2020

The Challenges of Adopting Cloud Computing in Nigerian Government Organizations

Ayodele Adegbenga Bakare
Walden University

Walden University

College of Management and Technology

This is to certify that the doctoral study by

Ayodele Adegbenga Bakare

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Review Committee
Dr. Cheryl Waters, Committee Chairperson, Information Technology Faculty
Dr. Gary Griffith, Committee Member, Information Technology Faculty
Dr. Bob Duhainy, University Reviewer, Information Technology Faculty

Chief Academic Officer and Provost
Sue Subocz, Ph.D.

Walden University
2020

Abstract

The Challenges of Adopting Cloud Computing in Nigerian Government Organizations

by

Ayodele Bakare

MS, Walden University, 2018

MS, University of Wales, 2012

BS, Federal University of Agriculture, 2002

Doctoral Study Submitted in Partial Fulfillment

Of the Requirements for the Degree of

Doctor of Information Technology

Walden University

June 2020

Abstract

Several technical challenges prevent the adoption of cloud computing by government organizations in Nigeria. Information technology (IT) leaders in the Nigerian government are concerned about this problem because the lack of cloud computing adoption may prevent the Nigerian government from taking advantage of cloud-based information systems to improve its service delivery to citizens and businesses. Grounded in the technology acceptance model, the purpose of this quantitative correlational study was to examine if IT administrators' perception of data security and perception of fault tolerance can predict their intentions to adopt cloud computing. Data were collected from 79 IT administrators in government organizations in Nigeria. The results of the multiple regression were significant, $F(2, 76) = 31.58$, $p < .001$, $R^2 = 0.45$, with IT administrators' perception of data security ($\beta = .72$, $p < .001$) being the only significant predictor of IT administrators' intention to adopt cloud computing; IT administrators' perception of fault tolerance ($\beta = .09$, $p = .37$) was not a significant predictor of IT administrators' intention to adopt cloud computing. The Nigerian government may use this study as a pedestal to measure cloud computing practice and maturity in all its organizations, improve existing cloud computing policies, and increase cloud computing training programs for its IT administrators. This study's results might contribute to positive social change by helping the Nigerian government improve its service delivery to citizens and businesses through the increased adoption of cloud computing-based information systems.

The Challenges of Adopting Cloud Computing in Nigerian Government Organizations

by

Ayodele Bakare

MS, Walden University, 2018

MS, University of Wales, 2012

BS, Federal University of Agriculture, 2002

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Information Technology

Walden University

June 2020

Dedication

I dedicate this study to God, who saw me through this program. I also dedicate this study to my lovely wife and children, who were patient and exhibited perseverance throughout the period of this program.

Acknowledgments

I thank God Almighty, for seeing me through this program, especially in my times of challenges. I specially thank Dr. Cheryl Waters, who was my committee chairperson for her mentorship, guidance, and prompt responses in my challenging periods. She provided me with the needed encouragement and support throughout my Doctoral study process. I also thank Dr. Gary Griffith, who was my second committee member for all his timely feedback and support. Special thanks to Dr. Steven Case for all his support and guidance right from the first course I did at Walden University, the two residencies, and my Doctoral study process. He has been a constant entity throughout my Doctorate program. I thank Dr. Bob Duhainy, who was my University Research Reviewer (URR), for his feedback and guidance.

Additionally, many thanks to my wife, children, mother, and siblings for their support and understanding throughout this program, you have all persevered through the inconveniences my program may have caused you.

Finally, many thanks to my organization, National Information Technology Development Agency (NITDA), Nigeria for its sponsorship and support. I appreciate all the support I received from the past and present Director Generals (Dr. Vincent Olatunji, Dr. Isa Ali Pantami, and Mr. Kashifu Inuwa), Directors, and my colleagues.

Table of Contents

List of Tables v

List of Figures vi

Section 1: Foundation of the Study 1

Background of the Problem 1

Problem Statement 2

Purpose Statement 2

Nature of Study 3

Research Question 6

Hypotheses 6

Theoretical Framework 6

Operational Definitions 7

Assumptions, Limitations, and Delimitations 9

Assumptions 9

Limitations 9

Delimitation 10

Significance of the Study 11

Application to the Applied IT Problem 12

A Review of the Professional and Academic Literature 12

Purpose of the Study 13

Hypotheses 13

Cloud Computing 16
Cloud computing models. 20
Critical Analysis and Synthesis of the Theoretical Framework 32
Supporting Theories 38
Contrasting Theories 47
Critical Analysis and Synthesis of Independent Variables 50
Critical Analysis and Synthesis of the Dependent Variables 52
Measurement of Variables 53
Compare and Contrast Points of View and Relationship of the Study to Previous 53
Research and Findings 53
Gaps in Literature 56
Transition and Summary 60
Section 2: The Project 61
Purpose Statement 61
Role of the Researcher 62
Participants 64
Research Method 67
Research Design 69
Population and Sampling 71
Ethical Research 75

Data Collection 79
Instrument 79
Data Collection Technique 83
Data Analysis Techniques 85
Study Validity 90
Transition and Summary 92
Section 3: Application to Professional Practice and Implications for Change 94
Overview of Study 94
Presentation of Findings 94
Descriptive Statistics 95
Data Cleaning 98
Reliability Analysis 99
Assumptions 100
Inferential Statistics Results 103
Analysis Summary 105
Theoretical Conversation on Findings 106
Application to Professional Practice 108
Implications for Social Change 110
Recommendations for Action 111
Recommendations for Further Study 112
Reflections 113

Summary and Study Conclusion....114
References....116
Appendix A: NIH Human Subject Research Certificate of Completion....161
Appendix B: Reprinted Diagrams Author's Permission....162
Appendix C: Morosan and DeFranco's Original Survey Instrument....164
Appendix D: Proposed Survey Instrument on Cloud Computing Adoption by IT Administrators in Nigerian Government Organizations....167
Appendix E: Survey Instrument Authors' Permission Statement....171
Appendix F: Confidentiality Agreement....172
Appendix G: Participants' E-mail Invitation....173

List of Tables

Table 1. Previous researches in challenges of cloud computing adoption……....57

Table 2. Frequency and Percent Statistics of Participants' Job Title ..... .96

Table 3. Frequency and Percent Statistics of Participants' Work Experience…….....97

Table 4. Frequency and Percent Statistics of Participants' Cloud computing Knowledge…….....97

Table 5. Frequency and Percent Statistics of Participants' Organizational Use.....97

Table 6. Frequency and Percent Statistics of Participants' Organization IT Users….....98

Table 7. Means and Standard Deviations for Study Variables..... 98

Table 8. Reliability Statistics.....100

Table 9. Variance Inflation Factor for Independent Variables 102

Table 10. Multiple Regression Analysis Among Study Predictors ……..….104

Table 11. Pearson Correlation Matrix……..... 105

List of Figures

Figure 1. Theory of reasoned action 33

Figure 2. Technology acceptance model 34

Figure 3. Technology acceptance model 2 36

Figure 4. G*Power analysis to compute the required sample size 74

Figure 5. Power as a function of sample size.....75

Figure 6. P-P Scatterplot of regression standardized residual testing normality…….101

Figure 7. Residuals standardized predicted value testing for homoscedasticity……..102

Section 1: Foundation of the Study

This study used a quantitative correlational method to examine the relationships between certain IT administrators' perceptions regarding data security and fault tolerance and their intentions to adopt cloud computing for managing organizational data and information systems (IS). The results of this study may provide a knowledge base for IT administrators in Nigerian government organizations to efficiently and effectively meet organizational goals and objectives. Additionally, the study result may provide information that can assist the Nigerian government in improving its service delivery to citizens and businesses through the effective use of cloud computing.

Background of the Problem

Cloud computing has created a simplified, cost-effective, and elastic computing model for users and organizations. Cloud computing offers technologies for users and organizations to manage their IS remotely and cost-effectively (Ali, Wood-Harper, & Mohamad, 2018; Xu, Liang, Jain, & Gu, 2019). The computing model represents a remote cluster of servers where users can access Information technology resources (Ashok, Steenkiste, & Bai, 2018).

Many technical challenges prevent IT administrators from adopting cloud computing. Some of these technical challenges include fault tolerance issues and data security. According to Mesbahi, Rahmani, and Hosseinzadeh (2018), about $285 million have been lost each year due to fault-related cloud service unavailability and unreliability. The goal of this study is to provide IT administrators and IT leaders in

Nigerian government organizations with information about the relationship between IT administrators' (a) perception of data security, (b) perception of fault tolerance, and (c) intentions to adopt cloud computing. This information may serve as a knowledge base for IT administrators and IT leaders in the Nigerian government organizations to manage the technical challenges of the adoption of cloud computing, thereby improving the adoption rate. Additionally, the findings of this study may provide a basis for further study on the technical challenges of cloud computing in Nigerian government organizations.

Problem Statement

Security, fault tolerance, and application integration challenges involved in the adoption of cloud computing have limited the number of government organizations implementing the technology (Ali, Soar, & Yong, 2016). About 85% of users in the Nigerian government and private organizations raised the issue of data security as a key cloud adoption impediment (Oguntala, Abd-Alhameed, & Odeyemi, 2017). The general IT problem is that government organizations in Nigeria lack strategies to adopt cloud computing. The specific IT problem is that some IT leaders in Nigerian government organizations lack information about the relationship between IT administrators' perception of data security, perception of fault tolerance, and intentions to adopt cloud computing.

