2019

Strategies for Cloud Services Adoption in Saudi Arabia

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This is to certify that the doctoral study by

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Abstract

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MS, Cairo University, 2001

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Doctoral Study Submitted in Partial Fulfillment

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Doctor of Business Administration

Walden University

June 2019

Abstract

The adoption rate of cloud computing is low among business organizations in Saudi Arabia, despite the cost-saving benefits of using cloud services. The purpose of this multiple case study was to explore the strategies that information technology (IT) leaders in the manufacturing industry in Saudi Arabia used to adopt cloud computing to reduce IT costs. The target population of this study consisted of 5 IT leaders from 5 different manufacturing companies in Saudi Arabia who successfully adopted cloud computing in their companies to reduce IT costs. Rogers's diffusion of innovation theory was the conceptual framework for this research. Data collected from face-to-face, semistructured interviews and a review of relevant corporate documentation were analyzed using Yin's 5-step data analysis method, which included compiling, disassembling, reassembling, interpreting, and concluding the data. Five themes emerged from the data analysis: identify business needs and requirements, apply value realization metrics, plan for migration, choose the right cloud service provider, and provide adequate training and awareness sessions. The implications of this study for positive social change include the potential to improve the local economy in Saudi Arabia by ensuring the sustainability of firms in the manufacturing industry through the implementation of cost-saving strategies associated with cloud computing adoption.

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Dedication

I dedicate this doctoral study to my wife, Doaa Youssef; I was truly blessed with your love, support, and patience during my countless hours of study. To my wonderful children, Ziad, Joudi, and Zeina, who have always been the most important people in my life, thank you. I also dedicate this study to my parents, Amina Hassan and Hussein Abdulghani; thank you for your sacrifice and suffering while raising me. Thanks, also, to my father-in-law, Mahmoud Youssef, who would have been so proud if he were with us today.

Acknowledgments

I would like to express my deepest appreciation to all those who supported me throughout this DBA journey. I give a special thanks to Dr. Mohamad Saleh Hammoud, my doctoral chair, for your generous guidance, patience, advice, and inspiration throughout the journey. I would also like to acknowledge my second committee member, Dr. Edgar Jordan, and my URR, Dr. Mary Dereshiwsky, for your constructive feedback and comments, which elevated the quality of my study. Many thanks and appreciation to the IT leaders who made a great contribution to the success of this study by providing valuable knowledge and experience. Last, I would like to extend my deepest appreciation to my family, friends, colleagues, and classmates who gave me strength and encouragement to complete my doctoral degree.

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Section 1: Foundation of the Study

Cloud computing has evolved as an innovation in the computing field because it provides a realm of opportunities for organizations (Ray, 2016). The benefits of cloud computing for organizations include flexibility, scalability, availability, and cost saving (Yamin & Al-Makrami, 2015). To encourage the adoption decision of cloud computing among business organizations in Saudi Arabia, IT leaders need to understand the effective adoption strategies for gaining a relative advantage (Almubarak, 2017). In this study, I explored the successful strategies that IT leaders in the manufacturing industry in Saudi Arabia used to adopt cloud computing to gain a cost-saving advantage.

Background of the Problem

Cloud computing has evolved as a technological innovation that provides several benefits for organizations such as flexibility, scalability, availability, and cost saving (Yamin & Al-Makrami, 2015). Reducing IT costs is the main advantage of cloud computing because organizations save the expenses of setting up their IT infrastructure and pay only for the used services (Karim & Rampersad, 2017). However, cloud computing adoption in developing countries such as the Kingdom of Saudi Arabia (KSA) has a slower adoption rate compared to countries in the West (Alassafi et al., 2016). According to Alassafi et al. (2016), many company leaders in the KSA have a negative attitude toward adopting and implementing advanced technologies such as cloud computing.

Cloud computing represents a major area of future investment in information and communication technology (ICT) in the KSA (Communications and Information

Technology Commission [CITC], 2015). Using new ICTs is important for expanding economic opportunities, which promotes the Saudi government's 2030 vision (Alassafi, Alharthi, Walters, & Wills, 2017). Some businesses in the United States that migrated to cloud services achieved more than 65% reduction in their technology operation costs (Lacity & Reynolds, 2014). Decision makers play a significant role in making the adoption decision of cloud computing (Almubarak, 2017). The lack of knowledge about cloud computing and its relative advantages is a main barrier for decision makers to adopt this innovation in their organizations (Almubarak, 2017). Understanding the strategies that IT leaders have used to reduce IT costs is essential to encourage the adoption decision of cloud computing in the KSA.

Problem Statement

The adoption rate of cloud computing is low among business organizations in the KSA, despite the cost-saving benefits of utilizing cloud services (Alassafi et al., 2016). In 2014, business organizations in the KSA had a relatively low total expenditure of only 50 million U.S. dollars on cloud services (CITC, 2015). The general business problem is that IT leaders in the manufacturing industry in the KSA have not adopted cloud computing, resulting in losing a possible opportunity to reduce IT costs. The specific business problem is that some IT leaders in the manufacturing industry in the KSA lack strategies to adopt cloud computing to reduce IT costs.

Purpose Statement

The purpose of this qualitative, multiple case study was to explore the strategies that IT leaders in the manufacturing industry in the KSA use to adopt cloud computing to

reduce IT costs. The target population of this study consisted of five IT leaders from five different manufacturing companies in the Eastern region of the KSA who have successfully adopted cloud computing in their companies to reduce IT costs. The implications for positive social change include the potential to ensure the prosperity of the local economy in the KSA by ensuring business sustainability of the firms in the country's manufacturing industry as a result of implementing cost-saving strategies associated with cloud computing adoption.

Nature of the Study

I used qualitative research methodology to explore participants' experiences. Creswell and Poth (2018) indicated that the qualitative research method is an effective tool for researchers to explore phenomena from participant viewpoints. Other researchers have also noted that qualitative research methodology is an appropriate methodology for researchers who seek to understand individuals' behavior regarding a contemporary phenomenon from the participants' viewpoints (Antwi & Hamza, 2015; Marshall & Rossman, 2016). The qualitative research method was appropriate for my study because the goal was to explore the adoption strategies of cloud computing from the viewpoint of the IT leaders in the manufacturing industry in the KSA. Quantitative methodology, which is used by researchers to examine the relationships or differences among variables (Antwi & Hamza, 2015), is applicable when statistical data exist, or when testing a theory is a requisite (McCusker & Gunaydin, 2015). Quantitative methodology was not applicable to my study because the goal was neither to conduct statistical analysis nor to examine relationships among variables. Researchers use mixed-methods research

methodology to collect and analyze both qualitative and quantitative data (Archibald, Radil, Zhang, & Hanson, 2015). The mixed methodology was not appropriate for my study because I did not assess quantitative data to answer my research question.

A multiple case study was my choice of research design for this study. The qualitative research method includes various research designs such as (a) ethnography, (b) narrative, (c) phenomenology, and (d) case study (Lewis, 2015). An ethnographic design is appropriate when researchers aim to study cultural characteristics of groups or cultures sharing same experience or beliefs (Wall, 2015). The ethnographic design was not appropriate for my study because I did not want to study cultural characteristics of a group over a prolonged period. Narrative design is appropriate when researchers wish to describe, or tell the story of, the lives of individuals (Lewis, 2015). The narrative design was not appropriate for my study because I did not focus on individual life experience. The phenomenological design is appropriate when researchers focus on examining participants' recent situations and lived experiences (Berglund, 2015). The phenomenological design was not appropriate to my study because I did not focus on the lived experiences of study participants. Case study design involves the use of different methods to collect and gain in-depth knowledge of a phenomenon (Yin, 2017). The multiple case study design was appropriate for my study because I sought to gain insights into the strategies that IT leaders in the manufacturing industry in the KSA use to adopt cloud computing technology.

Research Question

What strategies do IT leaders use to adopt cloud computing to reduce IT costs?

Interview Questions

1. What strategies are you using for successful adoption of cloud technology?
2. What are the main advantages associated with adopting the cloud technology for your organization?
3. How do you measure the success of the implemented strategies to reduce IT costs in your organization?
4. How would you describe the significant challenges or barriers to implement your strategies for adopting cloud technology?
5. What strategies have you used to address the key challenges or barriers to adopting cloud technology?
6. What other information would you like to share regarding adopting cloud technology in your organization?

Conceptual Framework

Rogers (2003) developed the diffusion of innovation (DOI) theory to explain how, why, and at what rate new ideas and technology spread over time. The adoption rate of innovation is the length of time required for members of a social system to confirm the adoption process (Rogers, 2003). Rogers proposed the main elements that increase or decrease an innovation adoption for a specific population or social system. The elements include the innovation itself, communication channels, time, and a social system. Decision makers evaluate the adoption of an innovation in several stages of processing (Weigel, Hazen, Cegielski, & Hall, 2014). The stages of the innovation-decision process start with awareness of the available innovation; proceed to increasing the attention given

to the innovation, making choices about the innovation, and testing the usefulness of the innovation; and end with confirming the adoption decision (Rogers, 2003).

Rogers (2003) also identified the innovation characteristics that influence the adoption rate of innovation. Potential innovation adopters evaluate these characteristics through the innovation-decision process to accept or reject an innovation. The innovation characteristics are (a) relative advantage, (b) compatibility, (c) complexity, (d) trialability, and (e) observability (Rogers, 2003). Exploring these characteristics allows researchers and practitioners to understand the key success factors for the adoption rate of innovation. Innovations are subject to higher adoption rate when they have a more relative advantage, compatibility, trialability, observability, and less complexity (Rogers, 2003). Previous researchers have used the DOI theory to plan innovation adoption strategies, identify adoption challenges, and evaluate adoption rate (Byambaa, Janes, Takaro, & Corbett, 2015). The DOI theory was suitable for this study because it provided a foundation to explore the cloud computing adoption strategies that IT leaders in the KSA could use to reduce IT costs. Some IT leaders in the country's manufacturing industry have adopted cloud computing as an innovative technology. They have created strategies to gain a relative advantage, increase compatibility, and reduce the complexity of the new technology (see Rogers, 2003). Study findings may highlight other strategies that IT leaders in the country's manufacturing sector can use to improve business performance and foster sustainability.

Operational Definitions

Cloud computing: Cloud computing is a model for on-demand delivery of a shared pool of hosted IT resources such as servers, network, storage, applications, and services over the Internet (Mell & Grance, 2011).

Cloud security: Cloud security refers to the policies and technologies that can be used to protect infrastructure, application data, and information associated with cloud computing use (Alassafi et al., 2017).

Cloud service provider: Cloud service provider is an individual or organization that provides a large, shared physical or virtual computing resources among multiple users (Singh & Chatterjee, 2017). Google, Amazon, Microsoft, and IBM are examples of major cloud service providers.

Green cloud computing: Green cloud computing is a new trend to make cloud computing more energy efficient and environmentally friendly by reducing the energy consumption of data centers (Alismail & Kurdi, 2016).

Relative advantage: The relative advantage of a new technology means perceiving better advantages than the old or existing technology (Lal & Bharadwaj, 2016).

Technology adoption: Technology adoption is the decision of an individual or organization to acquire, implement, and continue to use a new technology (Rogers, 2003).

Assumptions, Limitations, and Delimitations

Assumptions

Assumptions are what the researcher considers to be facts, even without existing scientific proof (Schoenung & Dikova, 2016). As the researcher, I assumed that five IT leaders from five different manufacturing companies in the Eastern region of the KSA would willingly participate in this study. The challenge was in having participants commit the time and agree to interview with me. In addition, I assumed that all participants would honestly describe their experience of successfully adopting cloud computing in their companies to reduce IT costs. I also assumed that the responses of the IT leaders to the interview questions would be accurate and related to their individual experience rather than that of someone else.

Limitations

Limitations are conditions or factors that are out of the researcher's control that may create bias or inappropriately affect the research findings (Simon & Goes, 2018). This research study had several limitations. First, the small sample size of five IT leaders limits the generalizability of the findings (see Kharuddin, Foong, & Senik, 2015). Another limitation was focusing on five firms in the manufacturing industry in the Eastern region of the KSA. These firms may not have been representative of other companies in different industries or different regions.

Delimitations

Delimitations refer to the boundaries in the study that the researcher can control (Simon & Goes, 2018). In this study, I focused on strategies that IT leaders in the

manufacturing industry in the KSA use to adopt cloud computing to reduce IT costs. Limiting the scope of the study to IT leaders in a specific industry was therefore a delimitation for this study. Another delimitation was that the selected participants were located in a limited geographic area. Inclusion of participants from other KSA regions may have resulted in different perspectives on the strategies available to business leaders because of changing the location. An additional delimitation included interviewing only IT leaders who successfully adopted cloud computing in their companies to reduce IT costs. I did not include IT leaders who have not successfully adopted cloud computing because they may lack the knowledge to provide successful strategies to adopt cloud computing.

Significance of the Study

Contribution to Business Practice

IT leaders in the manufacturing industry in the KSA may use the findings from this study to gain insights regarding cloud computing adoption as a business strategy to reduce IT costs. The potential benefits of adopting cloud computing arise from shifting computing from a product owned by an organization to a service provided to the organization (Goel, Bali, & Singh, 2015). Cost reduction is the main advantage of cloud computing adoption because it allows businesses to avoid the cost of an upfront capital investment, infrastructure maintenance, and a trained workforce (Avram, 2014). Business leaders have the advantage of investing in the core business instead of investing in IT fixed assets. IT leaders may take advantage of the opportunity to access high-end technologies with minimal resources and investment through the adoption of cloud

computing technology and may reduce the cost associated with hiring resources for setting up and maintaining their IT infrastructure.

Implications for Social Change

The adoption of cloud computing technology may improve economic development in the KSA. The low adoption rate of ICT by small and medium enterprises (SMEs) has impeded economic development in developing countries, according to Mbuyisa and Leonard (2015). A shortage of resources has been a major factor underpinning support for the IT revolution among many business organizations in developing countries (Avram, 2014; Mbuyisa & Leonard, 2015). The successful adoption of cloud computing technology is an opportunity for business owners in the KSA to enable IT services with minimal resources. The widespread deployment of IT services increases the awareness of global trends and innovations among IT leaders, which may positively improve the living standards of a country by offering the latest technologies for business organizations (Avram, 2014).

Cloud computing technology comprises a combined configuration of computing resources that may decrease energy consumption through effective resources utilization. Cloud computing provides more efficient energy management by eliminating local data centers and physical infrastructure. The resource utilization efficiency of cloud data centers exceeds 80%, compared to less than 30% for local data centers (Subramanian, Abdulrahman, & Zhou, 2015). Green cloud computing is an approach to reduce the carbon footprint of data centers to save the environment (Alismail & Kurdi, 2016); green cloud computing data centers operate in an environmentally-friendly way by using

renewable energy sources, such as solar or wind (Deng, Liu, Jin, Li, & Li, 2014). The leaders of large IT companies have started to build green data centers, such as the Facebook solar-powered data center in Oregon and Green House Data wind-powered data center in Wyoming (Deng et al., 2014). Researchers have found that decreasing energy consumption reduces carbon dioxide emissions and provides an environment-friendly atmosphere (see Alismail & Kurdi, 2016). Implementation of the strategies identified in this study may similarly help manufacturing business leaders in the KSA to improve the environmental aspects of their computing operations.

A Review of the Professional and Academic Literature

The purpose of this qualitative, multiple case study was to explore the strategies that IT leaders in the manufacturing industry in the KSA use to adopt cloud computing to reduce IT costs. Reviewing the academic and professional literature is necessary for researchers to understand relevant previous studies and potential opportunities for additional research (Macfarlane et al., 2015). In this subsection, I review relevant literature about strategies for cloud computing adoption to reduce IT costs. I provide a comprehensive synthesis of global research in the area of cloud computing adoption from various perspectives.

I searched various databases available through Walden University Library and Google Scholar to find the literature for the literature review and broader study. These databases included ProQuest, ABI/Inform Complete, EBSCO, Business Source Complete, ScienceDirect, and Emerald Management Journals. I also searched official government and corporate websites. Search terms included *cloud computing*, *technology*

adoption, *diffusion of innovation*, *cost advantage*, *relative advantage*, *security concerns*, *cloud definition*, *cloud service provider*, *adoption factors*, *technology adoption theories*, *green cloud computing*, *IT outsourcing*, *innovation characteristics*, *organizational context*, and *environmental context*. I expanded my search to ensure that at least 85% of the sources were peer-reviewed and less than 5 years old. This study includes 185 references. Of these references, 159 (86%) were from peer-reviewed sources, and 160 (86%) were published between 2015 and 2019. The literature review consists of 108 references. Of these references, 94 (87%) were from peer reviewed sources, and 94 references (87%) were published between 2015 and 2019.

This literature review includes four main topics. The first topic I address is the current status and feature trends of cloud computing. In this subsection, I focus on the definition and evolution of cloud computing, research on cloud computing, and green cloud computing as a future trend. In addressing the second main topic, I explore the theoretical models that have been commonly used in the innovation adoption literature. I explain the constructs and attributes of the DOI (Rogers, 2003) as the conceptual framework of this research. Also, I outline different models such as the technology-organization-environment framework (TOE; Tornatzky & Fleischer, 1990) and the technology acceptance model (TAM; Davis, 1989). The cloud computing adoption in different contexts was the third main topic. I focused on the effect of firm size, technological development level among countries, cloud adoption among different business sectors, and the main cloud adoption factors. The perceived characteristics of cloud adoption are the last main topic. In this subsection, I focus on several cloud

computing characteristics including relative advantage, cost advantage, security concerns, complexity, and compatibility.

