiwan hospitals, but their results showed that CIO innovativeness does not influence adoption.

Suggested Cloud Computing Adoption Model

The total number of tertiary factors retrieved from literature highlights the importance of performing this literature review. While the initial plan was to build on the TOE and DOI models, and to identify, using a SLR, specific factors influencing the adoption of cloud computing, the number of tertiary factors retrieved was however not anticipated. Also, in addition to the technological, organizational and environmental factors, human factors have been added. Figure 3 presents the suggested cloud computing adoption model based on the results of the literature review.

It was established that the intent to adopt originates from an individual; due to the characteristics of the decision maker or innovator within an organization. Additionally, thinking from an organizational point of view, before adopting any technology the organization needs to perceive it as being useful and helpful in helping it achieve its goals. This is the first phase of every adoption process, it is kick-started via human factors. After this comes the technological, organizational and environmental considerations. A positive conclusion from these considerations would usually lead to adoption.

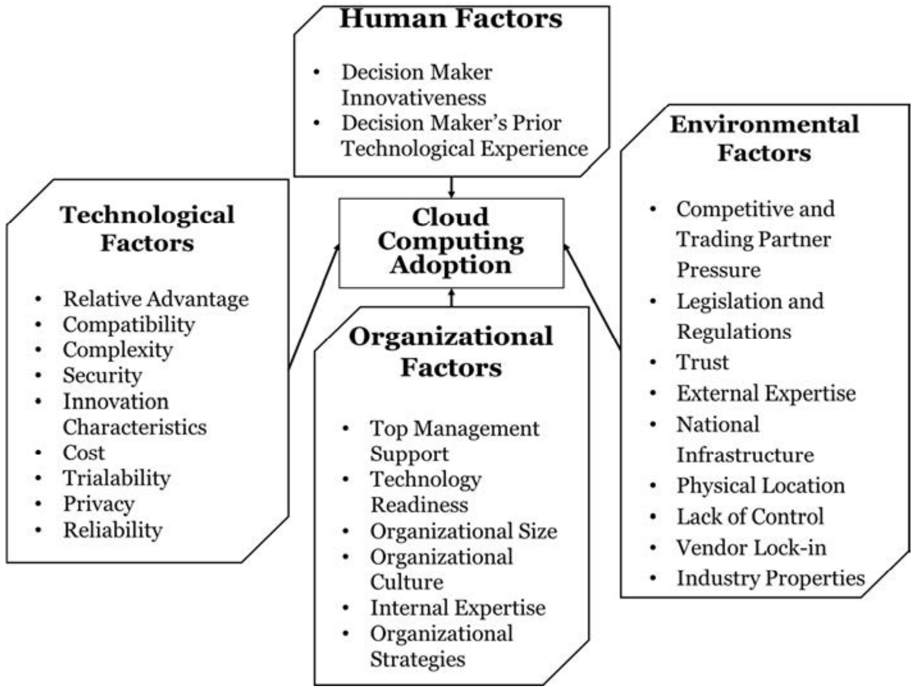

Figure 3. Final Cloud Adoption Model

Conclusion

The singular objective of this research work was to find the factors which affect cloud computing adoption in organizations and then propose an adoption framework which will act as a blueprint for organizations looking to adopt cloud computing. To achieve this objective, a review of technology adoption models was carried out resulting in an initial, generic adoption framework. Furthermore, a systematic literature review was used to extract the factors from 51 primary sources, this yielded a surprisingly vast number of factors. These factors were categorized into three hierarchical groups, namely: primary factors, secondary factors and tertiary factors. Primary factors are the adoption factors dimensions, they include technological factors, organizational factors, environmental factor and human factors. Secondary factors are second level factors derived after grouping the specific, tertiary factors based on similar themes such as complexity of technology, or culture of organization.

The study found a total of 194 unique factors; 65 technological factors, 59 organizational factors, 66 environmental factors and 4 human factors. The literature review indicated that technological factors are the most important factors when adopting cloud computing. Furthermore, relative advantage, top management support, compatibility, and complexity with coverage ratios of 71%, 63%, 57%, and 51% respectively, were found to be the most significant adoption factors.

Numerous studies have proposed various adoption frameworks, but very few studies have aimed to address the adoption of cloud computing across multiple contexts by proposing a general cloud adoption framework for organizations. Also, there was observed a lack of research into the impact of individuals on cloud computing adoption within organizations. This study contributes to the research by filling both gaps; it proposes a general adoption framework for cloud computing in organizations, and it highlights the important role individuals play on cloud computing adoption within organizations. Further research is proposed to address the relationships between different factors, as well as the impacts of different individual roles such as hierarchical position in the organization on the adoption of cloud computing in organizations.

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