Purpose Statement

The purpose of this quantitative correlational study was to examine the relationship between IT administrators' (a) perception of data security, (b) perception of

fault tolerance, and (c) intentions to adopt cloud computing. The independent variables are IT administrators' perception of data security and IT administrators' perception of fault tolerance. The dependent variable is IT administrators' intentions to adopt cloud computing. The target population of this study consists of IT administrators from government organizations in the Northern part of Nigeria who have (a) adopted cloud computing and having challenges, (b) successfully adopted cloud computing, (c) intentions to adopt cloud computing. The implication for positive social change lies in the potential to improve the Nigerian government service delivery to citizens and businesses. Cloud services can help the government store data and offer their services to the public. Integrated government data and services hosted on a cloud platform will help the government reduce the cost of IS infrastructure while increasing efficiency, productivity, and performance. When government organizations can successfully adopt cloud computing, then they can worry less about their information systems and focus more on increasing the performance and efficiency of their services to citizens and businesses.

Nature of Study

I used a quantitative research method for this doctoral study. Quantitative methods usually use statistical methods to test conceptual models and investigate relationships between variables (Christenson & Gutierrez, 2016). This study's intention was to examine the relationship between both independent and dependent variables. Quantitative research methods can also help in the use of a sample population through numerical analysis to generalize a population of the study. According to Rutberg and

Bouikidis (2018), quantitative methods research inclines to accurate measures using statistical numbers. Qualitative methods explore humans' knowledge and experiences to gain an in-depth understanding of issues (Malterud, Hamberg, & Reventlow, 2017). According to Malterud et al. (2017), researchers can use qualitative methods to explore meanings of phenomena and a deeper understanding of how and why humans behave within their natural context. This study was not exploratory and did not intend to gain an in-depth understanding of people's subjective knowledge or experience; therefore, a qualitative research method was not suitable for this study. Mixed methods research is used by researchers when a single research method cannot effectively explore a phenomenon. Mixed methods research is the fusion of both quantitative and qualitative methods in a single study (Zhou, 2018). According to Singh et al. (2017), mixed methods research involves conducting a quantitative data collection followed by qualitative data collection. The research method requires knowledge of both quantitative and qualitative research methods, a longer time to complete, and can be difficult to publish (Jennifer & Mary, 2011). This study did not utilize qualitative study, which is an element of mixed-methods; neither did it combine elements of quantitative and qualitative methods; therefore, mixed-method was not suitable for this study. Quantitative method is more appropriate for this study as opposed to using a qualitative and mixed-method because this study's goal was to investigate the relationship between independent and dependent variables using statistical methods.

I used a nonexperimental correlational design for this study. According to Turner, Balmer, and Coverdale (2013), researchers use correlational design to discover or examine the existence and strength of relationships between variables. Researchers use correlational design to determine the strength and type of association between variables (Omair, 2015). I used correlational design to determine the existence of relationships between the independent and dependent research variables. Other designs, such as descriptive, quasi-experimental, and experimental, were not suitable for this study. Experimental and quasi-experimental demonstrates connections in a process chain, showing a causative relationship between variables (Spector & Meier, 2014). Although experimental and quasi-experimental designs show a causative relationship between variables, the former randomly assign participants to different levels of treatment (test group) and control group while the latter does not allow researchers randomly assign participants.

Additionally, since quasi-experiments lack control, several rival hypotheses may exist that compete with experimental manipulations for observed results. This study did not intend to show a causative relationship between variables, nor did it intend to create experiment groups; therefore, experimental and quasi-experimental designs were not suitable for this study. Descriptive designs help researchers observe and describe the status of a variable, and may help researchers develop hypothesis sequel to data collection. According to Omair (2015), researchers use descriptive research designs to provide a simple description of the desired characteristics of a sample under study. This

study did not present a mere description of the characteristics of population samples; therefore, only descriptive design was not suitable for this study.

Research Question

What is the relationship between IT administrators' perception of data security, fault tolerance, and intentions to adopt cloud computing?

Hypotheses

Null Hypothesis (H_0): There is no statistically significant relationship between IT administrators' perception of data security, IT administrators' perception of fault tolerance, and IT administrators' intentions to adopt cloud computing.

Alternative Hypothesis (H_1): There is a statistically significant relationship between IT administrators' perception of data security, IT administrators' perception of fault tolerance, and IT administrators' intentions to adopt cloud computing.

Theoretical Framework

The theory that I utilized for this study is the technology acceptance model (TAM). This theory is possibly the most globally utilized model in the area of IS for measuring technology acceptance (Nagy, 2018). This assertion is also due to the adaptability, simplicity, and robustness of TAM (Al-Emran, Mezhuyev, & Kamaludin, 2018). Fred Davis developed the theoretical framework in 1985 (Dixit & Prakash, 2018). TAM analyzes the factors or influencers of the intentions by individuals to use technology (Joo, Park, & Lim, 2018; Rienties, Herodotou, Olney, Schencks, & Boroowa, 2018). The primary tenet of TAM is that individuals' perceived ease of use (PEOU) and

perceived usefulness (PU) of technology influence their intentions to use technology (Wang & Goh, 2017). The following are the main constructs used by TAM: (a) Perceived usefulness (PU), (b) Perceived ease of use (PEOU), (c) Attitude towards using (ATU), (d) Behavioral intention to use (BIU), and (e) Actual System use (ASU) (Koul, & Eydgahi, 2018). PU is the degree to which an individual believes that the use of a particular system or technology would enhance his or her job performance. PEOU is the degree to which an individual believes that the use of a particular system or technology would be free of physical and mental effort (Fathali & Okada, 2018). ATU is a user's assessment of the desirability of engaging a particular technology or system. BIU is a measure of the likelihood of a user engaging a technology or system. ASU signifies whether a user uses technology or not. PU and PEOU directly influence the use of technology, while PEOU directly affects PU (Joo et al., 2018). TAM framework helped examine the relationship between IT administrators' perception of data security and fault tolerance, and IT administrators' intentions to adopt cloud computing.

Operational Definitions

Application integration: Application integration refers to the tight relationship between software applications within an Information System (IS) (Jeferry et al., 2015).

Cloud computing fault tolerance: Fault tolerance in cloud computing is the ability of the cloud platform to detect and identify a fault and recover from the fault without negatively impacting on the cloud service (Nazari Cheraghlou, Khadem-Zadeh, & Haghparast, 2016).

Cloud computing: Cloud computing technology delivers on-demand computing resources such as applications, computation, database, virtual machines, networking, analytics, and data storage on a pay-as-you-go basis (Alamoudi Y. & Alamoudi W., 2016; Jain & Pandey, 2018).

Data security: Data security refers to ensuring the confidentiality, integrity, and availability of data in an information system (Kumar, Raj, & Jelciana, 2018).

Fault: Fault is the inability of a system to perform and deliver its required functions or services due to an anomaly or bug in one or many parts of the system (Sutaria, Prasad, & Bhavsar, 2017).

Infrastructure as a service (IaaS): IaaS is a cloud computing model that provides a virtual machine environment with underlying infrastructures such as storage, processing, memory, and network for use by individuals or organizations on a pay-as-you-go basis (Ali et al., 2016).

Platform as a service (PaaS): PaaS is a cloud computing model where the cloud service provider provides and manages the cloud infrastructure, including operating systems and applications (Cearnău, 2018).

Software as a service (SaaS): SaaS is a cloud computing model that provides software applications use to individuals or organizations on a pay-as-you-go basis (Alamoudi Y. & Alamoudi W., 2016).

Assumptions, Limitations, and Delimitations

Assumptions

Assumptions in a research study are beliefs or positions the researcher takes for granted or holds without absolute proof (Tavakol & Sandars, 2014). Researchers must consider assumptions in research so that they can identify such assumptions early in the research and develop strategies for an address if the assumptions are not true. According to Lips-Wiersma and Mills (2014), researchers recognize the importance of assumptions in research. The first assumption of this study was that participants would accurately answer questions regarding the lack of information about the challenges of adopting cloud computing since they will be IT professionals. The second assumption of this study was that participants would be eager to know more about the challenges involved in adopting cloud computing since it is one of the contemporary and pervasive computing models. The third assumption for this study was that participants would not complete more than one study questionnaire. The final assumption of this study was that authorities in the research sites would quickly grant permission for data collection since they may be interested in the outcome of the research and how it will impact on their organizations.

Limitations

Limitations are issues that can potentially threaten the internal validity of a study (Aguinis & Edwards, 2014). Yeatman, Trinitapoli, and Hayford (2013) also defined limitations as the inability of a researcher to respond to relational, behavioral, and social questions. A limitation of this study was that I would collect data from only IT

administrators within the Northern part of Nigeria. This limitation may reduce the generalizability of the research findings to the target population. Another limitation of this study was that I would be sourcing data from a small sample size. This limitation may also reduce the generalizability of the research since the result may not effectively represent the target population.

Additionally, a limitation of this study was the use of closed-ended questionnaires. This limitation prevented participants from providing additional data that may be beneficial to the research study. Furthermore, the result of this study may be limited because the statistical analysis utilized limited independent and dependent variables. The final limitation of this study was the participants' reluctance to complete questionnaires. This limitation delayed the time to reach the target sample size, which in turn increased the study time frame and cost. According to Strömmer et al. (2018), researchers struggle to acquire a target sample size that may affect the cost of study and morale of researchers.

Delimitation

Delimitations refer to the boundaries or scope of the study (Macheridis & Paulsson, 2017). The scope of this study was limited to government organizations in the Northern region of Nigeria. The boundaries of the study were limited to a survey of IT administrators in Nigeria government organizations.

Significance of the Study

The result of this study provided a knowledge base from which IT administrators in Nigerian government organizations may be able to address the technical challenges associated with the adoption of cloud computing. This knowledge is imperative because technology implementations in organizations attract both opportunities and challenges (McNaughton & Light, 2013). This study generated findings that may contribute to IT practice by filling the knowledge gap in the existing literature on the technical challenges of cloud computing adoption in government organizations in Nigeria. The addition of knowledge to existing literature will increase the understanding of cloud computing adoption challenges in government organizations in Nigeria.