Current Status and Future Trends of Cloud Computing

Cloud computing definition. Previous researchers have revealed the current confusion about what cloud computing means (Daylami, 2015). As Daylami (2015) observed, cloud computing is a technology trend more than a single-term definition. Many researchers have addressed different aspects of cloud computing. However, few researchers, overall, have sought to define cloud computing and describe its characteristics (Stieninger & Nedbal, 2014). Sobragi, Macada, and Oliveira (2014) stated that the absence of a solid definition for cloud computing can be attributed to the background of cloud computing researchers, the continuous evolution of the technological components of cloud computing, and the lack of wide acceptance to justify the concept of cloud computing.

The literature includes a range of definitions for cloud computing. Cloud computing is an evolution of several technologies such as virtualization, utility computing, grid computing, the Internet, and web services, as Tashkandi and Al-Jabri (2015) noted. Daylami (2015), in contrast, described cloud computing as a metaphor for the Internet. In 2011, the National Institute of Standards and Technology (NIST) defined cloud computing as a model for enabling on-demand network access to a shared pool of configurable resources such as servers, networks, applications, storage, and services (Mell & Grance, 2011). Although the NIST definition provides a solid basis for understanding the topic of cloud computing, the definition is not sufficient to cover all

aspects of the topic, according to Stieninger and Nedbal (2014). For example, NIST definition lacks a detailed classification for service models that may include storage as a service, information as a service, and process as a service (Stieninger & Nedbal, 2014).

The NIST definition includes five essential characteristics, three delivery models, and four deployment models for cloud computing (Mell & Grance, 2011; Singh & Chatterjee, 2017). The essential characteristics of cloud computing in the definition are (a) on-demand self-service, (b) broad network access, (c) resource pooling, (d) rapid elasticity, and (e) measured service (Mell & Grance, 2011; Singh & Chatterjee, 2017). The delivery models of cloud computing are

- Infrastructure as a Service (IaaS): IaaS is the most basic model of services. The virtualized resources include storage, processing, and network services. Customers can build their system on top of these services (Daylami, 2015; Mell & Grance, 2011; Singh & Chatterjee, 2017).
- Platform as a Service (PaaS): PaaS is the next level up, where service providers provide preconfigured systems running operating systems, databases, and programming languages (Daylami, 2015; Mell & Grance, 2011).
- Software as a Service (SaaS): SaaS is the highest level of the service models where the provided services are full applications running on cloud infrastructure (Daylami, 2015; Mell & Grance, 2011).

The deployment models of cloud computing are

- Public Cloud: Public cloud refers to running and managing the provided services by the service providers as shared resources among multiple users and organizations (Mell & Grance, 2011; Singh & Chatterjee, 2017).
- Private Cloud: Private cloud refers to deploying services strictly for a single organization to avoid the risk of data disclosure of the public model (Daylami, 2015; Mell & Grance, 2011).
- Community Cloud: Community cloud refers to deploying and sharing the services among a group of people or organizations having a common interest (Mell & Grance, 2011; Singh & Chatterjee, 2017).
- Hybrid Cloud: Hybrid cloud refers to mixing two or more cloud deployment models to take advantages of each model (Mell & Grance, 2011; Singh & Chatterjee, 2017).

The NIST definition is important because it provides a solid basis for the general understanding of cloud computing (Stieninger & Nedbal, 2014).

Cloud computing evolution. In the last two decades, many organizations have outsourced some of their ICT functions to external providers because of the rising cost of ICT systems, the shortage of skilled workers, the challenge of keeping pace with the dynamic change of ICT technology, and the increasing complexity of ICT operations (CITC, 2015). Cloud computing has evolved in less than 10 years as a mainstream IT strategy, from outsourced hosting to sophisticated services (Gonzalez & Smith, 2014). Previous researchers studying IT outsourcing have agreed that IT outsourcing is a direct predecessor to cloud computing (Gonzalez & Smith, 2014).

Gonzalez and Smith (2014) stated that using previous research in the IT outsourcing field is appropriate to develop a valid hypothesis for the current model of cloud computing. One reason is that IT outsourcing, especially outsourced hosting, has many of the cloud computing qualities such as on-demand, resource pooling, and measured service (Gonzalez & Smith, 2014). However, the five characteristics of cloud computing included in the NIST definition differentiate cloud computing from outsourcing (Tashkandi & Al-Jabri, 2015). Cloud services are different from the traditional IT services in business, acquisition, accessibility, and technical aspects (Chou, Chen, & Liu, 2017). The higher level of automation, pay-per-use billing model, and self-provisioning capabilities have set cloud services apart from traditional hosted and managed services (CITC, 2015). Cloud computing also provides a higher level of flexibility, reliability, and scalability than traditional ICT systems (Giacobbe, Celesti, Fazio, Villari, & Puliafito, 2015).

ICT services have moved to a new phase of maturity with the emergence of cloud services as a new model of higher automation, efficiency, and scalability (CITC, 2015). Cloud computing is the outcome of convergence between two major trends in the information technology: IT efficiency and business agility (Avram, 2014). For many researchers and practitioners, cloud computing is a new technological paradigm (Sobragi et al., 2014). Cloud computing is an innovation in the computing field because it provides a new realm of opportunities (Ray, 2016). According to some experts, cloud computing will change the way that businesses use technology to create a competitive advantage (Chen, Chuang, & Nakatani, 2016). For many organizations worldwide, cloud computing

has evolved as a top priority in the information technology (Carcary, Doherty, Conway, & McLaughlin, 2014). Compared with traditional IT solutions, cloud computing provides superior advantages (Subramanian et al., 2015).

Cloud computing research status. Cloud computing represents a new area of research for most of the management information systems disciplines (Tashkandi & Al-Jabri, 2015). Despite the numerous business benefits of cloud computing, few researchers have addressed the business value of cloud computing (Johnston, Loot, & Esterhuyse, 2016). Cloud computing is a sociotechnical system with different aspects including individuals, technical, and organizational components (Stieninger & Nedbal, 2014). Studying cloud adoption from different perspectives has resulted in a fragmented approach to understanding cloud adoption, which is still a challenge for most businesses (Ray, 2016). The diversity of these perspectives is useful for understanding *cloud* as a phenomenon, but not for providing a simple and holistic approach to cloud adoption (Ray, 2016).

Cloud computing researchers have examined cloud adoption from technical and business perspectives (Ray, 2016). The technical aspect of cloud computing includes virtualization and security issues (Ray, 2016). However, the business aspect includes the decision-making process to evaluate how cloud computing fits with the strategic goals of the firm (Ray, 2016). Researchers should focus on the comprehensive view of cloud computing instead of the narrow technical perspective, according to Stieninger and Nedbal (2014). Bayramusta and Nasir (2016) found that the cloud computing topic has garnered less attention in managerial and organizational journals compared to

engineering and information systems journals. Researchers need to provide more attention to study the impact of cloud computing on the organizational and institutional level (Bayramusta & Nasir, 2016).

Stieninger and Nedbal (2014) addressed the current status of cloud computing literature. The authors identified nine topics as the core concepts and components used within cloud computing literature. The identified topics include cloud computing definition, potential and challenges, success factors, requirements for successful adoption, the adoption consequences, the associated risks, the adoption decision guidance, business models, and service provider topics. The topic of cloud computing's potential and challenges has the largest coverage in the cloud computing literature while the topics that address the business model and service providers have the least attention in the cloud computing literature (Stieninger & Nedbal, 2014).

Bayramusta and Nasir (2016) conducted a study of 236 scholarly articles between 2009 and 2014 to investigate the development and evolution of cloud computing over 6 years. The results showed that cloud computing adoption followed by legal and ethical issues of cloud computing constitute the majority of cloud computing research. Nineteen percent of the examined research topics were about cloud computing adoption, and 15% of the topics were about legal and ethical issues of cloud computing. The results showed that cloud computing for mobile applications, benefits and challenges of cloud computing, and energy consumption were the least covered themes, accounting for 6%, 5%, and 4% of the research topics, respectively. Bayramusta and Nasir revealed that

energy consumption of cloud computing and cloud computing for mobile applications are trendy topics for the near future.

Cloud service description (CSD) is an attractive area for many researchers and practitioners since no standard CSD exists (Ghazouani & Slimani, 2017). The lack of CSD standardization is causing problems for service requesters because cloud service providers use different techniques and languages to describe cloud services (Ghazouani & Slimani, 2017). Most of the researchers have focused on the technical aspect of cloud service. Few researchers have addressed the four service aspects that include technical, operational, business, and semantic aspects (Ghazouani & Slimani, 2017). The operational and technical aspects of cloud service cover the interface and functionalities of services. The business aspect covers pricing, service level agreement (SLA), legal obligations, and actors interacting with the service (Ghazouani & Slimani, 2017). Fang, Liu, Romdhani, Jamshidi, and Pahl (2016) proposed a model for cloud service specifications, which covers the four aspects of cloud services. However, the authors were unable to cover all service types and interactions of all actors.

Green cloud computing and energy management. Energy cost-saving and energy sustainability are two major topics in the current and future cloud computing literature (Prasanna N Balasooriya, Wibowo, & Wells, 2016). Many researchers are seeking new strategies for energy management to overcome the massive increase of energy consumption of providers (Giacobbe et al., 2015). The energy consumption cost is a major factor for evaluating the total cost of the provided services (Giacobbe et al., 2015). Giacobbe et al. (2015) highlighted that defining energy management strategies is

important for future research to identify the best strategies for providing high performance IT services with the lowest costs. Most of the literature of energy management strategies focus on independent cloud providers. However, some researchers have started to address cloud federation strategies (Giacobbe et al., 2015). In a federated cloud environment, moving resources and services among service providers could be useful for organizations to enable cost saving and energy sustainability strategies (Giacobbe et al., 2015).

Using cloud computing may decrease the energy consumption of firms by eliminating data centers, using lower powered devices, and reducing materials and traveling needs (Subramanian et al., 2015). Subramanian et al. (2015) conducted a study to examine the short-term and long-term benefits of the cloud computing in the Chinese's context. The results of the study indicated that the resource sharing characteristics of cloud computing provides long-term green benefits for small to medium logistic service providers (SMLSPs). The results were aligned with those of Ramanathan, Bruccoleri, Awasthi, and Mazzola (2015) who asserted that the collective and collaborative resource deployment leads to green computing sustainability. In addition to the reported benefits of green cloud computing initiatives in banking and healthcare industries, the long-term cloud computing adoption leads to green benefits for logistics service companies and supply chain (Subramanian et al., 2015).

The emergence and spread of cloud computing resulted in a wide deployment of large-scale data centers (Mishra, Puthal, Sahoo, Jena, & Obaidat, 2018). These data centers have a massive power consumption, and consequently high carbon emission

(Mishra et al., 2018; Usvub, Farooqi, & Alam, 2017). The significant increase in energy consumption resulted in a huge amount of carbon dioxide emission (Alismail & Kurdi, 2016). Many researchers have provided hardware and software techniques to minimize carbon dioxide emission in cloud operations (Alismail & Kurdi, 2016). Cloud virtualization is one of the software techniques to reduce energy consumption through resource consolidation and live migration (Alismail & Kurdi, 2016). Singh, Mishra, Ali, Shukla, and Shankar (2015) proposed using cloud computing to minimize carbon emission in the beef supply chain industry. Storing carbon emission measurement in a private cloud is useful for the stakeholders to identify, quantify, prioritize, and optimize the carbon hotspots for the entire beef supply chain (Singh et al., 2015).

Green cloud computing is an important requirement for organizations to be environment-friendly in addition to the cost efficiency benefits (Alismail & Kurdi, 2016). Many service providers have considered using green data centers to reduce power cost and carbon emissions (Radu, 2017). Using green energy sources, such as solar energy, hydroelectric energy, and wind energy in cloud computing data centers instead of fossil fuel is an effective method to reduce exhaust gasses (Farooqi, Nafis, & Usvub, 2017). Large IT companies such as Microsoft and Google have started to use renewable energy sources for producing electricity (Usvub et al., 2017). Cloud service providers may distribute workloads among interconnected data centers in different locations to benefit from different types of available renewable energies (Giacobbe et al., 2015). Using renewable energy to power cloud computing data centers is a cost effective strategy to maximize the efficiency with the minimum energy wasting (Giacobbe et al., 2015).

Theoretical Models Used in Innovation Adoption Literature

The purpose of this qualitative multiple case study is to explore the strategies that IT leaders in the manufacturing industry in the KSA use to adopt cloud computing to reduce IT costs. Many theories, models, and frameworks relate to addressing the adoption strategies of new technology either directly or implicitly. Researchers have used different models to understand and predict the rationale behind the acceptance and continued use of a specific technology (Huang, 2017; Lai, 2017). The theoretical models of technological innovation may fit with information technology adoption studies (Hameed, Counsell, & Swift, 2012). Researchers have been utilizing several theoretical models to understand the technology adoption process from different perspectives (Hameed et al., 2012).

Tarhini, Arachchilage, Masa'deh, and Abbasi (2015) listed some of the theoretical models that researchers have used in their technology adoption studies. These models include the DOI theory, TOE framework, TAM, theory of reasoned action (TRA), theory of planned behavior (TPB), the unified theory of acceptance and use of technology (UTAUT), social cognitive theory (SCT), perceived characteristics of innovation (PCI) model, and the motivational model. Ogrezeanu (2015) identified the TRA, TPB, DOI, and TAM as the most important theories to address technology adoption issues. In the cloud computing literature, researchers have used many adoption frameworks such as the DOI theory, TAM, TOE framework, and TRA (Senyo, Effah, & Addae, 2016).

The technology adoption research includes different individual perspectives based on the level of analysis context and the stage of the adoption process (Hameed et al.,

2012; Rogers, 2003). The level of analysis in technology adoption research may have organizational or individual context (Hameed et al., 2012; Rogers, 2003). Chiyangwa and Alexander (2016) classified the technology adoption theories into two schools of thought. The first school of thought includes the intention-based theories such as the TRA, TPB, TAM, and UTAUT, where the main focus is cognitive processes of individuals. The second school of thought includes the theories and models such as the DOI theory and the TOE model, where the focus is on the factors that influence the adoption and implementation of technology through a social system. Senyo et al. (2016) confirmed that researchers had used two groups of frameworks based on the level of analysis context. One group of frameworks are appropriate for individual context and another group of frameworks are appropriate for organizational context.

Hameed et al. (2012) identified different theoretical models that are commonly used in the technology adoption literature from the organizational and individual level of analysis (see Table 1). The results in Table 1 supported Chiyangwa and Alexander's (2016) findings that researchers commonly use the DOI theory and the TOE framework when the focus is on the organizational analysis level. Senyo et al. (2016) asserted that the TOE framework is appropriate to investigate the adoption and implementation of technology within a firm context. Ogrezeanu (2015) stated that the DOI theory describes the phenomenon of innovation diffusion at social or group level. However, the TBA and the TRA describe the human behavior at the individual level. Unlike most of the studies, Senyo et al. (2016) considered the DOI theory is appropriate for technology adoption research at the individual context because it does not include the organizational and

environmental aspects of innovations. Oliveira, Thomas, and Espadanal (2014) asserted that the DOI theory and the TOE framework are commonly used in innovation diffusion and adoption studies in organizations. However, the TAM, UTAUT, and TPB pertain to an individual's choice.

Table 1

Theoretical Models Used in Innovation Adoption Literature

Innovation theories/frameworks	No. of studies	
	Organizational-level analysis	Individual-level analysis
Diffusion of innovation (DOI)	28	3
Perceived characteristics of innovation (PCI)	1	0
Technology acceptance model (TAM)	11	26
Theory of planned behavior (TPB)	4	12
Theory of reasoned action (TRA)	5	14
Technology acceptance model 2 (TAM2)	0	2
Technology-organization-environment (TOE) model	35	0
TriCore	2	0
Task technology fit (TTF)	0	1
Unified theory of acceptance and use of technology (UTAUT)	0	1
None/Others	81	12

Diffusion of innovation (DOI) theory. Rogers (2003) developed the diffusion of innovation theory to explain the typical spread of new ideas and technology within a social system. Rogers described the rate of innovation as the length of time required for members of a social system to confirm the adoption process (Rogers, 2003). Many researchers have used the DOI theory as a method to understand acceptance and implementation of innovations in a different context (Byambaa et al., 2015). The DOI theory is an appropriate framework to plan innovation adoption strategies, identify adoption challenges, and evaluate adoption rate (Byambaa et al., 2015). The DOI theory is helpful to frame the diffusion steps logically which will lead to successful innovation adoption (Byambaa et al., 2015). Rogers (2003) identified the main elements that influence the spread of a new idea. These elements affect increasing or decreasing the adoption rate of a new technology for a specific population. The elements of diffusion of innovation include the innovation, communication channels, time, and a social system.

The diffusion of innovation theory includes the main categories of potential adopters and stages of the adoption process. Rogers (2003) used personality traits to organize the individuals' response into five categories toward accepting an innovation. The categories of adopters include innovators, early adopters, early majority, late majority, and laggards. The adoption of innovation among the adopters' category follows the S-curve shape when plotted over a length of time (Rogers, 2003). The process of innovation adoption occurs through different stages including knowledge, persuasion, decision, implementation, and confirmation (Rogers, 2003). The process of decision-making begins with the awareness of the available innovation, followed by increasing the

attention to the innovation, making choices about the innovation, testing the usefulness of the innovation, and confirming the adoption decision (Hameed et al., 2012; Rogers, 2003).

Many IT researchers have sought to determine why individuals choose to use specific information technologies over others (Huang, 2017). Understanding the characteristics of innovation is crucial for researchers and practitioners to uncover which action is more effective to enhance the technology adoption process (Rogers, 2003). The perceived characteristics of the innovation are the core of the DOI theory (Weigel et al., 2014). Innovation characteristics are the factors influencing the adoption rate of innovation (Rogers, 2003). Many DOI researchers have focused on understanding how perceptions of innovation characteristics influence organizations or individuals to adopt technology innovations (Claudy, Garcia, & O'Driscoll, 2015). The potential innovation adopters decide to accept or reject an innovation based on their evaluation of the innovations characteristics (Rogers, 2003). Rogers (2003) identified five dimensions as the most common innovation characteristics in the IT adoption literature. The dimensions are relative advantage, complexity, compatibility, observability, and trialability.