This study may contribute to positive social change by improving government service delivery to citizens and businesses. Government services such as tax payment, vehicle registration, drivers' licensing, national identity number registration, and passport registration can be made available on a cloud-based electronic government (e-government) platform. Citizens and businesses can access the cloud-based e-government platform through a single-window portal. Integrated government data and services hosted on a cloud platform may help the government reduce the cost of IS infrastructure while increasing efficiency, productivity, and performance. When government organizations can successfully adopt cloud computing, then they may be able to worry less about their information systems and focus more on increasing the performance and efficiency of their services.

Consequently, improved services from the government may ensure that citizens and businesses benefit from government policies. For example, citizens can have their passports, driver's licenses, vehicle registration, and health services processed and delivered faster. Businesses can experience a significantly reduced processing time for requests such as tax clearance, company registration, and other government information.

Application to the Applied IT Problem

A Review of the Professional and Academic Literature

The literature review presents a myriad of relevant literature that examined the relationship between data security factors, fault tolerance factors, and IT administrators' intentions to adopt cloud computing. The review consists of peer-reviewed articles from journals with a focus on researches conducted within the past five years. I used a total of 277 resources in this study with 236 (85.20%) peer-reviewed and published within the last five years. I used 170 resources in the literature review, and 164 (96.47%) resources were published within the last five years. The total resources that are peer-reviewed and published within the last five years are 158 (92.94%). I acquired the resources from databases such as EBSCOhost, Science Direct, Google Scholar, ProQuest, SAGE Journals Online, and Thoreau. The strategy I used for searching literature included the use of relevant keywords related to cloud computing, Nigeria, and the theoretical framework. Keywords used while I searched the database include *cloud computing, challenges of cloud computing, data security in cloud computing, technology acceptance model, actor-network theory, diffusion of innovation theory, fault tolerance in cloud*

computing, security and privacy, cloud computing benefits, and application integration cloud computing. I focused the review of the professional and academic literature on the following themes: (a) technology acceptance model (TAM), (b) cloud computing challenges, (c) data security in cloud computing, (d) fault tolerance in cloud computing, and (e) application integration in cloud computing (f) supporting theories with TAM, (g) conflicting theories with TAM, and (h) fundamentals of cloud computing. I chose to base the professional and academic literature on these themes because the goal of this study is to examine the relationship between IT administrators' perception of data security, IT administrators' perception of fault tolerance, and IT administrator's intention to implement cloud computing.

Purpose of the Study

In this study, I aimed to examine the relationship between IT administrators' (a) perception of data security, (b) perception of fault tolerance, and (c) intentions to adopt cloud computing in the Nigerian government organizations.

Hypotheses

The null hypothesis (H_0) of this study states that there is no statistically significant relationship between IT administrators' perception of data security, IT administrators' perception of fault tolerance, and IT administrators' intentions to adopt cloud computing. Alternatively, the alternative hypothesis (H_1) for this study states that there is a statistically significant relationship between IT administrators' perception of data

security, IT administrators' perception of fault tolerance, and IT administrators' intentions to adopt cloud computing.

Several researchers have shown that different challenges may prevent users from adopting cloud computing, and the biggest of these challenges relates to data security and fault tolerance issues (Shynu & Singh, 2018). Oguntala, Abd-Alhameed, and Odeyemi (2017) examined the factors responsible for the poor adoption of cloud computing in most African enterprises using Nigeria as a case study. The researchers focused on the perception of IT and non-IT employees in government and private organizations towards cloud computing, and their findings reveal that employee misconceptions of job loss, cyber threat, privacy issues, and data theft are challenges impeding the adoption of cloud computing in Nigeria. Ali et al. (2016) explored the challenges and issues faced by both implementers and users of cloud computing. They revealed challenges and issues related to security and privacy, trust, data management, cost, and infrastructure. Ali et al. noted that IT managers need to conduct a proper evaluation and a deeper understanding of these challenges before engaging in the implementation of the technology.

Another example is the study of Hathout, Ghoniemy, and Ibrahim (2017), which examined the different challenges hindering the migration of user data and applications to the cloud. They associated these challenges to security and privacy perception of users and the increased overhead involved in using homomorphic encryption algorithms on data on the cloud. Hathout et al. proposed the modified data integrity framework as a solution to the increased overhead associated with a conventional homomorphic

encryption algorithm. Ali, Khan, and Vasilakos (2015) surveyed the security issues that surround cloud computing implementation and recent solutions to these problems. They stated that the implementation of cloud computing introduces cloud-specific security risks and vulnerabilities due to its multi-tenancy architecture. The multitenancy architecture of cloud computing exposes users to the risk of data visibility to unauthorized users and malicious cooperation between virtual machines (Ali et al., 2015).

Cloud computing is still considered an adolescent in terms of fault handling capability (Hasan & Goraya, 2018). According to Nazari et al. (2016), fault tolerance is at the top of the challenges of implementing cloud computing. Naik and Rajana (2015) exemplified cloud fault tolerance in their study, which surveyed functional minimum storage regenerating codes necessary to activate the repair of data lost on one cloud system and restoration of data on another cloud system to maintain redundancy and fault tolerance. Finally, Ding, Yao, and Hao (2017) stated that cloud computing systems are highly prone to resources failures due to their increased functionality and complexity. The researchers present a novel fault-tolerant workflow scheduling (ICFWS) algorithm for Cloud systems by combining two existing fault-tolerant techniques, namely resubmission and replication together to leverage on advantages of each technique for fault tolerance while trying to meet the soft deadline of the workflow. The result of their study demonstrates that the ICFWS outperforms some popular techniques for cloud computing systems.

The literature on challenges in user adoption of cloud computing focused more on end-users in developed and developing countries with little information on Nigeria. The gap in the literature is the lack of substantial information on data security and fault tolerance related challenges experienced by IT administrators in government organizations in Nigeria. This literature review aims at filling this gap by synthesizing relevant information from a plethora of literature.

Cloud Computing

Fundamentals of cloud computing.

Cloud computing has become the basis for a plethora of computing services used by most users (Han, Zang, Liu, Chen, & Yu, 2018). Cloud computing allows users utilized and share computing resources over the Internet without owning or maintaining computer resources (Oredo, Njihia, & Iraki, 2019). In other words, cloud computing focuses more on service delivery as opposed to the delivery of technology (Attaran & Woods, 2019). The computing model represents dynamic and distributed online computing resources that users can access and share from any location at any time (Law, NazatulAini, & Elankovan, 2020; Soltanshahi, 2016). Cloud computing is the benchmark for large-scale computing, where large numbers of computing devices are interconnected (Namasudra, Devi, Kadry, Sundarasekar, & Shanthini, 2020). Cloud computing offers technologies for users and organizations to manage their Information Systems (IS) remotely and cost-effectively (Ali, Wood-Harper, & Mohamad, 2018; Xu, Liang, Jain, & Gu, 2019). The computing model represents a remote cluster of servers where users can access Information technology resources (Ashok, Steenkiste, & Bai, 2018). Users can

take advantage of the sharable advance computing infrastructure that cloud computing provides (Alenezi, 2019). Cloud service providers domicile this cluster of servers in distributed data centers, which serve as the backbone for cloud computing (Vafamehr & Khodayar, 2018). The technology delivers on-demand computing resources such as applications, computation, database, virtual machines, networking, analytics, and data storage on a pay-as-you-go basis (Alamoudi Y. & Alamoudi W., 2016; Jain & Pandey, 2018; Tamura & Yamada, 2016;). Nikolopoulos, Karampela, Tzortzis, and Dalamaga (2018) also described cloud computing as a computing model that helps companies reduce their cost of IT infrastructure by leveraging the pay-as-you-grow strategy of cloud computing.

Cloud computing reduces or eliminates the need for IT administrators and end customers to purchase, implement, and sustain IT related hardware and software infrastructure (Priyadarshinee, Raut, Jha, & Gardas, 2017). In other words, the cloud computing model ensures that users and organizations can access resources without massively investing in IT infrastructure (Sharma, Gupta, & Acharya, 2017). Cloud computing delivers computing services in a way similar to metered utility services such as water, electricity, and gas (Sharma, Al-Badi, Govindaluri, & Al-Kharusi, 2016). This analogy draws from the description of cloud computing as the fifth popular utility after water, electricity, oil or gas, and phone utilities.

Cloud computing provides humongous, elastic, and ubiquitous storage to users. According to Xiong and Xu (2018), cloud computing provides huge storage and efficient

support for multimedia big data services. Implementers and users of the Internet of Things (IoT) also depend and benefit from the huge and flexible storage capacity of cloud computing (He, Zhang, Li, Zhu, Hu, 2019). Users of IoT-based devices have overcome the storage limitation of these devices by storing data on the cloud. The technology offers these computing resources in a multitenant environment using virtualization, where different subscribers operate as if on a dedicated platform (Biswas, 2018).

Virtualization is one of the main characteristics of cloud computing. According to Abdullah, Al-Muta'a, and Al-Sanabani, (2019), virtualization in cloud computing is a software implementation of a computing environment which mimics physical computing infrastructure. Virtualization enables cloud service providers host multiple virtual machines that, in turn, host virtual applications and services on a single physical server with a large number of resources (Li, R., Li, Q., Huang, & Kang, 2017). Servers located in data centers provide computing infrastructure access to users via virtualization using virtual machines. Virtualization in cloud computing ensures that users are focused on computing applications and not concerned with the intricacies of the numerous underlying physical infrastructure providing computing services. Virtualization in cloud computing is achieved through virtual machines, which are abstract or virtual based computers which mimic physical computers and servers. VMs ensure enable fast and easy replication of a computing environment. According to Zhuang et al. (2019), VMs makes it easy for researchers to quickly and easily replicate existing software environments in a cloud computing platform.