Relative advantage is the degree of superiority and perceived attractiveness of innovation over the competing ideas (Rogers, 2003). Relative advantage is a key variable in the most of IT adoption studies described as direct or indirect benefits (Hameed & Counsell, 2014). IT managers decide to adopt cloud-based services when they perceive the benefits of these services as a relative advantage (Lal & Bharadwaj, 2016). Relative advantage has a positive impact on evaluation, adoption, and use of the business

intelligent systems (Puklavec, Oliveira, & Popovič, 2017). Many researchers considered the relative advantage is the top determinant of innovation adoption (Hameed & Counsell, 2014). In the DOI research, the focus is on marketing and communicating the relative advantage of innovations. However, DOI studies have failed to explain the reasons against adoption (Claudy et al., 2015). Reasons against adoption have a stronger influence on consumers than reasons for adoption (Claudy et al., 2015).

Rogers (2003) defined innovation complexity as the degree of difficulty associated with using new technology as an important factor in the adoption decision. Organization leaders are less likely to adopt complex innovations. (Hameed & Counsell, 2014; Rogers, 2003). Compatibility of cloud technology is the degree of consistency with the existing infrastructure, needs, and experience of an organization (Rogers, 2003). The resistance to the adoption of innovation decreases when the innovation is compatible with the existing work practices and organizational needs (Hameed & Counsell, 2014; Rogers, 2003). Weigel et al. (2014) asserted that the relative advantage and compatibility have the strongest positive correlation with the technology adoption. However, the correlation between technology adoption and complexity does not exist across many studies. Contrary to Weigel et al.'s (2014) findings, Zolkepli and Kamarulzaman (2015) indicated that when complexity exists in an innovation, it becomes significant barrier for adoption.

The adoption rate of a new technology increases if the technology is available on a trial basis because trying technology innovations before adoption reduces the uncertainty of potential adopters (Hameed & Counsell, 2014; Rogers, 2003). Trying an innovation is a way for individuals to find out how it works under their conditions

(Zolkepli & Kamarulzaman, 2015). Observability of innovation refers to the visibility of the innovation outcomes. Leaders within organizations require a visible proof of success before deciding to adopt an innovation (Hameed & Counsell, 2014; Rogers, 2003). Kapoor, Dwivedi, and Williams (2014) synthesized the findings of 226 research conducted using the DOI theory to analyze the Roger's (2003) five innovation characteristics. The authors found that trialability and observability had the least efficacy among the five innovation characteristics. Most of the researchers have not used observability and trialability and focused on using relative advantage, complexity, and compatibility (Kapoor et al., 2014).

Although researchers use the DOI theory when they focus on the issues of innovativeness, the theory lacks the behavioral aspects that influence individual willingness to adopt new technologies (Sabi, Uzoka, Langmia, & Njeh, 2016). The TRA, TPB, and TAM are intention-based theories, in which the focus is on the behavioral aspects associated with social psychology (Sabi et al., 2016). Many researchers used behavioral frameworks such as the TRA and the TAM to investigate the effect of perceived product characteristics on adoption decisions (Claudy et al., 2015). The TRA and the TAM imply the assumption that the negative or positive attitudes toward innovation are the main drivers of adoption decision (Claudy et al., 2015). The Behavioral reasoning theory (BRT) is appropriate for researchers and managers to identify main reasons and relative factors for adoption decision (Claudy et al., 2015). The BRT could be an alternative model to the DOI theory, as it provides additional cognitive dimension in the adoption decision (Claudy et al., 2015). Researchers need to triangulate

the DOI theory with another theory to cover the behavioral aspects of innovation adoption study (Sabi et al., 2016).

Technology-organization-environment (TOE) framework. The TOE framework has been used widely to analyze the technology adoption in the firm-level using three types of contexts: (a) technological context, (b) organizational context, and (c) environmental context (Gutierrez, Boukrami, & Lumsden, 2015). The technological context may include the internal and external technologies that are relevant and applicable to the firm (Gutierrez et al., 2015). Organizational context may include the characteristics and resources of the firm such as firm size, managerial structure, and human resources (Oliveira et al., 2014). Environmental context refers to the environmental factors such as the size and structure of the industry, macroeconomic context, and the presence of technology service providers (Gutierrez et al., 2015). The TOE framework is the most appropriate framework to investigate the adoption and implementation of technology within a firm context (Senyo et al., 2016). The technological, organizational, and environmental contexts are the main drivers and inhibitors of adopting technological innovations (Senyo et al., 2016).

The innovation characteristics of the DOI theory overlap with technology and organization context in the TOE model (Oliveira et al., 2014). Researchers use innovation characteristics in the DOI theory and technology and organization context in the TOE extensively in IT adoption studies (Oliveira et al., 2014). Senyo et al. (2016) used the DOI theory characteristics such as relative advantage, complexity, and compatibility as the main technological factors of the TOE model. The DOI theory lacks a similar

component to the environment context in the TOE model (Oliveira et al., 2014). Unlike the DOI theory, TOE does not specify the role of individual characteristics such as top management support (Oliveira et al., 2014). Although the TOE model is commonly used in the cloud computing research, the TOE model does not include specific technological, organizational, or environmental factors (Gangwar, Date, & Ramaswamy, 2015). Researchers need to overcome the limitations of the TOE model by adding clear constructs to the model (Gangwar et al., 2015).

Technology acceptance model (TAM). The TAM is originated from the TRA theory to model how users come to accept and use technology (Marangunić & Granić, 2015). The TAM includes two main constructs: *ease of use* and *usefulness*. The authors assumed that uncertainty exists in the minds of decision-makers when they start thinking about new technology adoption. Many researchers used the TAM to explain the adoption of innovation in various disciplines such as information systems from behavioral patterns (Sabi et al., 2016). The TAM has become the most significant model in the IT field for many researchers (Alomary & Woollard, 2015). The TAM is a modification of the TRA that relates to studying the intended behavior of individuals (Singh, Gaur, & Ramakrishnan, 2017). Oversimplifying the explanation of technology adoption is the main critic for the TAM (Ogrezeanu, 2015). Some researchers pointed that the TAM is too simple and does not consider the adoption barriers. Although the TAM is a robust model, it is oversimplifying the explanation of technology adoption by using only two explanatory variables (Ogrezeanu, 2015).

Although the TAM explains intention and behavior usage in the continued use of a specific technology, 60% of intention and behavior variance remains unexplained (Huang, 2017). The TAM and the DOI theory are similar in the assumption that the relationships across their variables are unidirectional (Alomary & Woollard, 2015). Usefulness and ease of use are the main constructs of the TAM, are equivalent to the relative advantage and complexity constructs of the DOI theory (Sabi et al., 2016; Singh et al., 2017). Using the TAM to investigate cloud computing adoption is insufficient because it is too old to address modern technologies that have undergone multiple revolutions to date (Sabi et al., 2016). Sabi et al. (2016) proposed a model to use usability characteristics of the TAM as mediating factor for the DOI theory. In this model, Sabi et al. (2016) used ease of use and usefulness constructs from the TAM to mediate complexity and relative advantage characteristic respectively from the DOI theory.

Integrating technology adoption theories. The technology adoption literature lacks a unified theoretical framework that provides a theoretically grounded impetus for future research (Ogrezeanu, 2015). The technology adoption theories are fragmented, too simple, and idiosyncratic (Ogrezeanu, 2015). Selecting a suitable model to explain and predict the continuity of using specific information technology is a significant problem for researchers (Huang, 2017). However, selecting the best model is difficult because it may produce overflow when some constructs of the model are not necessary (Tarhini et al., 2015). Most of the existing models need more factors to provide a full explanation for the users' beliefs toward information technology adoption or continued use (Huang, 2017). The existing models have varied generalizability across different contexts because

of the inconsistency of the relationships among the factors of these models (Huang, 2017). Researchers need to find suitable psychological models and theories to explain the technology acceptance behavior (Alomary & Woollard, 2015).

Weigel et al. (2014) combined the DOI theory with the TPB to blend the strengths of both models. The perceived characteristics of innovation are at the core of the DOI theory, whereas the variables that affect the adoption behavior of the decision makers are at the core for the TPB (Weigel et al., 2014). Huang (2017) revealed that integrating the TAM with other theories will improve the prediction abilities of the model. Huang (2017) suggested that integrating the theory of interpersonal behavior (TIB) with the TAM may provide a better understanding of the continuity of using specific information technology. The TAM provides a better ability to predict intention to continued use than the TIB. However, the TIB provides a better ability to predict continuance behavior. Combining the TAM and the TPB links the constructs of perceived usefulness and ease of use from the TAM with the TPB predictors (Lai, 2017). The UTAUT is a unified theory that combines eight various models; TAM, TRA, motivational model, the model of PC utilization, TPB, combined TAM-TPB, SCT, and the DOI theory (Alomary & Woollard, 2015).

Cloud Computing Adoption in Different Contexts

Cloud adoption and firm size. Firm size is one of the essential factors affecting the adoption of cloud computing (Oliveira et al., 2014). Large organizations have a greater need to adopt innovations to improve their performance, despite spending a long time to take the adoption decision. On the other hand, the small organizations are more

innovative because the decision-making process is simple because of flexibility and simplicity of their structure (Sabi et al., 2016). Carcary et al. (2014) asserted that the adoption behavior of the large enterprises reported in the literature does not reflect the adoption behavior of SMEs. Unlike large-size enterprises, SMEs do not need in-depth planning and strategy development to migrate to cloud computing. However, step-by-step guidance and greater awareness of adoption process may foster SMEs to leverage cloud computing power (Carcary et al., 2014; Jamshidi, Pahl, & Mendonca, 2016).

Cloud computing has become a game changer for SMEs by providing affordable and scalable IT infrastructure and capabilities as services (Basahel, Yamin, & Drijan, 2016). Many researchers suggested that cloud-based services are more suitable for SMEs to encounter the capacity and financial constraints in comparison to larger firms (Attaran & Woods, 2018; He & Xu, 2015; Ross & Blumenstein, 2015). Cloud computing provides SMEs with an opportunity to significantly reduce the cost of building and sustaining the IT systems infrastructure by offering on-demand, unlimited computing resources (Basahel et al., 2016). Large enterprises have a competitive advantage over SMEs in terms of exploiting information and communication technology (ICT) resources (Ross & Blumenstein, 2015). However, cloud adoption is an opportunity for SMEs to reduce the technological gap with larger firms in terms of accessing the ICT resources (Ross & Blumenstein, 2015). Small firms may use cloud computing to benefit from compute-intensive business analytics that is available only for large firms (Avram, 2014).

Large companies are more likely to adopt new technologies because they have resources to cover cost and investment risk of the technology adoption (Oliveira et al.,

2014). Similarly, Habjan and Pucihar (2017) indicated that large enterprises have a higher adoption rate of cloud computing than small and medium enterprises because of their advantage in financial capital and human resources skills. In contrast, He and Wang (2015) highlighted that large enterprises such as multinational enterprises have a slower rate of cloud computing adoption than SMEs. Moving the large scale and complex legacies of the large-size enterprises to cloud environment entails many challenges (Gholami, Daneshgar, Low, & Beydoun, 2016). The leaders of large and multinational businesses can access shared data on the cloud to monitor subsidiary and remote activities (He & Wang, 2015). Cloud computing improves the communication between multinational enterprises and their partners (He & Wang, 2015). Many large IT companies such as Intel, IBM, Microsoft, HP, and Amazon provide technical documents including strategies, architecture, and solutions for large enterprises who are considering using cloud services in multinational settings (He & Wang, 2015).

Sobragi et al. (2014) conducted a study to analyze the factors influencing the adoption decision of cloud computing in different organization categories. The results indicated that the economic factors arising from scalability are more important for SMEs than large-size organizations. However, the reliability is the primary adoption factor for large-size enterprises (Sobragi et al., 2014). Cloud computing benefits do not vary significantly across different business sizes (Chen et al., 2016). Unlike Sobragi et al.'s (2014) findings, SMEs can obtain similar benefits from cloud computing as the large enterprises because of the affordability and flexibility of cloud services (Chen et al., 2016). However, the obtained benefits from different types of cloud computing vary

across different sizes of business (Chen et al., 2016). The SaaS computing model provides benefits in cost saving for large businesses more than SMEs, whereas, micro businesses gain higher benefits than SMEs and large businesses when adopting the PaaS computing model (Chen et al., 2016).

Cloud adoption in the developing countries. The technological, organizational, and environmental contexts are different between developing and developed countries (Senyo et al., 2016). In some countries, the rate of spending on cloud computing are five times more than the rate of spending on traditional IT systems (Alhammadi, Stanier, & Eardley, 2015). However, the spending rates on cloud computing relate to the level of technological development of each country. Global IT players like IBM have started to consider cloud computing sector in the developing countries by establishing many cloud centers in China, India, Brazil, Vietnam, and South Africa (Sabi et al., 2016). Cloud computing is an opportunity to many third-world countries to face the lack of resources challenge and to achieve widespread deployment of IT Services (Avram, 2014).

Although cloud computing has become matured technology, business enterprises in many developing countries are still lagging in the adoption of this technology (Karim & Rampersad, 2017). Alhammadi et al. (2015) examined the difference in the factors that affect cloud computing adoption among countries that have various levels of technological advancement. In the developing countries, security concerns and government support are more influential factors than in technologically developed countries (Alhammadi et al., 2015). Karim and Rampersad (2017) identified the main barriers to the adoption of cloud computing in developing countries as lack of cost-

benefit analysis, lack of service and infrastructure readiness, lack of cloud computing expertise, information security concerns and compliance, and reliability issues.

Many researchers have addressed the adoption of cloud computing in developed and large economies such as Gangwar et al. (2015) in India, and Oliveira et al. (2014) in Portugal. However, few researchers have addressed cloud computing adoption in the Middle Eastern countries, despite including some emerging economies and oil-rich countries (Sharma, Al-Badi, Govindaluri, & Al-Kharusi, 2016). Few researchers have addressed the cloud computing technology in Saudi Arabia (Alharbi, Atkins, & Stanier, 2016). Exploring cloud computing adoption in the literature in the developing counties such as Saudi Arabia is limited, particularly in the higher education sector (Karim & Rampersad, 2017). Tashkandi and Al-Jabri (2015) agreed with most of the researchers on that publishing research papers about cloud computing in Saudi Arabia is limited.

Cloud computing adoption in developing countries such as the KSA has a slower adoption rate compared to countries in the West (Alassafi et al., 2016). Organizational leaders in the KSA have a negative attitude toward adopting and implementing advanced technologies such as cloud computing (Alassafi et al., 2016). Similarly, Basahel et al. (2016) stated that SMEs leaders in the KSA are still reluctant to adopt cloud-computing technologies. Alhammadi et al. (2015) conducted a study to examine the adoption rate of cloud computing in the technologically developing countries. Unlike previous studies, the research findings indicate that Saudi Arabia business market has positive indicators toward cloud computing adoption. Seventy percent of the respondents in the ICT sector and 46% in the manufacturing sector in the KSA showed an intention to migrate their

organization's data and services to a cloud computing model (Alhammadi et al., 2015). Most of SMEs' leaders in the KSA have an interest in adopting cloud computing to capitalize on the advantages provided by cloud technology (Khan, Khan, & Kumar, 2015).

Security and privacy concerns are the most prominent factors in slowing the adoption rate in the KSA (Basahel et al., 2016). Security risks are the main reason for the low adoption rate of cloud services among business organizations in the KSA (Alharbi et al., 2016). Alassafi et al. (2016) identified the social factors that relate to the security issues of Saudi organizations toward the adoption of cloud computing as having trust in the service provider, organizational security culture, and privacy of data. In addition to security, training, hiring cost, service availability, and initial investment are inhibitors for cloud computing adoption in the KSA (Basahel et al., 2016). Technology providers have a significant, positive impact in cloud computing adoption (Maqueira-Marín, Bruque-Cámara, & Minguela-Rata, 2017). Cloud services may have promising business growth and adoption in the KSA if service providers are able to minimize the security and privacy issues of the provided services (Khan et al., 2015).

Cloud adoption and business sector. Sobragi et al. (2014) indicated that the type of business can influence the adoption of cloud computing technologies. Network access and interoperability are more important for IT and mobile companies (Sobragi et al., 2014). Improving operational performance by enabling physical and informational flows is a major benefit for supply chain organizations (Bruque-Cámara, Moyano-Fuentes, & Maqueira-Marín, 2016). Healthcare organizations in the KSA may benefit from cloud

computing in saving costs, reducing the shortages in health informatics, and increasing collaboration among healthcare facilities (Alharbi et al., 2016). Most of the universities in Europe and North America are using cloud services to deliver electronic educational services in a flexible, large scale (Alharthi, Alassafi, Alzahrani, Walters, & Wills, 2017). Educational institutions may benefit from IaaS, PaaS, and SaaS without the need to establish and maintain IT infrastructure (Kaur & Singh, 2015).

Ross and Blumenstein (2015) revealed that newly established firms are more likely to use cloud technologies immediately. However, existing firms may struggle to adapt to the new environment when shifting to cloud-based technologies. Ross and Blumenstein (2015) asserted that cloud technologies facilitate entrepreneurship, innovation, and collaboration. Cloud technologies increase the capacity for entrepreneurs to start-up quickly in the global market (Ross & Blumenstein, 2015). Oliveira et al. (2014) investigated the effects of cloud computing characteristics on the adoption decision among manufacturing and services sectors. The authors found that the drivers and inhibitors that influence the adoption of cloud computing are different in the services and manufacturing sectors. Complexity and compatibility of an innovation are significant factors affecting the adoption rate of cloud computing in the service industry but they are insignificant for the manufacturing firms (Oliveira et al., 2014). Conversely, relative advantage is more significant for manufacturing firms than for service industry firms.