Additionally, cloud computing ensures that users have ubiquitous access to their resources (Liu, Yang, Qu, & Liu, 2016). Ubiquity, in addition to elasticity, scalability, and virtualization in cloud computing enables organizations the flexibility of the deployment and use of their IT resources (Liu, Chan, Yang, & Niu, 2018). In addition to these features, cloud computing helps simplify IT resource management and maintenance (Akherfi, Gerndt, & Harroud, 2018). The ability of Cloud computing to simplify IT resource management and maintenance ensures that organizations and users focus on their core competence instead of dealing with the additional overhead of managing IT resources. Araya et al. (2018) exemplify this by proposing a cloud computing platform for astronomers to store and analyze astronomical data. Cloud platforms will ensure that astronomers focus on astronomy while cloud service providers handle IT infrastructure. Cloud computing provides the opportunity for organizations to increase their operational efficiency and performance while reducing costs. The technology has created a revolution in the way individuals and organizations approach the implementation of IT (Mohammed, Alzahrani, Alfarraj, & Ibrahim, 2017). Cloud computing can help government organizations actualize their e-government initiatives by offering an instant platform to host e-government services. According to Mohammed, Ibrahim, & Ithnin (2016), cloud computing can revolutionize e-government systems by providing cost savings and professional use of resources.

Cloud computing models.

Cloud service providers can implement cloud computing as public, private, community, or hybrid (Iwuchukwu et al., 2017; Lebeda, Zalatoris, & Scheerer, 2018; Liu, Yang, Qu, & Liu, 2016). Public cloud computing uses a third-party infrastructure to provide utility-oriented IT services to the public; examples of public cloud computing providers are Google, Amazon, and Microsoft (Mwakisole, Kissaka, & Mtebe, 2019). A private cloud allows large organizations to create their autonomous and proprietary public cloud services. A community cloud is a form of public/private cloud service that targets groups of individuals and organizations that share a common interest, and hybrid cloud service is a combination of both private and public cloud services. Cloud service providers also implement cloud computing as software as a service (SaaS), platform as a service (PaaS), and infrastructure as a service (IaaS) models (Alamoudi Y. & Alamoudi W., 2016; Attiya, Abd Elaziz, & Xiong, 2020). SaaS focuses more on end-users by providing instant access to online application and storage. PaaS focuses on the provisioning of development environments to deploy and host applications; it uses core middleware applications as a foundation. IaaS provides virtual computing infrastructure for the deployment of applications; it provides other scalable virtual infrastructure such as virtual machines, processors, memory, and storage (Zheng et al., 2017).

The choice of type or model of cloud computing depends on the user or organization's requirements and financial capacity. Additionally, cloud computing is composed of five layers, namely, client, server, application, platform, and infrastructure

(Shun-Jhe & Chung-Tai, 2018). Cloud computing allows users to enjoy the features of scalability and virtualization. Scalability ensures that users can scale up or scale down on their cloud computing requirements at any time without unnecessary costs and administrative overhead. Virtualization in cloud computing ensures that users can instantly provision and use different virtual servers or machines as permitted by their subscription (Arunarani, Manjula, & Sugumaran, 2018). Cloud computing utilizes the Internet and virtualization technologies in creating on-demand, configurable virtual resources that can be accessed by users ubiquitously (Chauhan, Pilli, Joshi, Singh, & Govil, 2018; Fagbolu, & Atoloye, 2018). Cloud computing implements virtualization using virtual machines (VM). According to Chen et al. (2020), a VM is an artificial or abstract machine without physical that provides services directly to end users. A VM returns all computing resources back to the physical servers once it has completed its computing tasks (Chen et al., 2020).

Cloud computing adoption benefits.

Cloud computing provides numerous benefits to both individuals and organizations. These benefits include but not limited to: (a) faster time to production and value, (b) reduced cost of operation, (c) high scalability and availability, (d) competitive advantage, (e) ubiquitous access to data and applications, (f) data backup and redundancy, (g) near infinite storage capacity, and (h) regularly updated applications.

Cloud computing provides an on-demand platform with ubiquitous access for individuals and organizations to achieve their goals and objectives quickly (Benlian, Kettinger, Sunyaev, & Winkler, 2018). Users will not have to worry about the

deployment and maintenance of IS infrastructure since the cloud service provider will handle this aspect, thereby reducing the time to achieve personal and business value. According to Kathuria, Mann, Khuntia, Saldanha, and Kauffman (2018), the potential value of cloud computing has motivated many organizations into the adoption of the computing model. Cloud computing provides cost savings in the long run by eliminating the high cost of purchasing hardware, applications, and manpower (Ogiela, U., Takizawa, & Ogiela, L., 2018; Yu, Cao, & Schniederjans, 2017). According to Holubnycha, Kostikova, Kravchenko, Simonok, & Serheieva, (2019), cloud computing is cost-effective because it reduces the cost of users' software application. Users' do not need to worry about purchase or updates to software applications as that has been addressed in the cloud computing back end. Cloud computing helps reduce cost since users only pay for computing resources used and can easily scale up or down as they require (Cearnău, 2018).

Additionally, individuals and organizations will reduce the cost of maintenance as they do not have to appropriate finances for the maintenance of IS infrastructure, support infrastructure, and support IT personnel. Cloud computing benefit regarding cost-saving has helped many businesses save as much as 22% on their total cost of operation (Joe-Wong, & Sen, 2018). In addition to the low cost of operation, cloud computing also offers users high scalability and availability (Si, Ke, & Shouyi, 2019). Users can easily scale their computing needs in a cloud computing environment. For example, users can demand an increase or decrease in their storage, processing, and memory requirements.

Users can also enjoy high availability of data and applications since most cloud computing service providers implement redundancy or disaster recovery (DR) sites, which ensure instant failover in the invent of a disaster in the primary cloud computing data center. The ability for cloud computing to provide users with low cost and highly scalable solution has attracted many startups. According to Ferri, Spanò, and Tomo (2020), startups have benefited from cloud computing regarding the ability to easily penetrate markets with entry barriers reserved only for large enterprises.

According to Akherfi, Gerndt, and Harroud (2018), cloud computing helps simplify IT resource management and maintenance. Organizations that adopt cloud computing can be competitive in the horizontal industry, and this is because they focus more on their core competencies, while cloud service providers help such companies optimize their service through cloud-based services. Such companies can leverage cloud computing services such as salesforce, human resource applications, accounting applications, advertising applications, and the rest to increase their competitive advantage. Cloud computing's ability to simplify the IT resource management and maintenance ensures that organizations and users focus on their core competence instead of dealing with the additional overhead of managing IT resources (Araya et al., 2018; Liu & Li., 2019). Ubiquity in cloud computing enables organizations the flexibility of the deployment and use of their IT resources (Liu, Chan, Yang, & Niu, 2018). Ubiquity ensures that computing resources can be accessed by individuals and organizations from any computing device, at any time, and from anywhere in the world. Users of cloud

computing will benefit from reliable data and application backup, disaster recovery, and redundancy. This assertion is because cloud computing service providers generally implement distributed computing over multiple data centers located in multiple cities and countries.

Distributed computing ensures that customers' data and applications are replicated in many locations so that faults in some servers or locations do not affect users' experience. Users also have the opportunity to scale their requirements for service redundancy easily; the higher the redundancy, the higher the cost of service. According to Sharma et al. (2016), cloud environments easily implement disaster recovery procedures due to their inherent virtualization features. Cloud service providers invest huge amounts of capital in storage technology. This action translates to almost near-infinite storage for users. Users can scale their storage needs; the larger the storage required, the higher the cost to the user. Finally, the implementation of cloud computing ensures that organizations and individuals do not worry about application patches and upgrades because the cloud service provider automatically handles this.

Cloud computing adoption challenges.

Data security.

Regardless of the advantages of cloud computing, certain challenges or risks prevent users and organizations to either adopt the technology or successfully manage data on the cloud platform. These risks which are difficult to mitigate is a major challenge for cloud service providers (Ismail, Ammar, Samer, & Issa, 2019). The biggest cloud computing adoption challenges are related to security, privacy, data migration, and

application integration (Shynu & Singh, 2018; Volkov & Sukhoroslov, 2017). Ebert, Weber, and Koruna (2017) also stated that data security and privacy are critical issues in cloud computing integration processes. Furthermore, Sun (2019), states that privacy and security are the prominent issues contributing to the popularity of cloud computing. Users perceive security and privacy as data confidentiality, availability, integrity, data transmission protection, and protection from breach of privacy. Cloud computing security and privacy issues can manifest in the areas of access control, authentication, data transmission, patch management, and security policy and compliance (Kaur, 2018). Diaz, Martin, and Rubio (2016) state that data security and user privacy are the biggest reasons why users and organizations are hesitant to adopt cloud computing. Alsmadi and Prybutok (2018) stated that security and privacy are major drawbacks to the wider adoption of cloud computing. Sharma and Kalra (2018), in their research, also mentioned privacy as the most significant challenge hampering users from migrating to the cloud.

He, Zhang, Li, Zhu, and Hu (2019) state that data integrity is one of the toughest issues in cloud computing; the migration of data protection from on-premise Information Systems to the cloud attracts the risk of an accidental or intentional data deletion and data breach (Ramachandra, Iftikhar, & Khan, 2017). In other words, organizations migrating to cloud computing platforms will lose the right to control data security (Marchisotti, Joia, & De Carvalho, 2019; Wang, Z., Wang, N., Su, & Ge, 2020). According to a cloud computing adoption research conducted by Basahel, Yamin, and Drijan (2016), an average of 77.5% of users agrees to the fact that security and privacy are major concerns

in the adoption of cloud computing. These users who exist in education, IT, manufacturing, and communication industries all responded to the research survey that data security and privacy are major barriers to the adoption of cloud computing.

Additionally, network attacks by hackers and malicious programs such as viruses have threatened the security of user data stored in the cloud (Gangwar & Date, 2016; He, Dong, Ota, Fan, & Wang, 2016). Consequently, users are reluctant to adopt the technology for fear of loss or theft of their data, as such, data security is one of the major requirements for users when planning to migrate to a cloud platform. Yan, Yu, Gong, and Li (2016) reference security as the principal barrier to the development of cloud computing. Additionally, architectural issues, communications issues, and contractual and legal issues constitute cloud computing implementation challenges at the service model perspective (Ali et al., 2015). Security and privacy challenges are also concerns for organizations engaged in mobile computing for remote access and marketing (Alonso-Monsalve, García-Carballeira, & Calderón, 2018). The advent of cloud computing has popularized the implementation of mobile computing, which takes advantage of the vast resources available on the cloud. According to Ahmad, Wang, Ullah, Sheharyar, and Mahmood (2018), mobile and smart devices can offload their complex computational requirements to the cloud to take advantage of high processing and storage resources. The proliferation of mobile cloud computing creates another level of security and privacy concerns for users. According to Mollah et al. (2017), the major concerns of users of cloud computing for mobile computing is related to the security and privacy of mobile

cloud computing. The shared environment in a cloud platform creates the proclivity for unauthorized access to data by attackers or unintentional alteration or deletion of data by cloud service providers (Ali, Shrestha, Soar, & Wamba, 2018). Confidentiality, integrity, and availability (CIA) of data are important factors to consider when migrating to a cloud platform. Loss of data CIA in a cloud system can render the system unsafe and untrustworthy since data is the core component for users (Kumar, Raj, & Jelciana, 2018). Trust and security are two major challenges of the adoption of cloud computing; therefore, maintaining the CIA in a cloud system help engender trust and sense of security in users. Trust in the cloud service providers' (CSP) cloud platform is the strongest factor that encourages users to adopt cloud computing. Trust is engendered in users when cloud service providers (CSP) can assure users of the CIA of their data. The multi-tenancy and virtualized environment make it difficult for conventional security measures such as firewalls, host-based antivirus software, and intrusion detection systems to adequately protect data and use due to the rapid spread of security threats via virtualized environments (Subramanian & Jeyaraj, 2018). Examples of security and privacy breaches in the cloud platform include the breach of iCloud service in 2014 and variously reported breaches of Google Drive, Dropbox, and Amazon Web Services cloud storage server (Patel & Alabisi, 2019; Widjaja, Chen, Sukoco, & Ha, 2018).

Another challenge of the adoption of cloud computing relates to infrastructure management and application integration. Infrastructure management issues can stem from a lack of expertise from the cloud service administrator or process algorithm issues. For

example, a research conducted by Madni et al. (2016) revealed that failing resource scheduling schemes and algorithms that allocate resources such as processor and memory to cloud applications may pose a challenge to the successful implementation of cloud computing. Cloud applications rely on the middleware layer of a cloud platform, and cloud users usually require the integration of these applications to create a complete virtual or cloud-based IS. According to Nowakowski et al. (2018), the middleware layer of a cloud platform consists of virtualization software and cloud computing stacks. This software ensures the creation and management of virtual machines that host different software applications. Application integration may become problematic if management issues are present in the middleware layer. Application integration issues may manifest as the inability to connect related applications on a cloud platform or failure to integrate cloud applications with an on-premise application or other partner organization's applications. The need for tighter cloud services and application integration is very imperative in delivering unified IS to organizations and users.

Fault tolerance.

Fault tolerance issues in a cloud system can hinder adoption, availability, and reliability. A fault is an abnormal or defective state of a system or part of the system, thereby preventing the system from functioning according to expectation. Sutaria, Prasad, and Bhavsar (2017) also described fault as the inability of a system to perform and deliver its required functions or services due to an anomaly or bug in one or many parts of the system. The actions of a fault can interfere with normal task execution, which may

cause a delay or a total halt in the cloud computing system. Faults may also lead to degradation in the cloud computing system, which may result in loss of time and money for the end-users (Louati, Abbes, & Cérin 2018). A fault may occur in the hardware, software, and network of a cloud system (Hasan & Goraya, 2019). According to Saritha and Raju (2016), the increasing functionality of the cloud system and complexities of applications, storage, and computation causes resource failures and faults in cloud computing, which reduces overall performance.

Similarly, Ding, Yao, and Hao (2017) attribute the high occurrence of faults in cloud computing systems to their increased functionality and complexity. Kumari and Kaur (2018) also relate faults in cloud systems to the extensive use of virtual cloud services, which results in service reliability and availability issues. A fault is an inherent part of cloud computing due to the amount of virtualization and physical servers involved (Shaikh & Ahmad, 2018). A fault is also a major challenge in cloud computing due to the increasing complexity of large-scale information systems within a cloud computing platform (Hui et al., 2018). A fault in a cloud computing platform can prevent system administrators from successfully provisioning the system and also preventing the availability and reliability of the system. Reliability, which is a very important aspect of cloud computing, is the probability of the hardware and software component of a system to perform correctly according to the user's expectations (Wang, Fu, & Cui, 2019). Therefore, IT administrators can ensure reliability in cloud computing systems by revising the issue of fault tolerance (Chiang, Chen, & Hsieh, 2018). According to

Mesbahi, Rahmani, and Hosseinzadeh (2018), about $285 million have been lost each year due to cloud service unavailability and unreliability. In March 2015, Microsoft Azure suffered two service failures related to faults, which affected users in the central and eastern parts of the United States of America (Wei & Pei-Li, 2016). Apple Cloud Services also experienced fault-related failures on 11 iCloud services in May 2015, which affect two million users (Wei & Pei-Li, 2016). Ali Cloud in 2011 also suffered a disk failure sequel to the completion of routine maintenance on its cloud platform, and this failure led to the loss of customer data (Yan, Zhang, & Yang, 2016).

Additionally, in 2017 alone, several cloud service providers suffered service failures. IBM's cloud infrastructure failure (January 26), GitLab's popular online code repository service outage (January 31), Facebook failure (February 24), Amazon Web Services (February 28), Microsoft Azure (March 16), and Microsoft Office 365 (March 21) (Mesbahi, Rahmani, & Hosseinzadeh, 2018). These failures, which are due to several faults in the cloud system, caused painful experiences for users who could not access their accounts, services, and critical data.

According to Kumari and Kaur (2018), the different types of faults in cloud computing are (a) Network fault, (b) Physical faults, (c) Process faults, and (d) Service expiry faults. Network faults are predominant in cloud computing because the service model is network-based. Network fault may occur as a result of packet loss, network disconnection, network congestion, and failure on a network node supporting a distributed application or service. Ultimately, faults in cloud service networks will

negatively affect businesses being conducted by users as a result of disconnection from the cloud platform. For example, a network fault may manifest in the form of data loss when exchanging health information over a network between a user and a cloud-based electronic health record application. Physical faults occur mainly in hardware infrastructures such as servers, server processors, storage hard disks, and power failure. According to Louati, Abbes, and Cérin (2018), the occurrence of physical faults in cloud computing systems is consequential to the presence of commodity hardware in the system. Commodity hardware involves the use and optimization of a huge amount of already available hardware components from different manufacturers to achieve cloud computing efficiency. The maximization of this commodity hardware may expose this hardware to conditions not originally designed for and may increase failure rates in cloud computing systems. Hardware fault is exemplified by Bala and Chana (2015) in their study. The researchers' study analyzed the problem of handling Virtual Machine (VM) fault during the execution of concurrent tasks where these tasks over-utilize cloud resources such as processors, memory, and storage disks. Process faults occur in processes due to low resources, software issues, and inefficient application processes. Service expiry faults occur when a resource's service expires, denying applications the use of such resources. Furthermore, Smara, Aliouat, M., Pathan, and Aliouat, Z. (2017) categorized types of faults in mobile cloud computing into data faults and computational faults. According to the researchers, data faults involve the exploitation of data in cloud

computing systems, while computational faults relate to hardware faults, software faults, and network faults.

Fault tolerance in cloud computing is the ability of a cloud computing platform to detect and identify faults and recover from the faults without negatively impacting on the cloud computing service (Nazari Cheraghlou, Khadem-Zadeh & Haghparast, 2016). Chaturvedi and Sharma (2017) also describe fault tolerance as the ability of a cloud system to handle failures that can occur during the scheduling process, which may be related to resource failure or unavailability, task failure, network issues, insufficient memory, and overloaded resources. Furthermore, Jiang and Hsu (2017) describe fault tolerance as a redundant design technique that ensures the availability of duplicate components to respond to primary component failures, thereby ensuring uninterrupted service from a system to its users. The researchers further describe fault tolerance as a standby technique that helps ensure the continuity of operation and an increase in quality of service (QoS) amid component failures in a system. According to Zhixin, Lei, and Zeyu (2017), fault tolerance can effectively mitigate failures in cloud computing platforms. Fault tolerance plays an essential role in the resilience, availability, and reliability of cloud computing resources, and users may strongly consider it as a factor for adopting cloud computing.

Critical Analysis and Synthesis of the Theoretical Framework

Technology acceptance model (TAM). TAM is one of the early models that explain the reasons why users accept and reject the use of IT. This theory is possibly the

most globally utilized model in the area of IS for measuring technology acceptance (Nagy, 2018). This assertion is also due to the adaptability, simplicity, and robustness of TAM (Al-Emran, Mezhuyev, & Kamaludin, 2018). Fred Davis developed this model in 1985 (Dixit & Prakash, 2018). TAM analyzes the factors or influencers of the intentions by individuals to use technology (Joo, Park, & Lim, 2018; Rienties, Herodotou, Olney, Schencks, & Boroowa, 2018). TAM provides this analysis by adapting the theory of reasoned action (TRA), which is a more general theory that predicts and explains human behavior across different spheres (Buabeng-Andoh, 2018). TRA hypothesizes that a person's exhibition of a certain behavior is influenced by his or her behavioral intention (BI) and the BI in question, also influenced by the person's attitude and subjective norm (SN) concerning the initially referenced behavior. Researchers widely use TAM 1 and TAM 2 in the IS literature such as scientific journals and conference proceedings, and this is because the framework easily validates why users utilize certain technologies.