The public sector has a slower rate of adopting cloud technologies than the private sector (Sharma et al., 2016). Government entities often lack trust in technology, willing to invest, in-house expertise, and the absence of regulatory authority (Sharma et al.,

2016). The public sector in the UK has very few implementations of cloud computing technology (Jones, Irani, Sivarajah, & Love, 2017). Government organizations in the UK have many concerns about the potential risks of implementing cloud-based technologies (Jones et al., 2017). Cloud computing adopting provides a cost saving for governmental organizations by increasing the effective use of resources and reducing repetitive operations (Almarabeh, Majdalawi, & Mohammad, 2016). The adoption of cloud computing by governmental organizations may provide opportunities for emerging economies in the Middle East to face social challenges (Sharma et al., 2016). Sharma et al. indicated that cloud computing adoption might result in creating job opportunities for developing, maintaining, and securing cloud infrastructure.

Big government organizations have a notably large amount of spending on the IT infrastructure (Alsanea & Barth, 2014). Many governments worldwide have recognized cloud computing as a platform for digital government services to handle massive data sets of citizen requests and transactions (Jones et al., 2017; Panori, González-Quel, Tavares, Simitopoulos, & Arroyo, 2016). The UK government have called the public sector organizations to adopt cloud computing as strategic move to reap the technology benefits (Jones et al., 2017). The Chinese government has started the process with IBM to develop a regional cloud services infrastructure (Alsanea & Barth, 2014). Similarly, the Japanese government have initiated a project to establish a single private cloud to host the IT infrastructure for all government offices (Alsanea & Barth, 2014). In the KSA, the government has planned to establish a national platform for cloud services, smart cities, and the nternet of things (Alassafi et al., 2016).

The KSA government has started to invest in mobility and cloud computing technologies as the future areas of ICT technologies (CITC, 2015). Using ICT is important for expanding the economic opportunities, which contributes to promoting the Saudi government's 2030 vision (Alassafi et al., 2017). In 2010, the government agencies in the KSA spent four million GBP on the IT infrastructure (Alsanea & Barth, 2014). Alassafi et al. (2017) conducted interviews with 12 IT experts in different governmental sectors such as telecommunication, ministries, education, and research institutes. The authors investigated the factors affecting the decision of cloud computing adoption within government agencies in the KSA. All experts agreed that security has a strong impact on cloud services adoption for government agencies in the KSA (Alassafi et al., 2017). Government agencies in the KSA will not adopt cloud services without ensuring an acceptable level of security (Alassafi et al., 2017). Basahel et al. (2016) suggested that government may seek to partner with trusted and reputable IT firms to mitigate the privacy and security risks.

Enablers and inhibitors for cloud adoption. Johnston et al. (2016) listed the enablers to cloud computing use as mobility, centralized IT architecture, the absence of existing infrastructure, and distributed environment. The authors identified security, cost, big data, bandwidth, and regulations as the main inhibitors of cloud computing. Lal and Bharadwaj (2015) revealed that easy to use interface, support from top management, and experience of the cloud service provider are important factors for cloud adoption decision. Harfoushi, Akhorshaideh, Aqqad, Al Janini, and Obiedat (2016) identified the top factors affecting the adoption of cloud computing as relative advantage, firm size, top

management support, competitive pressure, and trading partner pressure. Similar to many of the previous research findings, the most critical factors affecting the cloud adoption in Taiwan's hospital include data security, top management support, cost, complexity, and perceived technical competence (Harfoushi et al., 2016). Gangwar et al. (2015) listed the factors that influence the adoption of cloud computing within organizations as relative advantage, complexity, compatibility, top management commitment, organizational readiness, and training and education.

Lal and Bharadwaj (2015) agreed with most of the researchers that top management attitude is one of the most significant organizational factors in the cloud adoption decision (Alshamaila, Papagiannidis, & Li, 2013; Gangwar et al., 2015; Oliveira et al., 214). In contrary to the previous researchers, Gutierrez et al. (2015) found that top management support has not become a driving force for cloud computing adoption because of the increasing awareness of the potential benefits of cloud computing among IT managers. Many researchers have agreed about some organizational factors that positively affect cloud adoption such as firm size (Alshamaila et al., 2013; Oliveira et al., 214), technology readiness (Gutierrez et al., 2015; Harfoushi et al., 2016; Oliveira et al., 214), and prior technology experience (Alshamaila et al., 2013). Organizational factors such as top management support and technology readiness have less effect on the decision to adopt cloud computing than technological and environmental factors (Harfoushi et al., 2016).

Environmental context refers to the macro area where the business is running (Gutierrez et al., 2015). The environmental context includes industry market elements

and the technology service providers (Gutierrez et al., 2015). Lal and Bharadwaj (2015) supported the findings of many researchers about some environmental factors that affect positively on the cloud adoption decision such as industry pressure, market, partners, and competitors (Alshamaila et al., 2013; Gangwar et al., 2015; Gutierrez et al., 2015; Oliveira et al., 214). Harfoushi et al. (2016) agreed with the previous researchers on that competitive pressure, and trading partner pressure has a positive effect on cloud computing adoption. The trading partner pressure is the most significant factor in adopting cloud services because vendors' credibility and vendors' levels of support are the main concerns for most of the managers (Gutierrez et al., 2015).

Perceived Characteristics of Cloud Computing

Innovation characteristics are the factors that influence the rate of adoption of cloud computing innovation (Rogers, 2003). The perceived characteristics of the innovation are the core of the DOI theory (Weigel et al., 2014). Rogers (2003) identified the major innovation characteristics that facilitate or hinder the adoption of innovation as (a) relative advantage, (b) compatibility, (c) complexity, (d) observability, and (e) trialability. Examining these characteristics is important to highlight the prospected opportunities and challenges of adopting cloud technology. The Roger's innovation characteristics have different weights in their effect on cloud technology adoption and implementation, depending on the adoption context (Hameed & Counsell, 2014). Researchers have used trialability and observability rarely because these attributes are not relevant to cloud-computing technology (Oliveira et al., 2014). Kapoor et al. (2014) asserted that trialability and observability had the least efficacy among the five

innovation characteristics. Most of the researchers have not used observability and trialability and focused on using relative advantage, complexity, and compatibility (Kapoor et al., 2014).

Relative advantage. The relative advantage of new technology means perceiving better advantages than the old or existing technology (Lal & Bharadwaj, 2016). Hameed and Counsell (2014) revealed that relative advantage is one of the best predictors of IT adoption. Organization leaders are most likely to adopt a new technology if they recognize the advantages and benefits of the technology to their business. Lal and Bharadwaj (2016) explored the impact of adopting the cloud-based services on the organization. The findings showed that the adoption of cloud-based services provides a relative advantage for organizations. The relative advantage of cloud computing includes improving scalability, accessibility, and on-demand deployment time (Lal & Bharadwaj, 2016). The findings of Alharbi et al. (2016) supported the findings of other researchers that the relative advantage is a key factor to increase the willingness of organizations to adopt cloud computing (Oliveira et al., 2014; Tashkandi & Al-Jabri, 2015). Lal and Bharadwaj (2016) agreed with the previous researchers on that relative advantage of cloud computing weights higher than traditional IT systems in terms of implementation and availability (Alshamaila et al., 2013; Gangwar et al., 2015; Oliveira et al., 214).

The perceived benefits positively contribute to the final decision of adopting cloud computing (Harfoushi et al., 2016). Carcary et al. (2014) identified the cloud computing benefits as (a) cost reduction, (b) increased scalability and agility, (c) improved resource utilization, (d) mobility and collaboration, and (e) business continuity

and disaster recovery capabilities. Adopting cloud computing is an opportunity for many organizations to gain a competitive advantage (Rohani & Hussin, 2015). Cloud computing advantages include operational flexibility and the cost advantage of using shared resources (Ray, 2016). The energy cost saving provided by cloud computing has a positive environmental effect (Schniederjans & Hales, 2016). Cloud computing is a new area for IT investment (Harfoushi et al., 2016). Enterprises can scale their services up or down dynamically, as new requirements arise (Avram, 2014). Lal and Bharadwaj (2016) indicated that cloud computing enhances the organizational flexibility including economic flexibility, process flexibility, performance flexibility, and market flexibility.

Alharthi, Alassafi, Walters, and Wills (2017) revealed that cloud computing offers several benefits for the educational institutions: (a) hardware cost reduction, (b) scalable storage, and (c) universal access to computational resources. Cloud computing provides the healthcare care organizations in Saudi Arabia with a cost reduction benefit, more collaboration between healthcare facilities, and reduction of shortages in health informatics (Alharbi et al., 2016). Technological breakthroughs such as cloud computing improve the operational performance in the supply chain by enabling supply chain process integration (Bruque-Cámara et al., 2016). Cloud computing is a tool for supply chain professionals used to address the growing complexity of supply chain networks and the environmental pressure (Schniederjans & Hales, 2016). Cloud computing is one of the most supportive technologies to digital marketing (Mogoş, 2015). Companies can achieve success in their marketing campaigns through the use of cloud computing

(Mogoş, 2015). Cloud computing provides a competitive advantage for companies in terms of developing and distributing promotional materials (Mogoş, 2015).

The perceived benefits of cloud computing go beyond cost saving by providing new types of services (Garrison, Wakefield, & Kim, 2015). In contrary to prior studies, Chen et al. (2016) highlighted that the business capability and scalability benefits of cloud adoption are greater than cost-saving benefits. Chen et al. suggested that the decision makers should consider factors beyond cost reduction when deciding to adopt cloud computing. Avram (2014) showed that cloud computing provides new classes of services that were not possible before such as (a) mobile interactive services, (b) parallel batch processing, (c) business analytics services, and (d) extensions of compute-intensive applications. Cloud computing enables the IT services for many organizations in the developing countries that lack skilled resources required for IT deployment (Avram, 2014). Decision makers can expedite e-government implementation by leveraging cloud computing technologies (Wahsh & Dhillon, 2015). The unique characteristics of cloud computing provide solutions for many e-government challenges such as government information infrastructure, lack of online availability, and low telecommunication infrastructure (Wahsh & Dhillon, 2015).

Cost advantage. Successful innovation adoption is necessary for organizations to increase their business profitability (Hameed & Counsell, 2014). The cost saving is a confirmed relative advantage of cloud computing (Oliveira et al., 2014). Reducing IT costs is the main advantage of cloud computing because organizations save the expenses of setting up their IT infrastructure and pay only for the used services (Karim &

Rampersad, 2017; Ramzan et al., 2018). Cloud computing provides interactive applications in response to the consumers' requirements, which results in reduction in the information systems cost of their organizations (Ratten, 2015). Cloud computing lowers the cost of building IT infrastructure, which could be important for small firms to compete with larger corporations (Avram, 2014). Cloud computing provides immediate access to IT resources with little to no upfront capital investment (Avram, 2014). Shifting IT resources from capital expenditure (Cap-ex) model to operational expenditure (Op-ex) model reduces the upfront cost of corporate computing (Avram, 2014). The cloud-based ERP has a lower cost than the traditional ERP systems (Jain & Sharma, 2016; Ruivo, Rodrigues, & Oliveira, 2015).

Cost reduction is significant to study and understand cloud computing (Ray, 2016). The cost perspective is important to look at cloud computing adoption from multiple angles (Ray, 2016). Cost reduction is one of the factors that organizations should examine when determining the feasibility of adopting cloud computing (Ray, 2016). Researchers have used various factors to calculate the cost of cloud computing including the base cost of computing resources, the cloud implementation cost, the usage cost, and the cost of keeping the current infrastructure as is (Ray, 2016). Organization managers need to carefully balance all short and long term, costs and benefits of cloud computing before deciding to migrate (Avram, 2014). Cloud computing includes various hidden costs such as support, application modifications, disaster recovery, and data loss insurance (Avram, 2014). The transition costs from business solution to another may change the cost-benefit equation (Avram, 2014). Cloud computing may be costly for

healthcare or financial services organizations that need to manage their data storage closely (Ray, 2016). Hosting the heavy applications in the cloud may increase support and network redundancy issues (Ray, 2016).

Security and trust concerns. Cost savings and security concerns are antecedents to the relative advantages of cloud computing (Oliveira et al., 2014). Although the relative advantages of cloud computing increase while increasing the cost saving, they decrease significantly with increasing security concerns (Oliveira et al., 2014). It is not clear whether cloud computing provides adequate protection of organizational information and privacy of data (Avram, 2014). Security is a major challenge for organizations when adopting cloud computing technology (Alassafi et al., 2017; Shaikh & Sasikumar, 2015a). Cloud services include many web technologies that may cause a large number of security issues (Singh & Chatterjee, 2017). Some organizations have not adopted cloud computing technologies because of the high severity level of security concerns (Halabi & Bellaiche, 2017). The associated security risk of cloud computing is the main reason for many potential adopters to dismiss the adoption of cloud services (Ardagna, Asal, Damiani, & Vu, 2015). Many information executives highlighted that security is the main concern with cloud computing (Avram, 2014).

Cloud security refers to protecting confidentiality, availability, integrity, and privacy of a system (Ardagna et al., 2015). Confidentiality risk refers to information disclosure and failing to comply with privacy acts. Availability risk refers to the temporary disruption of provided services that may result in a significant financial loss for organizations. Integrity refers to violating the service level agreement (SLA) between

client and vendor in a way that decreases the efficiency of the provided services (Serrano et al., 2016). From the security point of view, cloud computing provides some advantages and disadvantages (Alassafi et al., 2017). The risk factors of cloud security include insecure interfaces, share technology risk, account hijacking, malicious insiders, data leakage, data ownership, service data protection, and compliance with regulations (Alassafi et al., 2016). The perceived security benefits include smart, scalable security, cutting-edge security techniques, advanced security mechanism, cloud security auditing, SLAs audit enforcement, and resource concentration (Alassafi et al., 2016).

Shifting the computing model from local computing to remote computing raises many security concerns (Singh & Chatterjee, 2017). Although public cloud model supplies highly scalable services with low cost, it is less secure and riskier than other deployment models (Ardagna et al., 2015). Protecting sensitive information on a public cloud remains a vital problem for organizations (Tripathi, 2017). The private cloud model provides more secured deployment model because the infrastructure may exist within the internal data center of an organization. However, private cloud model is more expensive than the public cloud model (Nawaz & Soomro, 2016). The hybrid cloud model is a mixture of private and public clouds that provides more secure model than public cloud through adding additional layer of security (Singh & Chatterjee, 2017). Community cloud model eliminates the security risk of public cloud and the high cost of private cloud because it is shared and controlled by a limited number of organizations that have common interests (Ali, Khan, & Vasilakos, 2015).

Trust between organizations and service providers is one of the biggest challenges of cloud technology (Manuel, 2015). Providing cloud services by a third-party entails additional security threats (Ali et al., 2015). Many business managers are reluctant to shift their digital assets to third-party service providers, out of the administrative domain of the organization (Ardagna et al., 2015; Ali et al., 2015). Large cloud computing providers invest billions of dollars in improving their infrastructure to gain the trust of the clients (Alenezi, Tarhini, & Sharma, 2015; Tarhini et al., 2017). The results of a study by Sharma et al. (2016) showed that trust is a key determinant in adopting and using cloud services. Providing a trusted environment for the clients of cloud services is the main responsibility of cloud service providers (Khan, 2016; Ramachandran & Chang, 2016). Measuring trust is important for organizations to locate the trustworthy service providers and best resources (Manuel, 2015; Onar, Oztaysi, & Kahraman, 2018; Shaikh & Sasikumar, 2015b). The decision makers select the cloud service providers based on the trust on the quality of the provided services (Lang, Wiesche, & Krcmar, 2018). Security and availability are the main factors for selecting a trusted cloud service provider (Rajasree & Elizabeth, 2016).

Evaluating the advantages of cloud computing. Cloud computing is an IT trend that that simplifies the way of using computing resources and provides an opportunity for organizations to reduce IT operational costs (Chen et al., 2016). However, business managers should decide whether to adopt cloud technology based on the values that cloud computing will add to their businesses (Chen et al., 2016). Hameed and Counsell (2014) indicated that changing entire company processes and work procedures requires a

visible proof of the viability of the innovation before making the adoption decision. Johnston et al. (2016) revealed that increasing the interest in the usage of cloud computing among business organizations in South Africa requires evaluating the business value provided by the technology. Company leaders should evaluate the advantages and risks before rushing into cloud computing (Avram, 2014; Islam, Fenz, Weippl, & Mouratidis, 2017). Organization leaders should identify the way that cloud services can sustain the organization's economic objective related to financial, customer, internal, and learning-development elements (Avram, 2014).

Despite the acknowledged importance of cloud computing, many European companies do not exploit the cloud technology (Maresova & Klimova, 2015). The inability to count the return on investment was the main reason for the low-level adoption of cloud technology (Maresova & Klimova, 2015). Maresova and Klimova (2015) conducted a study to facilitate the decision-making process on investments into cloud computing for organizations. Similarly, Chen et al. (2016) conducted a study to assess the claimed business benefits of cloud computing. Although many researchers have reported substantial benefits for cloud computing adoption, the question of the impact of the moderating factors for these benefits remains unanswered (Chen et al., 2016). Managers need to see tangible, quantifiable benefits before investing in a new IT technology such as cloud computing (Chen et al., 2016; Maresova, Sobeslav, & Krejcar, 2017). Cloud computing generates different amounts of benefits based on cloud computing type, size of company, and area of implementation (Chen et al., 2016).