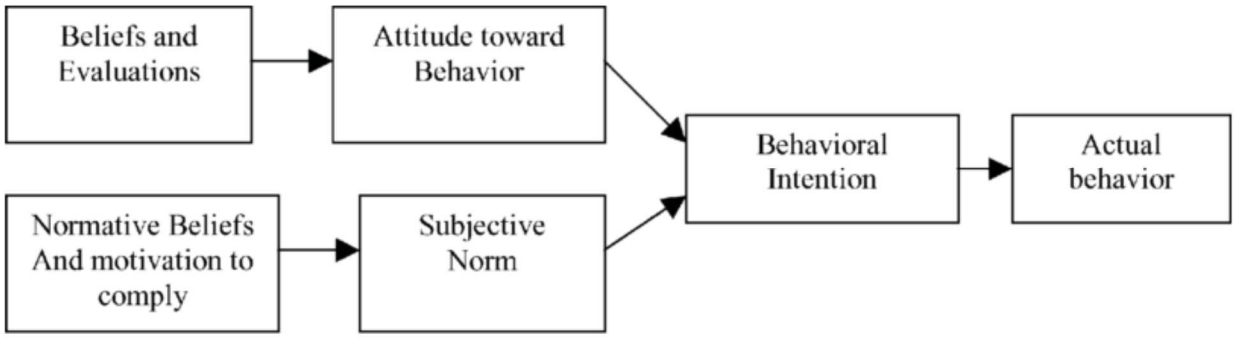


Figure 1. Theory of reasoned action (Reprinted with permission from Buabeng-Andoh, 2018, p. 180).

The primary tenet of TAM is that perceived ease of use (PEOU) and perceived usefulness (PU) of technology influence individuals' intentions to use technology (Wang & Goh, 2017). The following are the main constructs used by TAM: (a) Perceived usefulness (PU), (b) Perceived ease of use (PEOU), (c) Attitude towards using (ATU), (d) Behavioral intention to use (BIU), and (e) Actual System use (ASU) (Baki, Birgoren, & Aktepe, 2018; Koul, & Eydgahi, 2018).

PU is the degree to which an individual believes that the use of a particular system or technology would enhance his or her job performance. PEOU is the degree to which an individual believes that the use of a specific system or technology would be free of physical and mental effort (Fathali & Okada, 2018). ATU is a user's assessment of the desirability of engaging a particular technology or system. BIU is a measure of the likelihood of a user engaging a technology or system. ASU signifies whether a user uses technology or not. PU and PEOU directly influence the use of technology, while PEOU directly affects PU (Joo, Park, & Lim, 2018).

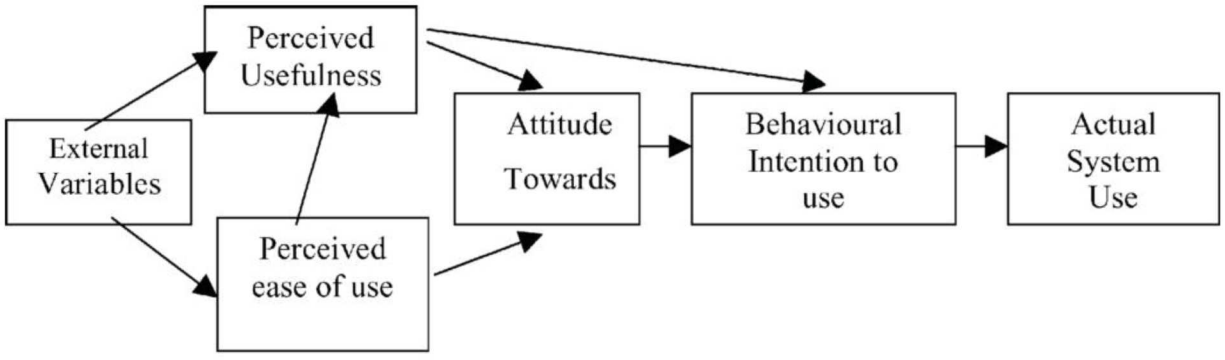


Figure 2: Technology acceptance model (Reprinted with permission from Buabeng-Andoh, 2018, p. 180).

Organizations can utilize TAM in determining the reasons behind staffs' decisions to accept or reject the use of IS. Understanding these reasons can help organizations select and deploy ISs that are easily adoptable by staff. Furthermore, organizations can also implement training and change management, which simplifies the use of technology and communicates the usefulness of technology to staff.

Venkatesh and Davis (2000) extended TAM to TAM 2 by introducing new variables. These variables include subjective norm, image, job relevance, output quality, result demonstrability, experience, and voluntariness. Additionally, the researchers merged the variables "attitude towards using" and "behavioral intention to use" into the new variable "intention to use." The new variable "intention to use" measures a user's intention towards the use of technology; this intention may be positive or negative. Furthermore, the new variables of TAM 2 can be categorized under the social influence and cognitive instrumental process. The category of social influence includes subjective norm, image, experience, and voluntariness. Additionally, the category cognitive

instrumental process includes job relevance, output quality, and result demonstrability.

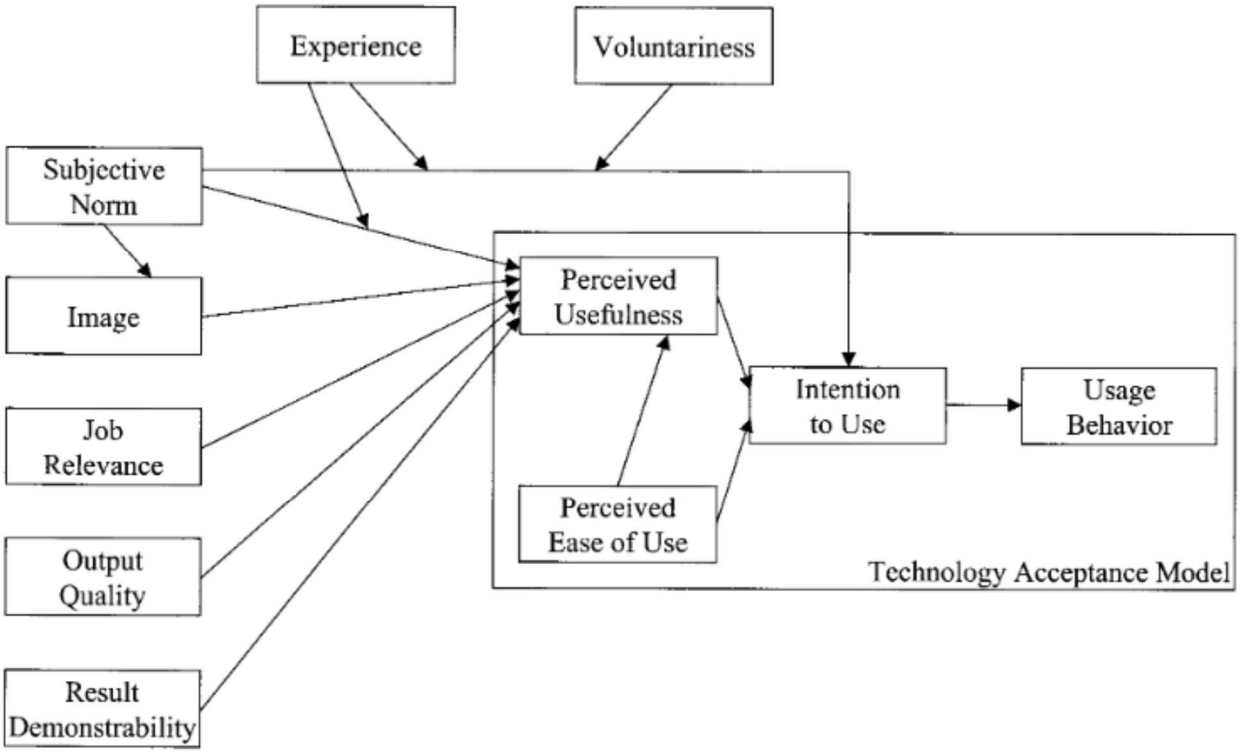


Figure 3. Technology Acceptance Model 2 (Reprinted with permission from Venkatesh & Davis, 2000, p. 188).

As applied to this study, the TAM framework helped to investigate the significance of the independent variables (IT administrators' perception of data security and fault tolerance) on the dependent variable (IT administrators' intentions to adopt cloud computing). TAM provided the framework to examine the relationship between IT administrators' perception of data security, IT administrators' perception of fault tolerance, and IT administrators' intentions to adopt cloud computing. TAM provided the framework to test the validity of both the null and alternative hypotheses. TAM relates to the variables of this study in the following ways: PU in this study relates to IT

administrators' intention to adopt cloud computing; perceived usefulness of cloud computing influences the intention of IT administrators' to adopt cloud computing, in other words, if IT administrators perceive cloud computing to simplify data storage, simplify integration of applications, simplify administration, improves data security, reduces cost, and increase job performance, they may adopt cloud computing, otherwise, they may drop the intention to adopt cloud computing. PEOU in this study relates to IT administrators' intentions to adopt cloud computing, IT administrators' perception of data security, and IT perception of fault tolerance; IT administrators' intentions to adopt cloud computing may be impacted by their perception of ease of use.