Compatibility and complexity. Hameed and Counsell (2014) suggested that innovation compatibility is important in both the adoption and implementation stages. Compatibility has a positive effect on adopting cloud computing in the services sector in Portugal (Oliveira et al., 2014). Yoo and Kim (2018) agreed with Alharbi et al. (2016) that compatibility with the organizations' information systems was behind other adoption factors. In contrary to the previous researchers, Tashkandi and Al-Jabri, (2015) mentioned that compatibility is not a significant factor for adopting cloud computing in the KSA. The results of Harfoushi et al.'s (2016) study supported the results of many types of research that technology factors including relative advantage, compatibility, and complexity have the most impact on the decision of adopting cloud services. However, Gutierrez et al. (2015) disagreed with the previous researchers that compatibility is not a major driver for the decision of cloud computing adoption.

Lal and Bharadwaj (2015) support what Gangwar et al. (2015) reported that the compatibility of cloud computing to integrate with the existing system is a significant enabler for the adoption decision. Organizational managers should prepare for smooth and successful adoption of cloud services to ensure the compatibility of IT legacy systems (Gutierrez et al., 2015). Managers may progressively enhance the Internet infrastructure, mobile technology, and skills of IT staff to allow smooth access to cloud services (Gutierrez et al., 2015). Increasing compatibility facilitates the integration of technology within an organization (Harfoushi et al., 2016). Hameed and Counsell (2014) suggested that organizations may need more time in the initiation stage to increase the awareness and familiarity of the innovation within the company.

Complexity is a clear barrier to cloud computing adoption (Gutierrez et al., 2015). Lal and Bharadwaj (2015) agreed with many researchers that degree of complexity has a negative impact on the decision to adopt cloud computing (Alshamaila et al., 2013; Oliveira et al., 214). In contrary to many studies, Hameed and Counsell (2014) indicated that innovation complexity is not a significant determinant of organizational adoption of IT. Organizational leaders tend to adopt the most advanced technology, regardless of its complexity to gain a competitive advantage (Hameed & Counsell, 2014). The complexity of using cloud computing may refer to the time taken to perform tasks, the efficiency of data transfer, integration with cloud infrastructure, interface design, and system functionality (Gangwar et al., 2015). Determining the complexity level is an essential step for organizations before moving to the cloud (Ray, 2016). Many cloud vendors do not consider the complexity of IT systems of some organizations (Gutierrez et al., 2015). Vendors should be more aware of their customers' needs to provide the suitable cloud services (Gutierrez et al., 2015). Data protection and privacy add another complexity to the process of selecting an appropriate vendor (Gutierrez et al., 2015).

Transition

Section 1 of this qualitative multiple case study covered the foundation of the study including problem statement, purpose statement and the central question of this study. Also, I addressed the nature of the study, the proposed interview questions, and Roger's DOI conceptual framework. Additionally, I discussed assumptions; limitations; and delimitations, and the significance of the study. In the review of the literature, I addressed the current status and future trends of cloud computing, the theoretical models

used in innovation adoption literature, cloud computing adoption in different contexts, and the perceived characteristics of cloud computing adoption. Section 2 includes the associated elements of the project of this study such as a detailed discussion of the research method and design and the research population. In Section 3, I will provide the research findings from the interviews, possible contributions to social change, applications to professional practice, recommendations for actions, and conclusions from the completed case study.

Section 2: The Project

Section 2 includes a restatement of the study purpose and an overview of the role of the researcher, the study participants, and the research method and design selected for the study. This section also contains information on key aspects of the study, including population and sampling, data collection instruments, data collection techniques, data organization techniques, and ethical procedures. In addition, in this section, I present the data analysis results and consider the study's reliability and validity.

Purpose Statement

The purpose of this qualitative, multiple case study was to explore the strategies that IT leaders in the manufacturing industry in the KSA use to adopt cloud computing to reduce IT costs. The target population of this study was five IT leaders from five different manufacturing companies in the Eastern region of the KSA who have successfully adopted cloud computing in their companies to reduce IT costs. The implications for positive social change include the potential to ensure the prosperity of the local economy in the KSA by ensuring business sustainability of the firms in the manufacturing industry in the KSA as a result of implementing cost-saving strategies associated with cloud computing adoption.

Role of the Researcher

My role as the researcher in this qualitative multiple case study was to design the study, collect data, and report the findings. As the primary investigator, I served as the primary instrument of data collection. Researchers serve as the primary research instrument to obtain data from respondents in qualitative research (Dikko, 2016). The

researcher as a human instrument can gain deep understanding of the participants' experience through direct involvement (Kaczynski, Salmona, & Smith, 2014). As a senior IT professional, I was acquainted with the topic of cloud computing as part of my knowledge acumen. I used my experience and awareness about the topic to understand the shared experience of the participants. I did not have any relationship with the participants of the study whether on the personal or professional level.

I adhered to all ethical standards and principles throughout the study as presented in the *Belmont Report* protocol. The *Belmont Report* contains the basic ethical principles and guidelines needed by researchers to avoid impartial selection of participants, respect respondents, maximize study benefits, and minimize risks (Ross, Iguchi, & Panicker, 2018). I adhered to the ethical principles including protecting participants from any potential harm by maintaining their privacy and confidentiality. Also, I demonstrated respect for the participants by obtaining each participant's consent. In addition, I completed the training offered by the National Institutes of Health to be aware of the policies and regulations that define human ethical research.

Bias has a negative effect on research studies because it may lead to data misinterpretation (Bengtsson, 2016). The personal experience, feelings, and viewpoints of qualitative researchers may lead to bias in presenting participants' perspectives (Enosh & Ben-Ari, 2016; Noble & Smith, 2015). To mitigate personal bias in my research, I used certain strategies to set my personal beliefs and opinion aside when collecting and analyzing data and when presenting the study findings. Using member checking, triangulation, detailed transcription, and a systematic plan and coding are strategies that

researchers can use during data collection process to mitigate personal bias (Gunawan, 2015). I used these strategies during the data collection stage to avoid viewing data through a personal lens.

Researchers use an interview protocol as a guide during interviews to ensure that they collect reliable and consistent data from each participant (Dikko, 2016). An interview protocol is a set of instructions for the interview including an introduction, study key questions, and possible follow-up questions ((Dikko, 2016; Yin, 2017). I used an interview protocol (see Appendix A) throughout the interviews to (a) facilitate the interview process, (b) ensure that I asked relevant questions in a uniform manner, and (c) correctly interpret participant responses. Using an interview protocol was also important to ensure adherence to participants' confidentiality and the data security standards of Walden University.

Participants

Researchers should establish eligibility criteria for participant selection to ensure the richness of the collected data (Sen et al., 2016), and to improve the breadth and depth of data (Charlick, Pincombe, McKellar, & Fielder, 2016). Knowledge about the research topic and personal experience are the main criteria used by most researchers to select participants (Gentles, Charles, Ploeg, & McKibbon, 2015; Palinkas et al., 2015). The criteria I used in selecting the participants of this study were that participants were (a) IT leaders in the manufacturing industry in the Eastern region of the KSA who had (b) successfully adopted cloud computing in their companies to reduce IT costs and

possessed (c) knowledge and experience of using cloud technology strategies to reduce IT costs and (d) the authority to participate in the study and provide information.

Gaining access to participants is crucial step for researchers in collecting data (Peticca-Harris, deGama, & Elias, 2016). By approaching the main cloud service providers in the Eastern region in the KSA, I obtained a list of manufacturing companies in the region that have cloud services implementation. Before recruiting participants, I had to sign a letter of cooperation (see Appendix B) by the authorization official of each company. Telephone communication is a common way to recruit participants and build rapport with them (Darcy-Jones & Harriss, 2016). Using phone calls as a strategy for recruiting participants is an efficient way to increase the rate of acceptance to participate in a study (Cridland, Jones, Caputi, & Magee, 2015). I used phone calls to obtain initial approval from prospective participants to participate in the study. I chose five candidate participants who fit the selection criteria and who agreed to participate voluntarily in the study.

Case-study researchers need to establish a working relationship with participants to ensure proper implementation of the case-study protocol (Yin, 2017). Researchers can work to build rapport with participants as soon as they meet to gain the participants' trust (Flurey, 2015; Yin, 2017). My strategy to establish a working relationship with the participants included inviting potential candidates to participate, clarifying the voluntary nature of participation, providing a consent form for signing, and assuring participants that I would share a copy of the research findings with them. Through communication with the participants, I confirmed the alignment of their experience with the research

questions. Yin (2017) stated that selecting properly informed participants is important for a successful research outcome. I took steps to ensure that I selected participants who had significant experience in adopting and implementing cloud computing in their companies.

Research Method and Design

Research Method

In this research study, I used a qualitative research methodology to explore the strategies that IT leaders in the manufacturing industry in the KSA use to adopt cloud computing to reduce IT costs. Qualitative methodology is appropriate for researchers when they seek to obtain detailed insight of peoples' experiences, beliefs, and emotions (Antwi & Hamza, 2015; Leung, 2015). In qualitative studies, researchers perform rigorous investigations to uncover in-depth information without using statistical data analysis (Antwi & Hamza, 2015; Leung, 2015; Sarma, 2015). Qualitative researchers can use various techniques for collecting data such as interviews, document review, observations, and analysis of multimedia materials (DeMassis & Kotlar, 2014; Yin, 2017). Collecting subjective content is appropriate for qualitative research studies (Abdinnour & Saeed, 2015; Antwi & Hamza, 2015; Leung, 2015). Yin (2017) highlighted that using open-ended questions in qualitative research reduces the possibility that participants' responses will be constrained. By using a qualitative methodology and asking open-ended interview questions, I was able to explore IT leaders' viewpoints on adoption strategies for cloud computing to reduce IT costs.

Researchers use the quantitative methodology when they intend to collect and use quantifiable statistical data to test a theory or a hypothesis (Marshall & Rossman, 2016;

McCusker & Gunaydin, 2015; Yin, 2017). Unlike qualitative methodology, the data collected in quantitative research is used to express the relationship between measured variables (Antwi & Hamza, 2015). Using quantitative methodology is not appropriate when the researcher's objective is to explore experiences and attitudes regarding individual situations (McCusker & Gunaydin, 2015). Quantitative methodology was not appropriate for this study because my objective was neither to collect numerical data nor to test a theory. Researchers use a mixed methodology when answering the research questions is not achievable by using a qualitative or a quantitative methodology alone, or when using one method is required to clarify the other (McCusker & Gunaydin, 2015). Using a mixed methodology requires collecting quantifiable or numerical data for statistical analysis in one phase. In this study, using qualitative methodology was sufficient to answer my research question without needing to collect quantifiable or numerical data.

Research Design

The qualitative research designs include narrative, phenomenology, ethnography, and case study (Yin, 2017). In this study, I chose a multiple-case study design to explore the strategies that IT leaders in the manufacturing industry in the KSA use to adopt cloud computing to reduce IT costs. A case study design is appropriate to discover the sophisticated professional facts of the experienced, professional participants (Dasgupta, 2015). Using a case study design, researchers can use multiple data sources such as interviews with participants, observations, and document reviews to conduct in-depth analysis of a phenomenon (Yin, 2017). Researchers can use the logical structure of the

case study design to connect information to the research question (Yin, 2017). A multiple case study design increases the credibility of the research because researchers can gain an in-depth understanding of a phenomenon through gathering data from multiple cases (DeMassis & Kotlar, 2014). Case study was the most appropriate design for this study over other alternatives.

Researchers use a narrative research design to tell the bibliographical stories of the participants (Yin, 2017), which was not appropriate to this study. Researchers use a phenomenological research design to understand the experiences of a group of people about a social phenomenon (Creswell, & Poth, 2018; Mayoh & Onwuegbuzie, 2015). Using a phenomenological research design is ideal to study life experiences of individuals in the real world (Cibangu & Hepworth, 2016; Creswell, & Poth, 2018). A phenomenological research design was not appropriate for this study because the objective was to discover professional facts from experienced participants, rather than discovering the actual life experiences of those participants. Researchers use an ethnographic study design when the objective is to get detailed information about specific communities, cultures, or social groups (Creswell, & Poth, 2018; Pluye, Hong, Bush, & Vedel, 2016). Using an ethnographic research design is ideal to explore the shared patterns among groups of individuals (Creswell, & Poth, 2018; Kalou & Sadler-Smith, 2015). An ethnographic research design was not appropriate for this study because the objective was to explore the participants' strategies, rather than exploring the shared patterns among those participants.

Researchers reach data saturation in a qualitative study when collecting new data does not yield new information (Yin, 2017). Data saturation occurs when the collected data is sufficient to sustain the study, and when conducting additional interviews will not add new data or themes (Fusch & Ness, 2015). Interviewers can increase the probability of data saturation by asking the participants specific questions to ensure including all aspects of the phenomenon of interest (Palinkas et al., 2015). During interviews, I asked the participants specific open-ended questions until no additional information or themes have arisen to ensure data saturation. Using secondary data sources confirms the findings of the primary source (Graue, 2015), and increases the probability to attain data saturation (Fusch & Ness, 2015). Researchers apply triangulation by using multiple data sources to enhance the reliability of results and to attain data saturation (Fusch & Ness, 2015). Using triangulation has a direct link to data saturation because one ensures the other (Fusch & Ness, 2015). In this study, I applied triangulation through collecting data from multiple sources such as interviews, review of company documents, and follow-up interviews to ensure data saturation.

Population and Sampling

The targeted population for this study consisted of IT leaders from different manufacturing companies in the Eastern region of the KSA, who have successfully adopted cloud computing in their companies to reduce IT costs. The main criteria for selecting participants included their knowledge and experience in using cloud computing adoption strategies to reduce IT costs, and the availability to provide such information. I used purposeful sampling to identify the participants in this study. The purposeful

sampling is a non-random sampling method (Benoot, Hannes, & Bilsen, 2016), which is useful for researchers to ensure the capability of the participants to address the research and interview questions (Robinson, 2014). Using purposeful sampling is appropriate for qualitative research because researchers can select the participants who have relevant knowledge and experience to address the research context and problem (Palinkas et al., 2015). Unlike using random sampling methods to minimize bias in the quantitative studies (Palinkas et al., 2015), the purposeful sampling is appropriate for qualitative studies to maximize the information gained from limited sample size (Duan, Bhaumik, Palinkas, & Hoagwood, 2016).

Researchers can use a small sample size for a case study research (Boddy, 2016). Unlike the quantitative studies, the qualitative studies have a smaller sample size (Malterud, Siersma, & Guassora, 2015). The small sample size is appropriate for researchers to identify thematic expressions and perform in-details analysis of the participants' responses (Fusch & Ness, 2015). To answer the research question appropriately, the sample size should be broad enough (Fusch & Ness, 2015). Yin (2017) asserted that researchers must use adequate sample size to attain data saturation. In qualitative research studies, researchers determine the best sample size depending on the purpose of the research, research question, and the value of the collected data (Malterud et al., 2015). Using a sample size of four or five participants in a case study research is suitable for gathering data (Creswell, & Poth, 2018). Researchers need to use adequate number of participants in a case study research to achieve data saturation (Creswell, & Poth, 2018). I followed the recommendations of Creswell and Poth (2018) by selecting

five IT leaders from five different manufacturing companies in the Eastern region of the KSA, who have successfully adopted cloud computing in their companies to reduce IT costs.

Data saturation is essential for the qualitative research quality (Lowe, Norris, Farris, & Babbage, 2018). Failing to achieve data saturation has a negative impact on the content validity and the results (Fusch & Ness, 2015). Researchers achieve data saturation when they can no longer identify new themes (Fusch & Ness, 2015). Hennink, Kaiser, and Marconi (2017) suggested that starting the data analysis process early after few interviews is useful for researchers to attain data saturation. Data saturation is a key determinant to indicate the best sample size of a study (Bekhet & Zauszniewski, 2012; Fusch & Ness, 2015). Yin (2017) posited that researchers should maintain sufficient sample size as appropriate to contain consistent patterns with no new themes. I continued to conduct face-to-face interviews with five IT leaders until data saturation. I ensured that no new themes were emerging during the interviews. I did not need to add more participants because the responses of the participants were duplicative, and no significant information emerged.

Compared to survey instruments, semistructured, open-ended interviews provide more extensive, rich data (Yin, 2017). I set up face-to-face interviews with the participants rather than using phone calls or video conference. A face-to-face interview is the primary means of data collection in the qualitative studies because interviewees are more likely to share more stories than other types of interviews (Bowden & Galindo-Gonzalez, 2015). Selecting a setting with little distraction is important for researchers to

set the stage for interviewing (Dikko, 2016). I conducted the interviews in a private, safe space such as the participant's office or conference room to avoid distractions. Recording interviews is an appropriate choice to capture data more effectively (Jamshed, 2014). Researchers might miss some key points when using handwriting during the interview (Jamshed, 2014). I used the audible recording rather than handwriting to focus on listening and understanding the participants' responses.

Ethical Research

For academic graduate level education, conducting ethical research is a major requirement (Whelan, 2018). Researchers must obtain Institutional Review Board (IRB) approval from the university when the research involves human subjects (Kaczynski et al., 2014). The IRB approval should include respect, beneficence, and justice as the three main principles for protecting the participants (Kaczynski et al., 2014). Obtaining participants' consent before collecting data is necessary to maintain ethical research (Makhoul, Chehab, Shaito, & Sibai, 2018; Noain-Sanchez, 2016). The process of informed consent includes the participants' affirmation to participate and understand all aspects of the study in a written form (Harriss, Macsween, & Atkinson, 2017). I obtained the approval of IRB of Walden University before conducting the study (IRB # 02-01-19-0632933). I sent by email the consent form to the selected participants and asked them to confirm their willingness to participate in the study.