On the one hand, if IT administrators perceive difficulty in using cloud computing because of data security and fault tolerance issues, they may decide not to adopt cloud computing. On the other hand, if IT administrators perceive that the use of cloud computing is easy and free of data security and fault tolerance issues, they may decide to adopt cloud computing. ATU in this study relates to IT administrators' perception of data security, perception of fault tolerance, and intention to adopt cloud computing; IT administrators may evaluate the first two variables to determine whether it is desirable to use cloud computing or not. BIU in this study relates to the likelihood of IT administrators adopting cloud computing. Finally, ASU in this study helped determine if an IT administrator has used cloud computing before or not.

Supporting Theories

Numerous theories exist to explain the challenges of the adoption of cloud computing. Such theories include Unified Theory of Acceptance and Use of Technology (UTAUT), The Theory of Reasoned Action (TRA), Theory of Planned Behavior (TPB), Task, Technology Fit (TTF) model and Technology, Organization, Environment (TOE) framework. The supporting theories for this study highlight their authors, variables, and how they relate to the challenges of the adoption of cloud computing.

Unified theory of acceptance and use of technology. Venkatesh, Morris, Davis, and Davis created the Unified Theory of Acceptance and Use of Technology in 2003 (Gümüşoğlu & Akay, 2017). The researchers developed this theory due to the inability of TAM 2 to accurately predict technology adoption. According to Venkatesh and Davis (2000), TAM 2 is only able to predict success in technology adoption in 30-50% of the cases. This reason led the Venkatesh et al. (2003) to assess eight other existing models such as the technology acceptance model (TAM), theory of reasoned action (TRA), the theory of planned behavior (TPB), the combined TAM and TPB (C-TAM-TPB) the innovation diffusion theory (IDT), motivational model (MM), the model of PC utilization (MPCU), and the social cognitive theory (SCT). Venkatesh et al. (2003) discovered that TAM had the highest R-value of .53 among the other assessed models, and this revelation informed the theorist that TAM possesses the best fit for the prediction of users' intention to use technology.

UTAUT consists of four key constructs that influence behavioral intention and use behavior towards technology (Hanifi & Ali, 2017). These four constructs are (a) performance expectancy (PE) – the extent to which a technology provides benefits to users in increasing performance in certain activities, (b) effort expectancy (EE) – the degree of ease associated with users' use of technology, (c) social influence (SI) – the degree to which users perceive as important, that others believe they should use a new system or technology, and (d) facilitating conditions (FC) – users' perceptions of the availability of resources and support to use a new system or technology (Isaias, Reis, Coutinho, & Lencastre, 2017). Rahi, Ghani, Alnaser, and Ngah (2018) investigated the role of UTAUT in the internet banking adoption context. They conduct a quantitative approach-based survey to collect data from 398 internet banking users. The researcher utilized the structural equation model (SEM) approach, and the result of their study indicates that the UTAUT model provided a good theoretical foundation in technology adoption.

Similarly, Howard, Restrepo, and Chang (2017) extended the UTAUT model to understand the perceptions that users have towards utilizing building information management (BIM). The researchers conducted a survey which 84 industry stakeholders completed, and the results analyzed against a modified UTAUT model with additional variables, namely Attitude and employees moderators of Experience and Voluntariness. The results reveal that Performance Expectancy does not directly affect Behavioral Intention, signifying that stakeholders perceive BIM as an unrewarding addition to

existing work processes. As it relates to this study, UTAUT may help explain factors such as increase in productivity within organizations by implementing cloud computing (performance expectancy), ease of use of cloud-based applications and access to data (effort expectancy), influence other IT administrators to implement cloud computing (social influence), availability of supporting systems such as cloud security and fault tolerance (facilitating conditions) which are contributing factors to IT administrators acceptance of implementing cloud computing.

Theory of reasoned action (TRA). TRA is a widely used theory that elaborates and predicts the determinants of behavioral intentions (Fishbein & Ajzen, 1975). Martin Fishbein and Icek Ajzan developed the theory in 1975 (Karnowski, Leonhard, & Kümpel, 2018). TRA hypothesizes that a person's exhibition of a certain behavior is influenced by his or her behavioral intention (BI) and the BI in question, also influenced by the person's attitude and subjective norm (SN) concerning the initially referenced behavior. In other words, a person's BI will be influenced by his or her Attitudes (A) (evaluations of the consequences of a behavior) and Subjective Norms (SN) (perceptions of other person's approval or disapproval of the behavior), that is BI = A+SN (Lorenzo-Blanco et al., 2016). TRA utilizes the following constructs: (a) Behavioral Intentions (BI), Attitudes (A), and Subjective Norms (SN) (Dippel, Hanson, McMahon, Griese, & Kenyon, 2017). BI measures a person's intention to perform a specific behavior (Fishbein & Ajzen, 1975, p. 288). Attitude is a person's positive or negative feelings towards performing a specific behavior (Fishbein & Ajzen, 1975, p. 216). Finally, Subjective norm refers to a person's

perception that other persons think he or she should or should not perform a specific behavior (Fishbein & Ajzen, 1975, p. 302). Buabeng-Andoh (2018) explored the ability of the integration of technology acceptance model (TAM) and theory of reasoned action (TRA) to predict and explain university students' intention to use mobile learning in schools. The researcher surveyed 487 students using a seven-point Likert scale survey questionnaire. The researcher used structural equation modeling as the statistical technique to analyze the data, and the findings reveal that the resulting model was quite able to predict and explain behavioral intention (BI) among students in Ghana. Additionally, the study discovered that attitudes toward the use and subjective norm significantly determined students' BI to use mobile learning. In another example, Barman S. and Barman A. (2016) used TRA to identify the determinants of university lecturers' intention to adopt Problem Based Learning (PBL). They surveyed a sample of 112 lecturers of USM, chosen by random sampling. The researchers explored the effect of two external variables, namely knowledge and skill and three independent variables, namely attitude, subjective norm, and perceived belief control on the adoption of PBL by the lecturers. The findings of their study reveal that the lecturers' knowledge of PBL affects their attitude and perceived belief control.

Additionally, the lecturer's skills on PBL affect their subjective norm positively and significantly. Finally, the lecturer's attitude, subjective norm, and perceived belief control about PBL affect their intention to adopt PBL. As it relates to this study, TRA can help determine IT administrators' behavioral intentions to adopt cloud computing based

on their attitude towards the use and perception of other IT administrators' approval or disapproval (subjective norm) of their adoption of cloud computing.

Theory of planned behavior (TPB). TPB is the theory that uses independent variables to predict and explain an individual's behavioral intentions (BI), and BI, in turn, is used to predict an individual's behavior (Guo, Hermanson, Berkshire, & Fulton, 2019). Icek Ajzen developed the TPB in 1985 to improve on the predictive capability of TRA by including the variable perceived behavioral control. TPB utilizes three independent variables or formative predictors to predict an individual's behavior (Yuha, Jin, & Kyungmook, 2018). These variables are (a) attitude toward behavior, (b) subjective norms, and (c) perceived behavioral control (Ajzen, 1991; Anjum, Sharifi, Nazar, & Farrukh, 2018). Attitude toward behavior is the extent to which an individual positively or negatively evaluates a specific behavior, subjective norms is an individual's perception of how others approve or disapproves the individual's performance of a given behavior, and perceived behavioral control is an individual's perceived competence in performing a specific behavior based on experience or anticipated challenges (Ajzen, 1991). Many researchers have utilized TPB in predicting an individual's behavior. For example, Bhochhibhoya and Branscum (2018) conducted a systematic review to determine the effectiveness of the TPB and the Integrated Behavioral Model (IBM) in predicting and explaining alcohol-related behaviors in individuals. They reviewed 11 articles, and their findings revealed that the TPB and IBM models predicted between 45% to 75% variance for intentions and 26% to 90% of the alcohol-related behaviors. They also discovered that

attitudes accounted as the strongest predictor of behavioral intention, and behavioral intention accounted for the strongest predictor of alcohol-related behavior.

Similarly, Alami et al. (2019) used the TPB to explore the determinants that influence supplement intake, specifically determinants that influence dietary supplement behavior towards the use of iron and vitamin D supplements amongst adolescent girls in Iran. The researchers surveyed 485 adolescent girls aged 12-17 years. They used multiple analytical models, including hierarchical regression and structural equation modeling (SEM) to examine the link between TPB constructs and adolescent's behavioral intentions to consume dietary supplements. Their findings show that the variables of TPB and knowledge were found to predict 74% of the variation in the behavioral intentions of the adolescent girls. Additionally, SEM showed that perceived behavioral control (PBC) and knowledge had significant associations with intention behaviors to take nutritional supplements. As it relates to this study, TPB can help determine IT administrators' behavioral intentions to adopt cloud computing based on their attitude towards use, perception of other IT administrators' approval or disapproval (subjective norm) of their adoption of cloud computing, and their perception of past experiences with the adoption of cloud computing and related challenges (perceived behavioral control).

Diffusion of innovation theory (DOI). Researchers and analysts consider DOI as one of the essential theoretical models in explaining users' utilization of innovative ideas and technology (Mohammed, Alzahrani, Alfarraj, & Ibrahim, 2017). Dincă, Dima, and Rozsa (2019) describe DOI as one of the most generally utilized theories for the analysis,

interpretation, and estimation of users' adoption of technologies. Rogers and Shoemaker developed the DOI theory in 1983 (Turan, Tunç, & Zehir, 2015). The theory explains the process of communicating the innovation of ideas and technology through specific channels to users within a society over time. In other words, DOI explains the various stages of the adoption of innovative ideas and technology by users. The main constructs of DOI are relative advantage, compatibility, complexity, trialability, and observability. These constructs represent the various attributes that possess 49 to 87 percent capability to influence the adoption of innovative ideas and technology (Kim & Amran, 2018).