Researchers must inform participants about the voluntary nature of their academic research (Harriss et al., 2017; Robinson, 2014). The participants of this study did not receive any incentives for their participation. Using financial incentives motivates the

participants to potentially provide fabricated information during the interview to gain money (Robinson, 2014). I clarified to the participants the potential benefits of the study. Robinson (2014) suggested that clarifying the potential applied benefits of the research may act as an incentive for many participants. Yin (2017) suggested that researchers should provide an option to the participants to withdraw from the study at any time. The informed consent form includes details about how participants can withdraw from the study at any time. The participants of this study was able to withdraw by submitting an email notification or by making a direct phone call to me.

Protecting the confidentiality of participants is the researcher's responsibility (Doody & Noonan, 2016). The obtained personal information of participants must not lead to their identity (Doody & Noonan, 2016). I used generic codes such as P1 and P2 for participants, and C1 and C2 for companies, instead of using the actual names, to ensure confidentiality and privacy of participants. Prior to any agreement to participate, researchers should inform the participants the purpose of the study, the processes they will use to protect personal information, the voluntary nature of the study, and what participation entails (Robinson, 2014). Each participant received a copy of the consent form that includes detailed considerations and measures about the ethical protection of the participants. Doody and Noonan (2016) recommended maintaining all data in a safe place for 5 years to protect the participants' confidentiality and to support the audit trail of the study. I will store the collected data and transcripts in a personal, protected hard drive for 5 years. After 5 years, I will delete the stored digital data from the hard drive, and I will destroy all printed materials.

Data Collection Instruments

In this qualitative multiple case study, I was the primary data collection instrument. In qualitative studies, researchers act as a human instrument because they directly observe the meanings and knowledge during data collection (Kaczynski et al., 2014). Researchers use different qualitative data sources to collect data including interviews, direct observations, historical records, and documentation (DeMassis & Kotlar, 2014). Interviews are the most common tool for collecting data in qualitative research (Jamshed, 2014). I used a semistructured interview technique with open ended questions and concluding questions to ensure understanding. I asked the participants if they have anything additional to offer. Using semistructured interviews is a useful technique for qualitative researchers to capture rich data, interpret information, and make a judgement about the participants' thoughts (Elsawah, Guillaume, Filatova, Rook, & Jakeman, 2015).

Interview protocol is a structured process for researchers to follow for pursuing the line of inquiry (Dasgupta, 2015). The interview protocol (see Appendix A) of this study includes six open-ended questions covering the participant's experience of strategies used to adopt cloud computing to reduce IT costs. I used the same questions, for all participants, as outlined in the interview protocol systematically. Interview protocol is useful to explore different respondents systematically and to optimize the utilization of interview time (Jamshed, 2014). I asked probing, follow-up questions when the participant's responses required clarification. Using follow-up questions or prompts are important for researchers to ensure obtaining the optimal responses from participants

(Kallio, Pietila, Johnson, & Kangasniemi, 2016). I used a digital recording in the interview to focus on the verbal prompts and to facilitate generating interview transcript, as recommended by Jamshed (2014).

Triangulation provides multiple ways for researchers to explore deep understanding by collecting data from multiple sources (Kaczynski et al., 2014; Morse, 2015). The use of multiple data sources enhances the researcher's understanding of the whole phenomenon and increases the data credibility (DeMassis & Kotlar, 2014; Kaczynski et al., 2014). Integrating secondary sources of information is useful for constructing the validity of a study (DeMassis & Kotlar, 2014; Morse, 2015). Researchers apply triangulation by collecting different types of qualitative data including site documents, field observations, and interviews (Kaczynski et al., 2014). I reviewed the relevant company documents including printed and digital materials as a secondary data source to enhance data validity. Member checking is the process of taking the collected data back to the participants for verification and ensuring accuracy (Harvey, 2015; Morse, 2015). Researchers can use member checking to reduce the misinterpretation threats and to improve the validity and accuracy of the researchers' observations (Morse & McEvoy, 2014). After transcribing the recorded interviews, I ensured that each participant received and reviewed my interpretation to increase the reliability and validity of my observation.

Data Collection Technique

Interviews are the most appropriate method for collecting data for a case study because most of the case studies are about human matters (Morse & McEvoy, 2014).

Face-to-face interviews provide the most valid form of data collection over other interview methods (Morse & McEvoy, 2014). Researchers use either structured, semistructured or unstructured interviewing for developing an account of a situation (Dikko, 2016). Researchers can address the case study topic directly in the semistructured interviews, through preparing the interview questions in a targeted manner (Yin, 2017). Using open-ended and follow-up questions in the semistructured interviews are useful for researchers to gain in-depth information from the opinion of industry professionals (Yin, 2017). For this study, I used semistructured, open ended questions and conducted face-to-face interviews as the primary data collection technique. Researchers integrate data collected from multiple sources of information in a triangulation process to ensure validity (DeMassis & Kotlar, 2014). I used the relevant company documentation as a secondary source of information to implement triangulation. The documentation included information about cloud adoption strategies, cloud adoption reports, and IT cost metrics.

Before conducting interviews and reviewing company documentation, I asked the authorization official of each manufacturing company to sign the letter of cooperation (see Appendix B). I started the data collection process after receiving the IRB approval from Walden University (IRB # 02-01-19-0632933). Each potential participant received a formal email notification regarding the study. The email notification included an attachment of the consent form. After receiving a signed consent form from each participant, I arranged a date, time, and location for the interview. I started the interview session by noting the time, turning on the audio recorder, and greeting the participant. During a 30 to 60 minutes interview, I asked the participant six open-ended questions in a

systematic manner. Each participant had enough time to respond to each question. I used probing and follow-up questions, as needed, to gain further information or clarification for a specific point. After completing each interview, I collected any supportive documents related to the implemented adoption strategies of cloud computing to reduce IT costs.

Face-to-face interviews are useful for researchers to build rapport with participants (Elsawah et al., 2015). With face-to-face interviews, researchers collect data synchronously with social cues, which decrease the misinterpretation of the collected data (Bowden & Galindo-Gonzalez, 2015). Face-to-face interviews provide additional data because the participants can share more stories (Bowden & Galindo-Gonzalez, 2015). However, some of the collected data from face-to-face interviews are not relevant to the research questions (Bowden & Galindo-Gonzalez, 2015). Face-to-face interviews might include background noise (Bowden & Galindo-Gonzalez, 2015). Many researchers have demonstrated that data collected verbally via face-to-face interviews is less succinct than the data collected via online text (Abrams, Wang, Song, & Galindo-Gonzalez, 2015). The transcript of face-to-face interviews is a time-consuming process (Yin, 2017).

Similar to interviews, reviewing company documentation includes advantages and disadvantages. Reviewing company documentation provides many advantages for researchers such as providing background information, gaining insights to research problem, and developing understanding (Bretschneider, Cirilli, & Jones, 2017). Researchers can validate the collected information from the interviews by accessing, reviewing, and analyzing company documentation (Morse, & McEvoy, 2014). Reviewing

corporate documents and business reports provide another source of information for researchers to compare the responses of the interviewed participants (Dasgupta, 2015). Using company documentation as another source of data enables researchers to triangulate the data (Yin, 2017). However, reviewing a large volume of company documentation involves a significant amount of time (Yin, 2017). Some researchers face difficulties in gaining access to company documentation.

Member checking is the process of reviewing the researcher's interpretation of the interview transcript by the participant for confirmation (Harvey, 2015). Member checking is a component of data triangulation, which is important for researchers to reduce the misinterpretation threat, and to increase the validity and accuracy of observations (Morse, & McEvoy, 2014). I provided each participant with the opportunity to review his or her interview responses. I considered any potential comments from participants that may require revising transcript, as needed. Using a pilot study prior to conducting interviews is an effective method to increase validity and reliability of the interview instrument (Yin, 2017). However, Kaur, Figueiredo, Bouchard, Moriello, & Mayo (2017) stated that small and non-random sampling of pilot studies may affect negatively the feasibility of conducting these studies. I did not use a pilot study to avoid wasting time and monetary resources.

Data Organization Technique

The collected data included semistructured interviews and a review of the relevant company documentation. During the interviews, I used an electronic recording device to record the interviews to aid in generating an interview transcript. Researchers use a

recording device to capture, preserve, and bind the natural setting of an interview (Nordstrom, 2015). Recording interviews is useful for researchers to capture data more effectively than using paper notes (Jamshed, 2014). I used Microsoft Word and Excel for data organization. The rigorous organizational process for the collected data is a vital step for researchers to develop valuable results (Morse & McEvoy, 2014). I compiled the participants' response to the interview questions, interview notes, and company documentation into a Microsoft Word document. Protecting the personal identity of the participants is the researcher's responsibility (Doody & Noonan, 2016). I used alphanumeric coding system such as P1 and P2 for participants, and C1 and C2 for companies, to protect the identity of each participant.

I created a digital folder on my desktop computer to save the compiled data for each participant. After completing the member checking process with all participants, I revised and saved the compiled data into one Excel file for better organization. Organizing the interview data is necessary for identifying the emerging themes, patterns, and trends in the subsequent operations (Yin, 2017). I used NVivo software v12 to organize the compiled data into codes and themes. NVivo provides several features, functions, and capabilities that are crucial for qualitative data management (Zamawe, 2015). I used Excel sheet to save the output from NVivo software. I saved the input and output data in a password protected flash drive. Researchers rely on digital drives and CDs as an easy way for storing their data (Weller & Monroe-Gulick, 2015). I stored the flash drive and the paper materials in a locked cabinet in my home. No one will have

access to the data for 5 years. By the end of the fifth year of publication, I will destroy all digital data and paper materials.

Data Analysis

Methodological triangulation is the convergence of multiple methods of data collection to establish themes (Morse & McEvoy, 2014). Researchers use methodological triangulation to correlate data collected by more than one method (Bekhet & Zauszniewski, 2012; Fusch & Ness, 2015). Methodological triangulation is useful for researchers to gain a deep understanding of the primary research question, increase the validity of the study, and help confirm the results of a study (Bekhet & Zauszniewski, 2012). Researchers collect and analyze different sources of information in a case study to obtain convincing and accurate findings (Yin, 2017). I used methodological triangulation with interviews as the primary source of data and review company documentation as the secondary source of data. Using methodological triangulation is important for researchers to ensure that the data is rich in depth, and to attain saturation (Fusch & Ness, 2015). Methodological triangulation increases the reliability of results obtained in a social science study (Heesen, Bright, & Zucker, 2016). Using methodological triangulation increases the study validity and credibility when studying social science issues (Lodhi, 2016).

In qualitative research, analysis of qualitative data is a challenging process (Kaczynski et al., 2014). Researchers perform data analysis concurrently with the data collection process (DeMassis & Kotlar, 2014). Researchers shift concurrently between inductive and deductive reasoning to support discovering social meanings (Kaczynski et

al., 2014). I performed the data analysis iteratively by moving back and forth between the data and the emerging evidence. Analyzing each data source independently has a significant risk associated with the data analysis process (DeMassis & Kotlar, 2014). Data analysis starts with placing the collected pieces of the puzzle on a table to make sense of the data, and to generate different pictures (Kaczynski et al., 2014). I started the data analysis process by transcribing the recorded interviews, interview notes, and company documentation into one document. Qualitative researchers should use a systematic approach and explain the process when analyzing data (DeMassis & Kotlar, 2014). I explained the data analysis process as an important step to evaluate the strengths of a case study (DeMassis & Kotlar, 2014).

Preparing collected data for analysis includes data reduction, display, categorization, and contextualization (DeMassis & Kotlar, 2014). Data reduction includes simplifying the collected information to facilitate the subsequent analysis of evidence (DeMassis & Kotlar, 2014). I simplified the data by selecting and focusing on the most useful data for answering the research question. Data display means organizing the collected data to ease the identification of themes and conclusions (DeMassis & Kotlar, 2014). I highlighted the data that have a common meaning such as a passage of text, a part of an image, or a diagram. Data categorization includes grouping and distinguishing different categories of information into distinct groups (DeMassis & Kotlar, 2014). I categorized the collected information by searching for similarities and differences in the data to decompose or aggregate information into categories. Data contextualization includes identifying connections between the external contingencies and the collected

data to enlighten the contextual conditions of the relationships (DeMassis & Kotlar, 2014). I implemented the data contextualization by identifying the links and connections between the collected information and the contextual conditions.

Using qualitative data analysis software (QDAS) is useful for researchers in coding and organizing large amount of data (DeMassis & Kotlar, 2014; Zamawe, 2015). The main function of QDAS is to support the analysis process rather than performing the analysis for researchers (Zamawe, 2015). Before using QDAS, researchers were using papers, scissors, and colored highlighters to identify patterns from the transcribed data (Kaczynski et al., 2014). Qualitative researchers can use QDAS to develop connections and discover relationships throughout the collected data to construct codes and themes (Kaczynski et al., 2014). I used NVivo software version 12 to support the data analysis process. I used NVivo for coding and for exploring patterns across the data. Finally, I exported the output from NVivo software to an Excel file for the presentation of the findings.

NVivo software extracts the information that relates to each other into nodes. The extracted nodes provide a structure, compatible with the thematic analysis approach, for creating codes and finding themes. Grouping and conceptualizing the objects that have common pattern into themes is important to understand the study phenomenon and to draw conclusions (Dasgupta, 2015). The generated themes included the strategies that IT leaders in the manufacturing industry in the KSA use to adopt cloud computing to reduce IT costs. I compared the generated themes with the results from the recent studies in the literature review to find similarities and differences. Also, I discussed the correlation

between the generated themes and the characteristics of the diffusion of innovation theory as the conceptual framework of this study.

Reliability and Validity

Reliability and validity are the criteria used for determining the trustworthiness of qualitative research (Morse, 2015). Many students employ the concept of reliability and validity of quantitative research in their qualitative dissertations incorrectly (Anney, 2014). Researchers should use different approaches for assessing the trustworthiness of qualitative and quantitative research because both methods have different assumptions in the nature of (a) reality, (b) inquirer-object relationships, and (c) truth statements (Anney, 2014). In qualitative research; dependability, credibility, transferability, and confirmability correspond respectively to reliability, internal validity, external validity, and objectivity. (Anney, 2014; Morse, 2015).

Reliability

Reliability of research refers to whether or not the results are repeatable (Leung, 2015). Reliability means obtaining the same results if the study is repeated by someone else (Morse, 2015). Researchers attain reliability when their studies are stable and not subject to random variation (Morse, 2015). By developing a coding system for use through semistructured interviews, researchers can achieve reliable studies (Morse, 2015). A reliable coding system includes listing all possible items, using duplication, and standardizing the coding decision (Morse, 2015). Other strategies to attain reliability include member checking, triangulation, peer-reviewed debriefing, and external audit (Morse, 2015).

Dependability. In qualitative research, dependability refers to the reliability and consistency of the study (Hays, Wood, Dahl, & Kirk-Jenkins, 2016). Dependability in qualitative research is similar to reliability in quantitative research (Bekhet & Zauszniewski, 2012). To ensure dependability, I developed a coding system, in which I considered the reliability of a piece of information if it exists in two interviews at least, or if it has a confirmation in the secondary data source. I used member checking to provide further enhancement of dependability and accuracy of the findings. Researchers use member checking to ensure understanding the responses of the participants correctly (Morse, 2015). Member checking is a respondent validation technique by returning the data or results to participants to check for accuracy of their responses (Birt, Scott, Cavers, Campbell, & Walter, 2016). After conducting the interviews, I sent my interpretations to each participant for review and verification. The participants was able to correct any misinterpretation of their ideas to improve the accuracy of the research observations.

Validity

The validity of research refers to whether or not the final results represent what the researcher claims (Leung, 2015). Researchers attain validity when the findings of the research reflect the collected data accurately (Noble & Smith, 2015). The strategies to ensure validity include a thick description, triangulation, member checking, peer review debriefing, and external audits (Morse, 2015). To enhance the validity of a study, DeMassis and Kotlar (2014) suggested that researchers should (a) triangulate data from multiple sources (b) share data with participants, and (c) share transcript and drafts with

other investigators. In qualitative research, the criteria to construct validity include credibility, transferability, and confirmability. (Gunawan, 2015; Morse, 2015).

Credibility. The credibility of a study is the accuracy of the study inferences (Morse, 2015). Credibility involves ensuring that the findings of a study represent the original data correctly (Anney, 2014). Achieving credibility in qualitative research is similar to achieving internal validity in quantitative research (Bekhet & Zauszniewski, 2012). The strategies to attain credibility include triangulation, member checking, reflexivity, and prolonged field experience (Anney, 2014). I used methodological triangulation and member checking to ensure the credibility of the study. Using triangulation is useful for increasing the credibility of a study (Yin, 2017). Methodological triangulation is the use of multiple methods simultaneously in collecting and analyzing data to increase the validity of the results (Heesen et al., 2016). Researchers can enhance the validity of their research by using member checking for accuracy verification (Birt et al., 2016).

Transferability. Transferability is the ability to apply the findings of a study to another situation or population (Morse, 2015). Transferability in qualitative research is corresponding to external validity in quantitative research (Bekhet & Zauszniewski, 2012). Researchers can increase the transferability of the research by using thick description and purposeful sampling (Anney, 2014). Researchers can apply thick descriptions by clarifying all the research processes including data collection, data analysis, and the conclusion of a study (Anney, 2014). I provided a detailed explanation of every research process including data collection, data analysis, and final results to

improve transferability of the study. Collecting and interpreting data of the most knowledgeable people about the case enhances the generalization of the study results (Morse & McEvoy, 2014). I used purposeful sampling to select the participants with high knowledge and experience of using adoption strategies of cloud computing to reduce IT costs to improve transferability of the study.

Confirmability. Confirmability of research refers to the ability of the researcher to provide unbiased interpretations of the data, derived directly from the participants' responses (Anney, 2014). Researchers use confirmability in qualitative research as analogous to using objectivity in quantitative research (Bekhet & Zauszniewski, 2012). Researchers use triangulation, audit trail, and reflexive journal strategies to achieve confirmability (Anney, 2014; Morse, 2015). I used methodological triangulation to ensure confirmability of the study. The convergence of multiple methods in methodological triangulation provides a better conclusion than the one of a single method (Heesen et al., 2016). An audit trail is a collection of notes and materials that document the researcher's assumptions and decisions of collecting, recording, and analyzing data (Hadi & Closs, 2016). I maintained audit trail by keeping and cross-checking recorded interviews, interview notes, company documentation, coding procedure, and data analysis decisions to ensure confirmability.

Data Saturation. Data saturation occurs when collecting more data will not add new information or themes (Fusch & Ness, 2015). Failing to attain data saturation has a negative effect on content validity and the quality of the research (Fusch & Ness, 2015). Researchers use triangulation as a method to attain data saturation (Fusch & Ness, 2015).

Qualitative researchers must use multiple sources of data to ensure the validity of study results through data saturation (Fusch & Ness, 2015). By reaching saturation, researchers can achieve transferability of their study (Bekhet & Zauszniewski, 2012). Reaching data saturation is essential to ensure the credibility of qualitative findings (Anney, 2014). Achieving data saturation by using appropriate sample size and collecting thick, rich data is necessary to ensure the validity of a study (Morse, 2015). To reach data saturation, I collected thick, rich data from multiple sources. I conducted interviews with 5 participants, reviewed relevant documents, used member checking until no emerging themes existed.

Transition and Summary

The purpose of this qualitative multiple case study was to explore the strategies that IT leaders in the manufacturing industry in the KSA use to adopt cloud computing to reduce IT costs. In section 2, I started with describing the role of the researcher and participants. I explained research method and design, instruments and techniques used in data collection and organization, and the methods of data analysis. Finally, I identified the assessment criteria of trustworthiness of the study. I discussed the reliability and validity of the research in the form of dependability, creditability, transferability, and confirmability. In section 3, I will present the findings of the study, application of the findings to professional practice, implications for social change, my recommendations for actions and further research, and my reflections and conclusions.

Section 3: Application to Professional Practice and Implications for Change

Introduction

The purpose of this qualitative, multiple case study was to explore the strategies that IT leaders in the manufacturing industry in the KSA use to adopt cloud computing to reduce IT costs. I interviewed five IT leaders who have successfully adopted cloud computing in their companies to reduce IT costs. During the semistructured interviews, the participants responded to six open-ended questions. The collected data included the participants' responses to the interview questions and a review of company documents containing information on cloud adoption strategies, cloud adoption reports, and IT cost metrics. Following the interviews, I transcribed the collected data. After doing so, I sent the transcriptions to the participants for validation. I analyzed the collected data manually, and I confirmed the results by using NVivo qualitative data analysis software. The analysis resulted in the identification of five main themes that address the strategies used by IT leaders in adopting cloud computing. The main themes were (a) identify business needs and requirements, (b) apply value realization metrics, (c) plan for migration, (d) choose the right cloud service provider, and (e) provide adequate training and awareness sessions.

Presentation of the Findings

The overarching research question for this study was, what strategies do IT leaders use to adopt cloud computing to reduce IT costs? After receiving IRB approval, I contacted the prospective participants, who were five IT leaders who have successfully adopted cloud computing in their companies to reduce IT costs, and obtained their

consent to participate in the study. During face-to-face interviews the participants described their deep experience in developing strategies to adopt and implement successful cloud computing. Other collected data included documents provided by participants containing information about cloud adoption strategies, cloud adoption reports, and IT cost metrics. Five themes emerged from the data analysis. The five themes were identify business needs and requirements, apply value realization metrics, develop a plan for migration, choose the right cloud service provider, and provide adequate training and awareness sessions. Table 2 shows the frequency and percentage of each of the main themes. In the discussion that follows Table 2, I use code names to identify interviewees as P1, P2, P3, P4, and P5 to protect participants' privacy. I use C1, C2, C3, C4, and C5 to identify participants' companies.

Table 2

Themes That Address the Strategies Used by IT Leaders

Themes	Frequency	Percentage
Identify business needs and requirements	33	29%
Apply value realization metrics	24	21%
Develop a plan for migration	22	19%
Choose the right cloud service provider	21	19%
Provide adequate training and awareness sessions	13	12%
Total of all sources	113	100%

Theme 1: Identify Business Needs and Requirements

The first theme that emerged from my analysis of the data was identifying business needs and requirements. The findings from my analysis showed that identifying business needs and requirements is the first step for a successful cloud computing adoption and implementation. That is, understanding the business needs and requirements of all stakeholders is essential to determine the conditions and capabilities of cloud computing model to solve a specific business problem or to achieve a specific objective. This theme is consistent with Rogers' (2003) statement that the initial stage of adopting a new technology or innovation starts with identifying and prioritizing the organization's needs and problems to locate the potential usefulness of the new technology. As researchers have noted, business needs and requirements are the main factors for determining the best deployment model of cloud services for the manufacturing enterprises (He & Xu, 2015). Hameed and Counsell (2014) indicated that compatibility with organizational needs and work practices decreases the adopters' resistance to an innovation or technology.

P1 stated that the first priority is to identify the company's needs to avoid paying hundreds of thousands of dollars for a system that no one will take advantage of. P1 conducted a meeting with all business leaders such as product managers, regional managers, general managers, and sales managers to listen to their expectations for the new system. P2 emphasized that identifying business needs is necessary to choose which type of cloud solutions is suitable for the business case. P2 said, "We don't build solutions for cloud strategy in mind. We focus first on the business requirements, then we think about the business state and the project assessment." P4 mentioned, "Business

needs were the main drivers for adopting cloud computing to improve our business efficiency to overcome the business collapse in Saudi Arabia in the last two years." P5 revealed, "We started with discussing the business needs first to determine the things that we need to adopt and the things that we need to change."

Companies have different business needs and requirements. A conclusion drawn from study findings and from the literature (see Rogers, 2003) is that identifying business needs and requirements is important for IT leaders to understand the determinants affecting the decision to use cloud computing. The findings showed that the main factors influencing the adoption decision include cost reduction, flexibility, reliability, agility, scalability, mobility, and ease of use. Cloud computing provides several benefits for organizations not available from traditional ICT systems. These benefits include flexibility, scalability, availability, reliability, improved resource utilization, cost saving, and business continuity and disaster recovery capabilities (Carcary et al., 2014; Giacobbe et al., 2015; Yamin & Al-Makrami, 2015). The relative advantage of cloud computing includes improving scalability, accessibility, and on-demand deployment time (Lal & Bharadwaj, 2016).

P1 stated, "The start point for thinking about cloud computing was when we found that the business is expanding, the storage system ought to change, the system doesn't support the modern style reporting, and the remote access is not allowed." P1 elaborated, "Cloud eliminated the problem of depreciating the hardware every few years. The benefits of cloud services included the agility, flexibility, and simplicity of doing the business. Cloud services provided flexibility to update or switch easily to another

system." P3 revealed, "The cloud system solved the problem of having at least three versions gap behind the latest version of our applications. The cloud system eliminated the burden of taking care of our hardware, servers, performance, man power, backup, and disaster recovery." P4 stated, "Agility and scalability are the main benefits for cloud services. The agility of cloud services enabled us to fulfil the new requirements that the dynamic business adds frequently." P5 mentioned, "The cloud services solved the problem of increased number of interruptions and downtime of our servers. The cloud services provided 99.99% availability, eliminated the maintenance headache, and provided ease of access and upgrade to the latest software versions." The review of cloud reports documentation for C5 supported participants' responses by illustrating the significant reduction in the number of server downtime and interruptions after moving to cloud.

Cost reduction is one of the factors that organizations should consider when determining the needs and feasibility of adopting cloud computing (Ray, 2016). P1 mentioned, "The comparison study between on-premises model and cloud model showed that we can save more than 50% of the IT infrastructure cost. The review of the IT cost metrics documentation for C1 showed that the IT budget was reduced by 35% after moving to the cloud computing. P2 stated, "The cost reduction comes when we don't have to buy a new hardware every three years as per our depreciation policy." P3 revealed, "Cost benefit is one of the main advantages of implementing cloud technology. Cloud computing reduced significantly the cost of upgrading the hardware and software, which was a costly process in terms of time, money and needed expertise." P4 declared,

"Although the cost reduction was not the most important element when we decided to move to cloud, it was a significant element to take into consideration." P5 stated that moving to cloud provided significant financial benefits through improving the utilization of IT human resources and reducing the cost of licenses.

Theme 2: Apply Value Realization Metrics

The second theme that emerged from my analysis of the data was applying value realization metrics. The findings indicated that showing tangible business value of cloud computing by using appropriate metrics is crucial for the success of the adoption process. The value realization metrics may include return of investment (ROI), total cost of ownership (TCO), and cost-benefit analysis (CBA). Chen et al. (2016) stated that business managers should decide whether to adopt cloud technology based on the values that cloud computing will add to their businesses. Hameed and Counsell (2014) indicated that changing entire company processes and work procedures requires a visible proof of the viability of the innovation before making the adoption decision. Johnston et al. (2016) revealed that increasing the interest in the usage of cloud computing among business organizations in South Africa requires evaluating the business value provided by the technology.

All participants applied value realization metrics when they started the adoption process. P1 used ROI and cost analysis to compare between the annual expenses of shifting to cloud computing and the huge amount of money that the company will spend for replacing the outdated servers. P2 mentioned, "We used ROI analysis right from the beginning as a part of value realization process. We collected all data that allow us to

analyze accurately to show the envisioned benefits." P3 used TCO analysis for 5 years to show the benefits for each component, for each deployment model, and for the consolidated one. The performed TCO included everything related to cloud migration such as infrastructure, utilities, air-conditioning, electricity, man-power needs, licenses, upgrades, and yearly subscriptions. Similarly, P4 compared the TCO for on-premises model with the TCO for cloud computing model for 5 years to show the benefits of the cloud model over the on-premises model. P5 used cost-benefit analysis to evaluate the tangible and intangible benefits of using cloud model over the on-premises model.

Obtaining management commitment and support is one of the main advantages of applying value realization metrics. The findings showed that by applying value realization metrics, managers can perceive and measure the delivered value of cloud computing. Managers need to see tangible, quantifiable benefits before investing in a new IT technology such as cloud computing (Chen et al., 2016; Maresova et al., 2017). Harfoushi et al. (2016) stated that top management support has a significant role in adopting and implementing cloud computing because top managers are responsible for setting organizational strategy and direction. Lal and Bharadwaj (2015) agreed that top management attitude is one of the most significant organizational factors in the cloud adoption decision.

P3 asserted that translating the benefits of cloud computing to numbers is an effective strategy to obtain management buy-in because management was concerned about expenses. P2 mentioned that shifting the control of the company assets from the own data center to an external one is a business decision. Business leaders need to realize

the business value of this change to have the willingness and to provide support. P1 stated, “Our top management approved to move to cloud after realizing the needs to do this change, and after the vendor provided them with an accurate budgetary quotation for the implementation.” P5 declared the importance of showing the top management the pros and cons of using cloud services rather than using on-premises model, in terms of expenses and benefits.

Theme 3: Develop a Plan for Migration

The third theme that emerged from my analysis of the data was developing a plan for migration. Planning for cloud migration is essential to ensure successful migration. Gholami et al. (2016) stated that migration to cloud requires careful planning to ensure successful implementation. The findings showed that IT leaders need to develop a plan to identify and prioritize the adoption components that they will migrate to the cloud as IaaS, PaaS, or SaaS. IT leaders should address in their plan which data type will move to the cloud and which data type will remain on premises based on data classification process. The findings indicated that data classification is a crucial step in the planning for migration to determine the level of confidentiality and criticality for each data type. Shaikh and Sasikumar (2015a) showed that classifying data based on security level criteria has become essential for organizations that use cloud services. Jones et al. (2017) declared the significance of implementing a data classification approach before moving to the cloud. The data classification should be based on the importance and criticality of the information (Jones et al., 2017).

P3 revealed that moving to cloud requires a good planning because if it fails, it may lead the business to fail because IT and technology now are driving the business. Without good preparation, plan, and vision, the business might collapse. The review of the documentation of cloud adoption strategies for C2 showed that moving to cloud is a part of the whole strategy for digital transformation plan. P2 declared that looking into the data is the first step before making a decision about adopting cloud computing. Understanding the type of the hosted data is a mandatory step. P2 said, "We don't host confidential and restricted data outside our premises, and we have different strategies to keep these data on-premises. For the nonconfidential data, we use public cloud to host the data." P4 emphasized on the importance of data classification to decide what data and services will move outside. P4 added that integration with some governmental organizations such as the ministry of interior and Saudi Arabian Monetary Authority (SAMA) is one of the main data hosting constraints, because these organizations don't allow hosting their data outside the KSA.

The developed migration plan should include identification and prioritization of the IT components that will move to the cloud based on the organization's needs, compatibility, and interoperability. The findings showed that IT leaders should prioritize moving the most needed components, which have a good level of compatibility with the cloud system, and which have no interoperability issues with other components. The actions that IT leaders should address in the cloud migration plan should include selecting potential services for deployment and integrating with cloud infrastructure (Panori et al., 2016). The findings showed that planning to move the cloud adoption

components gradually in phases is an effective strategy for successful migration. IT leaders can break down the IT services into discrete components to facilitate the migration process. Using a fine-grained, service-based cloud migration instead of the coarse-grained migration solutions facilitate and simplify the cloud migration process (Jamshidi et al., 2016).

The review of documentation of cloud migration plan for C4 showed that moving to cloud was planned to take place gradually in phases. P4 mentioned, "After deep analysis, we decided to move gradually in phases. We started to move IaaS and PaaS first, then moving SaaS has started in a later stage. For the applications, we started with the big modules first." P4 elaborated, "We preferred the hybrid deployment model to maintain integration and interoperability among applications. In the hybrid model, our externally-hosted modules still integrate with our on-premises Oracle EBS system." P3 stated, "We planned to move gradually to cloud. We started by moving some basic platforms and applications like emails and some of our servers." P3 added, "In the following phases, we moved the ERP system from the on premises to the cloud, then we replaced the on premises Oracle E-Business Suite (EBS) to Oracle Fusion on the cloud." P2 indicated that breaking down the IT services into discrete services is a good strategy for implementation. Breaking down the services provides flexibility for planning the adoption per service rather than thinking of the IT services as a full integrated echo system.

P4 revealed, "We studied and analyzed which application should move to the cloud first. We started to move the applications that have no compatibility or integration

issues such as the HR and the Payroll applications." P4 declared that moving some applications was a challenge because of the discrepancies between the on-premises version and the corresponding cloud version. P4 showed that some of the on-premises applications have higher maturity level than the corresponding cloud version of these applications because they have been in the market for more than 20 years. P4 stated, "Moving these applications to cloud requires re-implementing many functions of these applications. We need to evaluate whether to go or to wait until this cloud products get more matured." P5 stated "We faced a synchronization issue when we started moving our databases and applications. The differences between the on-premises version and the corresponding cloud version was the main reason for the synchronization issue." P5 added, "We had to create an in-house project to upgrade our applications to cope with the cloud version."

The findings showed that IT leaders should analyze the potential risks and develop a plan for responses to the risks that may occur during the migration process. Islam et al. (2017) affirmed that managing risks is crucial for a successful cloud computing adoption. Understanding the risks associated with the process of migrating data and applications enables the users to respond properly to these risks (Islam et al., 2017). The findings showed that establishing a project governance is an effective way to expedite the decision making process and responses for the potential issues during the implementation. Jones et al. (2017) asserted that using strong project management with committed senior management team to drive the implementation and project delivery is a major success factor for cloud migration. The findings indicated that performing proper

testing is useful to discover the migration issues and to reduce the impact of these issues on the users' performance. Gholami et al. (2016) indicated that IT managers can use agile practices such as short release and continuous testing to support cloud migration process. Validating and testing services by users is the last major stage in a successful plan for cloud migration (Panori et al., 2016).

P2 mentioned, "We analyzed all variables that may impact the migration process to get an early idea about the potential risks that we may face." P4 stated, "We studied and analyzed the constraints and the potential risks that we may face in the future." P3 revealed that establishing a project governance was a crucial step in cloud implementation. P3 said, "Before starting to move from on premises to cloud, we had to establish a project organization structure, steering committee, and business leaders with multiple levels of escalation to secure the decision making process throughout the project." P3 asserted that most of the projects fail because of lacking a project governance as a critical element for addressing the potential implementation barriers. P4 stated, "The proper testing is crucial for the success of the migration plan. We spent significant time in performing our test to mitigate the risk to the minimum." P5 stated, "The testing phase is important to discover and sort out most of our migration issues. The proper testing is necessary to mitigate the impact of the potential issues on the users' performance."

The findings showed that planning early for the new configuration requirements is important for a successful migration. IT leaders need to reconfigure the organization network setting, database connections, and users' privileges to ensure reliable and secure

connectivity with the cloud system. Setting environment configuration is necessary to ensure reliable and secure connectivity between the local network and cloud systems (Gholami et al., 2016). The findings showed that smooth migration process requires ensuring the availability of codes and documentation of the existing systems, internal and external technical support, and a plan for incompatibilities resolution. Panori et al. (2016) revealed that the cloud migration plan should incorporate aspects referring to (a) source code and documentation, (b), ways to cope with any probable incompatibilities, (c), availability of technical support, and (d) coordination with specific technical partners.

P1 indicated that setting the environment is necessary before moving to cloud to avoid interruption of the migration. P1 said, "The lack of documentation for some of our systems was a challenge because the documentation shows how these systems operate. We had to spend 5 months to write the missing documentation, which caused a significant delay in our migration process." P1 added, "It was a learned lesson to plan early for the following implementations. The problem of the missing documentation costed us 5 months of subscription without gaining any benefits from the new system." P1 revealed, "The network capacity was another challenge for us when we moved to cloud. Once we went online, the Internet became slow because of increasing the bandwidth utilization." P1 continued, "In the following implementation, we took into consideration the infrastructure challenges. We calculated the required bandwidth for each system separately to ensure stability of the performance."

Theme 4: Choose the Right Cloud Service Provider

The fourth theme that emerged from my analysis of the data was choosing the right cloud service provider. Selecting the right cloud service provider is crucial for the long-term success of the cloud adoption. The findings showed that IT leaders should understand the best selection criteria that match with organization's business and technical needs while providing the maximum value. Identifying the right selection criteria provides the framework for assessing cloud service providers to select the right one. The findings indicated that the key selection factors include security and trust, compatibility and integration, pricing, technical support, and service level agreement (SLA). Lang et al. (2018) noted that cloud customers should select the right cloud service provider to assure quality of the provided services. Lang et al. (2018) identified the main criteria for selecting the right cloud service provider as functionality, flexibility, integration, control, legal compliance, contract, support, monitoring, and geolocation of the services. IT managers concern about the past credential and the present capabilities when they seek a service from a vendor (Manuel, 2015). Onar et al. (2018) identified the main evaluation factors for selecting cloud service providers as trust, cost, agility, security and privacy, assurance, performance, and usability.

P1 stated, "We started with 20 vendors. We made a comparison study between them to select the right one. We established a team for evaluation and judgement. Then we raised the decision to the management." P1 added, "After shortlisting the companies many times, we preferred the company that has existing office in Saudi Arabia, has many success stories in Saudi Arabia, and has a better price." P2 mentioned, "We had to go for multiple vendors to get a better chance to select the best one." P3 said, "We started by

selecting the product like Google Business, Office365 with Microsoft, Oracle for ERP or SAP, and Dynamic with Microsoft. We have to identify the products first, then we make the comparison." P3 added, "We invited all vendors. We gathered proposals, advantages and disadvantages, and then we identified who is ready to move us to the cloud." P5 stated, "We made a comparison between the local partners who are providing the cloud services."

The findings showed that compatibility is one of the most important factors for selecting the right cloud provider. Compatibility is crucial for IT manager to ensure what works on-premises will work effectively on the cloud. Compatibility includes integration and interoperability with the legacy system and the cloud environment. All participants agreed on the importance of compatibility when selecting a cloud service provider. The findings indicated that increasing the compatibility between the cloud environment and the legacy system facilitates the migration process and minimizes the need for customization or re-implementation effort. Yoo and Kim (2018) found that compatibility is one of the top priorities for the IT leaders when they decide to adopt cloud computing. Alharbi et al. (2016) indicated that compatibility with the organizations' information systems was behind other adoption factors. Compatibility of cloud computing to integrate with the existing system is a significant enabler for the adoption decision (Gangwar et al., 2015; Lal & Bharadwaj, 2015).

P4 revealed, "We preferred to move and host our applications with Oracle because our data with Oracle, our application layer with Oracle, and even our middle tier with Oracle. It is better to go with Oracle rather than any other vendor." P4 added,

"Oracle was more cost effective than Amazon because they offered to maintain our licenses. Additionally, Oracle has many data centers up to the latest technology. We host with them in Germany and England. They guarantee 99.99% business continuity." P1 mentioned, "One of the major points was the integration with ERP, integration with HR, and integration with Office 365. We took 2 to 3 days with each company to compare between them in terms of product integration." P5 revealed, "We choose Oracle because all of our applications from Oracle, we thought about the compatibility and integration. Obviously, we will not find any compatibility between servers and applications if they are from different vendors." P2 said, "If you are using SaaS, you may need to do some customization to meet your requirements because not everything exists on-premises will exist on the cloud." P2 added, "We went to all vendors one by one with a detailed analysis of our requirements. We asked for each detail; is it there or not there? Does it require customization or configuration?" P3 stated, "More than 90% of the companies that have ERP on premise have a lot of customizations. They are away from the standard application." P3 added, "When we are going to move to cloud, we have to take these customizations into consideration, we have to adapt with them."

P1, P2, P3, and P4 agreed that security is a significant factor when selecting a cloud service provider. The findings showed that IT leaders can mitigate the security risks by selecting a trusted service provider, which provides the best security controls and SLA guarantee. Sharma et al. (2016) revealed that selecting a trusted service provider is a key determinant in adopting and using cloud services. Large cloud computing providers invest billions of dollars in improving their infrastructure to gain the trust of the clients

(Alenezi et al., 2015; Tarhini et al., 2017). Security and availability are the main factors for selecting a trusted cloud service provider (Rajasree & Elizabeth, 2016). Cloud service providers must ensure a secured environment for their clients (Khan, 2016). Service providers are responsible for securing the infrastructure and services (Ramachandran & Chang, 2016). IT managers use SLA to guarantee obtaining the required level of confidence for the provided cloud services (Serrano et al., 2016). Cloud customers can include the required security parameters in the SLA.

P2 said:

> We asked the vendors about the security in terms of phishing and encryption. The questions were; how you are going to implement security on the cloud? How will you encrypt? How can you prevent the unauthorized access? What is the security metrics that you will use to ensure that only authorized people can access my data. What is your process of granting access? How can you reassure me that my data privacy is well protected? Then we let them talk about the keys of encryption, the provisioning of the environment, and the provisioning of the services.

P4 declared, “The most important point was the compliance with our data security. As per our agreement with Oracle, our data must be secured. Oracle invested billions of dollars to maintain their reputation worldwide. They can’t destroy their reputation.” P1 stated, “We preferred Microsoft because they have a very advanced level of security. They have 8 layers of security. We have a higher level agreement level between our legal departments and the vendor to protect our data.” P3 mentioned, “When we talk about data

security, the large vendors like Microsoft or Oracle have a high level of trust. In addition, we have a confidentiality agreement with the vendor." The cloud threat report provided by P1 is one of the tools provided by the service provider to allow P1 to monitor the risk of the potential cyberattacks.

Theme 5: Provide Adequate Training and Awareness Sessions

The fifth theme that emerged from my analysis of the data was providing adequate training and awareness sessions. The findings showed that IT leaders need to align the employees of their organization with the new change to ensure a successful adoption for the new technology. Providing adequate training is important to build the team's knowledge and to develop their experiences about the new system. Increasing the awareness of the employees about the cloud computing is necessary to get their buy-in and to decrease their resistance toward using the system. IT leaders should plan early for the training and awareness sessions to prepare the mindset of the employees in alignment with the implementation. Alharthi et al. (2017) concluded that providing training and increasing the awareness on running the cloud-based services are major requirements for a successful utilization of cloud computing. Hameed and Counsell (2014) suggested that organization leaders may need more time in the initiation stage to increase the awareness and familiarity of the new technology within the company. Gangwar et al. (2015) showed that training and education is one of the main factors that influence the adoption of cloud computing within organizations. Lacking the perceived knowledge about the usage, value, and uncertainty risks of a new technology are the main factors for resisting using this technology (Claudy et al., 2015).

P1 said, “Change management is one of the biggest challenges in Arabic countries. People usually have a fear from change. Some people will be happy if the implementing of the new system fails.” P1 elaborated, “We put a plan for training in parallel to the implementation to increase the awareness about the new system. We divided our implementation into stages. Once I finished a stage, I train the people who have completed this stage.” P1 added, “I provided the training division by division to avoid the problems that happened in the first implementation.” P3 stated, “People resistance is one of the challenges that we face. The on premise system is customizable. However, in cloud, not everything is allowed. The way that they are doing the business and dealing with day to day activities changed.” P3 added, “We need to get everyone involved from the beginning by providing awareness sessions to get their buy-in. There is no way to implement or to succeed without people’s buy in, and feeling they are part of the decision.” P3 elaborated, “We need to show the people what the business value is; what is the expectation from the product, from the vendor, and from them as employees. This is a part of the change management approach.”

P2 emphasized that training and building the knowledge for the team is highly important to deal with the new technologies. P2 stated, “We need to develop our team to do certain aspects. If we want to switch back or change the vendor, we need someone who understands how to migrate to a new vendor and how to bring the on premise back.” P2 added, “We still need to have the know-how within our team at least to understand the basic knowledge.” P5 said, “as a new technology, our users don’t know even what cloud computing is. In the beginning, we lost about 4 months of subscription because of lacking

the experience in dealing with the new system." P5 revealed, "We need first to convince the end users that we are going to a new technology to prepare their mindset and to increase their experience."

Connecting the Findings to the Conceptual Framework

I used Rogers's DOI theory as my conceptual framework. The DOI theory is an appropriate framework to plan innovation adoption strategies (Byambaa et al., 2015). Cloud computing as a new technology represents the innovation in the DOI theory. The presented themes are the adoption strategies that the participants used to adopt cloud computing in their organizations to reduce IT costs. Rogers (2003) identified the innovation characteristics that influence the adoption as relative advantage, compatibility, complexity, observability, and trialability. Innovations are subject to higher adoption rate when they have a more relative advantage, compatibility, trialability, observability, and less complexity (Rogers, 2003).

The identified business needs and requirements showed that the IT leaders are prone to adopt cloud computing because it provides more relative advantages and has less complexity than the on premises technology. Rogers (2003) defined the observability as the degree to which the benefits of an innovation are visible. Applying value realization metrics is important to quantify the relative advantages of cloud computing to the top management to increase their visibility for the cloud computing benefits. Rogers (2003) defined the compatibility as the perceived degree of consistency with the existing work practices, experiences, and needs. The findings showed that planning for migration and choosing the right cloud service provider are important to increase the compatibility and

interoperability between the existing legacy system and the cloud computing. Rogers (2003) stated that the innovation should be meaningful for the potential adopters. Providing training and awareness sessions increases the clarity and decreases the complexity of cloud computing for the potential users.

Applications to Professional Practice

The findings of the research may provide a valuable source for IT leaders to improve business practices by developing effective strategies and processes. The findings of this study present the insights shared by five IT leaders who used effective strategies to adopt cloud computing technology in their organizations. The emerged themes provide practical and professional guidelines for potential IT leaders to implement successful strategies for adopting cloud computing. The five IT leaders were able to adopt cloud computing successfully in their organizations through identifying the business needs and requirements, applying value realization metrics, planning for migration, choosing the right service provider, and providing training and awareness sessions. By combining these themes with the current corporate strategic goals, the potential IT leaders can adopt cloud technology successfully to reduce IT costs and to gain several benefits for their organizations.

Implications for Social Change

The adoption of cloud computing technology has a contribution to improving the economic development in the KSA. The findings of the study provide effective strategies to encourage the potential IT leaders to use cloud computing, which contributes to increasing the adoption rate among business companies in the KSA. The widespread

deployment of IT services such as cloud computing increases the awareness of global trends and innovations that would positively improve the living standards in the country (Avram, 2014). Using cloud computing widely increases the chance for creating new job opportunities that were not existing before such as cloud architects, cloud capacity planners, and cloud service managers .Sharma et al. (2016) indicated that cloud computing adoption might result in creating job opportunities for developing, maintaining, and securing cloud infrastructure. The cost saving is a confirmed relative advantage of cloud computing (Oliveira et al., 2014). Ensuring business sustainability of the firms in the KSA by applying cost saving strategies has a contribution to the prosperity of the local economy of the country.

Recommendations for Action

The purpose of this qualitative case study was to explore the strategies that IT leaders in the manufacturing industry in the KSA use to adopt cloud computing to reduce IT costs. IT leaders in the manufacturing industry should be aware of the best strategies that align with their corporate strategic goals such as increasing efficiency and reducing costs. The findings of this study include five themes: (a) identify business needs and requirements, (b) apply value realization metrics, (c) plan for migration, (d) choose the right cloud service provider, and (e) provide adequate training and awareness sessions. By integrating these themes into the business practices, IT leaders can take advantage of adopting cloud computing technology to reduce IT costs.

Current and future IT leaders in the manufacturing companies can benefit from the results of this study by implementing similar successful strategies for adopting cloud

computing in their organizations. Current and future IT leaders in other industries may be able to use the results of this study as proven successful strategies for cloud computing adoption. I will share the findings of this study with the five IT leaders who participated in this study. I intend to disseminate the findings of this study with the business communities, professional consultancy firms, and other jurisdictions in the KSA. I intend to take advantage of opportunities to share the findings of this study with wider audience via appropriate platforms such as seminars and conferences.

Recommendations for Further Research

Limitations are the conditions or influences out of the researcher's control that may create bias or affect inappropriately the research findings (Simon & Goes, 2018). Recommendations for further research include using a sample size larger than five participants. Despite a sample size of five participants may be adaquate for a case study design (Creswell, & Poth, 2018), using a larger sample size may be beneficial to validate the study findings. Another benefit for using a larger sample size is to avoid the limitation of the potential lack of knowledge and experience of the research participants, to ensure data saturation. Another limitation of the study is focusing on the manufacturing industry at one geographical location which is the Eastern region of the KSA. Further research could explore similar studies for different industries and different regions and countries to increase the generalizability of the research findings.

Reflections

Although the DBA journey was challenging and stressful, it enriched my academic and professional knowldege to advanced level. I have gained extensive

knowledge and insights into academic work, research inquiry, and scholary writing. Throughout the DBA journey, I went through hunderds of sources on doing qualitative research and cloud computing adoption as the research topic. The DBA program connected me to a vast network of professionals who shared their thoughts and insights during the weekly discussions. The DBA study was an opprotunity to engage with professional IT leaders who discussed the startegies that they implemented for a successful cloud computing adoption. The shared experience with the participants was an opportunity for me to learn practically how to conduct a qualitative research to gain insights into the research topic. On the other hand, the participants had an opportunity to increase their awareness of how the research contributes to improving their business practices.

Conclusion

Cloud computing has emerged as a disruptive technology that provides several benefits for organizations such as flexibility, scalability, availability, and cost saving (Yamin & Al-Makrami, 2015). The adoption of cloud computing in the developing countries such as the KSA has a slower rate compared to countries in the West (Alassafi et al., 2016). Gaining a better understanding of strategies for a successful adoption of cloud computing is essential to encourage the adoption decision among IT leaders in the KSA. The findings of this study presented five themes for the main strategies that the IT leaders used to adopt cloud computing in their organizations to reduce IT costs. IT leaders need to (a) identify business needs and requirements, (b) apply value realization

metrics, (c) plan for migration, (d) choose the right cloud service provider, and (e) provide adequate training and awareness sessions.

In conclusion, the findings of this study enable IT leaders in the manufacturing companies to develop and implement a more successful adoption strategy for cloud computing. Many IT leaders do not adopt cloud computing and prefer to continue with the on premises solutions, resulting in losing a possible opportunity of the proven benefits. The presented strategies provide proven methods for IT leaders to use the cloud computing to run their organizations more efficiently. Refraining from using new technologies such as cloud computing is not an option for business and IT leaders who are seeking increased profitability and efficiency in the competitive market. Applying the reported strategies is important for IT and business leaders to take the full advantage of adopting cloud computing technology.

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Appendix A: Interview Protocol

Participant: _____

Location: _____

Date/Time: _____

Study Title Strategies for Cloud Services Adoption in Saudi Arabia

During the interview, I will complete the following steps:

1. Introduce self to participant, thank interviewee for participation, provide a brief overview of the research, and show the time range to complete the interview.
2. Verify receipt of the consent form, provide a copy for her/his records, and review the main items of the consent form such as voluntary participation, withdrawal right, and data disclosure.
3. Obtain the participant's signature on the consent form as a proof of accepting participation.
4. Begin the audio recording after confirming the participant's permission.
5. Start asking interview questions sequentially from question 1 to question 6 with using probing and follow-up questions, as necessary.
6. Request the authorized documents that relate to the interview questions such as plans, charts, reports, or any internal records.
7. End the interview by thanking the interviewee for participation.

Interview Questions

1. What strategies are you using for successful adoption of cloud technology?
2. What are the main advantages associated with adopting the cloud technology for your organization?

3. How do you measure the success of the implemented strategies to reduce IT costs in your organization?
4. How would you describe the significant challenges or barriers to implement your strategies for adopting cloud technology?
5. What strategies have you used to address the key challenges or barriers to adopting cloud technology?
6. What other information would you like to share regarding adopting cloud technology in your organization?

Appendix B: Letter of Cooperation

Company XX
Contact Information
Eastern Region, Saudi Arabia

Date

Dear Wessam H. Mahmoud,

We are pleased to respond to your request to cooperate with you to conduct doctorate dissertation with the title “Strategies for Cloud Services Adoption in Saudi Arabia”. We are pleased to participate in an interview to discuss best practices related to cloud adoption strategies and objectives.

We understand that participation will be limited to allow you to discuss and review our cloud services adoption strategies and goals. We reserve the right to withdraw from the study at any time if our circumstances change.

I confirm that I am authorized to approve research in this setting and that this plan complies with the organization’s policies.

I understand that the data collected will remain entirely confidential and will not be provided to anyone outside of the student’s supervising faculty/staff without permission from the Walden University IRB.

Sincerely,

Authorization Official
Contact Information

Walden University policy on electronic signatures: An electronic signature is just as valid as a written signature as long as both parties have agreed to conduct the transaction electronically. Electronic signatures are regulated by the Uniform Electronic Transactions Act. Electronic signatures are only valid when the signer is either (a) the sender of the email, or (b) copied on the e-mail containing the signed document. Legally an "electronic signature" can be the person’s typed name, their e-mail address, or any other identifying marker. Walden University staff verify any electronic signatures that do not originate from a password-protected source (i.e., an e-mail address officially on file with Walden).