The period users require to traverse the innovation-decision dimensions can vary widely across users and circumstances (Scott & McGuire, 2017). Moore and Benbasat (1991) explained further explain DOI theory using seven dimensions. These dimensions are relative advantage, ease of use, compatibility, image, result demonstrability, visibility, and trialability. Relative advantage refers to users' perception that an innovative technology or idea is advantageous to increase their job performance; relative advantage is synonymous with perceived usefulness in TAM. Compatibility is the extent to which users perceive an innovative idea or technology as being consistent with their existing values, needs, and past experiences. Complexity refers to users' ease of learning and effortless use of innovative technology; complexity is synonymous with perceived ease of use in TAM. Trialability presents the opportunity for potential users to experiment with innovative ideas or technology. Finally, observability is the degree to which users see the results of an innovative technology or idea. As it relates to this study, DOI may

help explain the various dimensions IT administrators must consider before making adoption decisions on innovative technology such as cloud computing.

Task-technology fit model (TTF). The TTF model is a widely used model for assessing the fit between task and technology characteristics (Wu & Chen, 2017). The model helps explain the importance of how the implementation of technology improves users' performance. Users' identification of the task the technology addresses and the fit between the task and the technology determines the successful implementation of technology (Khan I., Hameed, Yu, Islam, Sheikh & Khan S., 2018). In this regard, TTF makes a general assumption that users will adopt technology based on its appropriateness to the task they intend to perform. In other words, TTF assumes that users will match technology with their task requirements. Goodhue and Thompson developed TTF in 1995 and included a measure of task-technology fit that consists of 8 factors, namely quality, locatability, authorization, compatibility, ease of use/training, production timeliness, systems reliability, and relationship with users (Goodhue & Thompson, 1995). The four constructs of TTF are Task characteristics, Technology characteristics, Individual performance, and System utilization. As it relates to this study, TTF can help explain the fit between different tasks (remote storage, virtual desktop infrastructure, and application management) and cloud computing technology. It can help explain IT administrators' consideration of the usefulness of cloud computing in achieving these tasks.

Technology-organization-environment (TOE) framework. This framework has become very important in providing researchers with a model for technology adoption,

which they can use for any organizational technology innovation adoption (Ngah, Zainuddin, & Thurasamy, 2017). Tornatzky and Fleischer developed the theoretical framework in 1990. TOE analyzes the factors or influencers of the adoption of technological innovations by firms and organizations (Tomás, Thomas, & Oliveira, 2018; Yousef, Rusli, Rodziah, & Yusmadi, 2018). The primary tenet of the TOE theory is that technology, organization, and the environment influence organizations' adoption of technological innovation or improvement (Chatzoglou & Chatzoudes, 2016). The following are the main constructs used by TOE: (a) Technology, (b) Organization, and (c) Environment (Yeh & Chen, 2018). Technology context refers to characteristics of technology such as availability, complexity, and compatibility, which impacts on the adoption of innovation.

Hassan, Nasir, Khairudin, and Adon (2017) also discovered IT resources as a technological factor affecting the adoption of innovative technology. Additionally, technology also refers to technologies that are relevant to the organization. The technology aspect of this study focuses on technology characteristics that show complexities involved in implementing cloud computing. According to Aboelmaged and Hashem (2018), users find a new technological innovation complex when it is difficult to use or implement. The organizational context depicts the characteristics of an organization relative to IT adoption; such characteristics include the size of an organization, the degree of complexity in management structure, the degree of formalization, intentions of staff, and relationships among employees (Ahmed, 2020).

The environmental context depicts the composition and structure of the industry, competitors, and government's regulations and policies (Ahmed, 2020). The environmental context may significantly affect the adoption of technology by organizations. For example, to obtain competitive advantages in the marketplace, the more intense the competition in business, the more pressure is on an organization to adopt an innovation and technology. As applied to this study, the TOE framework may help investigate the significance of the independent variables (data security and fault tolerance) on the dependent variable (system administrator's intention to implement cloud computing). TOE may provide the framework to examine the relationship between system administrators' perception of data security, system administrators' perception of fault tolerance, and system administrator's intention to implement cloud computing. TOE may provide the framework to test the validity of both the null and alternative hypotheses.

Contrasting Theories

Considering that multiple supporting theories exist to conduct this study, many other contrasting theories to this study exist. The chosen theoretical framework for this study is TAM. The contrasting theories presented highlight their definition, focus, authors, constructs, and the reasons they may not be as suitable for this study.

Actor-network theory (ANT). Bruno Latour, Michel Callon, and John Law developed the ANT in 1986 (Smith, Kempster, & Barnes, 2017). ANT conceptualizes how social interactions occur in a network of disparate elements (Iyamu & Mgudlwa,

2018). ANT can help understand how disparate elements converge to constitute networks and associations and connections (Parker, 2017). ANT can also help to describe the reasons why certain phenomena, ideas, and facts exist with a particular composition or configuration (Hung, 2016). Freeman (2018) states that researchers can only visualize the actions and interactions of entities by following the connections between heterogeneous elements that constitute such entities. According to Smith, Kempster, and Barnes (2017), Law applied ANT in the diagnosis of science, suggesting that it involves the process of heterogeneous engineering where different human and non-human elements fit together to form a set of equally heterogeneous scientific products. For example, while people believe that they are in control of data and they can manipulate data to make decisions, it is equally true that data also influence how people make decisions, thus creating a mutual interaction between human and non-human elements (Desai et al., 2017). Drawing from this example, it is evident that ANT perceives both human and non-human elements in a network as the same (Abrams, & Gibson, 2017).

The primary tenet of ANT is that heterogeneous elements constitute a network or system, and every element is important to the success or failure of the system (Zawawi, 2018). The following are the main constructs used by ANT: (a) Actor, (b) Actor-Network (c) Punctualization, (d) Translation, (e) Black box, and (f) Obligatory Passage Points (OPP). Actor refers to the natural, human, or non-human elements of the network. Actor-network is a network consisting of different elements with aligned interests (Bowers, 2018). Punctualization provides a form of abstraction for a complex network when

connecting to other networks; an abstracted network eventually becomes a node in a larger network. Translation is a process of aligning the interest of actors in the network with the focal actor. Black box creates an abstraction for a cooperative network. Finally, OPP describes how the focal actor mandates the other actors to pass through its requirements for the network. Considering this study, ANT was not suitable for explaining the challenges IT administrators consider in adopting cloud computing.

The reason being that ANT focuses more on how social interactions occur in a network of heterogeneous elements, while this study focused on the influencers of technology adoption.

Grey systems theory (GST): GST, which was developed by Julong Deng in 1982, focuses on the study of problems and systems with small samples and partial information (Rafal, Xie, & Dong, 2019). Salookolaei, Liu, and Nasseri (2018) also described GST as a system with partial and uncertain information, which is provided by both grey numbers and grey variables. In simple words, the theory focuses on extrapolating information from systems with very little information to understand the system (He, 2018). This theory has been useful in solving various real-life problems in the fields of economy, nature, technical, and social (Rafal, Xie, & Dong, 2019). Rafal, Xie, and Dong (2019) explained GST by using the black box and white box concepts; information about a known system is white information while an unknown system presents black information, and partial information about a system is grey information. Considering this study, GST was not suitable to explain the challenges IT administrators

consider in adopting cloud computing. The reason being that cloud computing is not a grey system worthy of being studied using GST; IT administrators already know information about cloud computing and its technical challenges. Additionally, this study is about the examination of the relationship between IT administrators' perception of these technical challenges and their intentions to adopt cloud computing.

Critical Analysis and Synthesis of Independent Variables

This study used two independent variables, namely: (a) IT administrators' perception of data security, and (b) IT administrators' perception of fault tolerance. This study examined if IT administrators' perception of these variables influences their intentions to adopt cloud computing. The result of this examination helped determine whether to accept or reject the null hypothesis of this study.

IT administrators' perception of data security. This independent variable represents how IT administrators perceive data security as an essential element in adopting cloud computing. IT administrators' understanding of this variable may influence their decisions to either adopt cloud computing or adopt a different computing model. For example, if IT administrators interpret cloud computing as a computing model with numerous data security issues, they may decide not to adopt the technology.

Conversely, if IT administrators understand that cloud computing is susceptible to data security issues, but understand the strategies to mitigate data security issues, they may adopt cloud computing. Data security is an imperative concept in IT implementation. Data security issues are growing at an exponential rate affecting personal data and the

survival of organizations globally (Noguerol & Branch, 2018). According to Hallová, Polakovič, Šilerová, and Slováková, (2019), there are a plethora of data security incidents such as malware information, data manipulation, and data leakage affecting many organizations globally. Data security ensures that organizations and individuals preserve the confidentiality, integrity, and availability of data. The absence of data security practices in an organization may prevent such organizations from achieving its business goals and objectives. Therefore, this variable helped measure how IT administrators' intentions to adopt cloud computing are affected by their perception of data security.

IT administrators' perception of fault tolerance. This independent variable represents how IT administrators perceive fault tolerance in cloud computing systems as an important element in adopting cloud computing. IT administrators understanding and interpretation of this variable may influence their decisions to either adopt cloud computing or adopt a different computing model. For example, if IT administrators interpret cloud computing as a fault intolerant computing model, they may decide not to adopt the technology. Conversely, if IT administrators understand that cloud computing is susceptible to faults, but understand the strategies to ensure fault tolerance, they may adopt cloud computing. Faults are inherent in cloud computing systems (Abdulhamid, Abd Latiff, Madni, & Abdullahi, 2018), and this is due to the network of multiple heterogeneous sub-systems that constitute cloud computing systems. Each of these sub-systems can easily fail due to numerous reasons, thereby causing the cloud system to fail. Fault tolerance in cloud computing is the ability of a cloud computing platform to detect

and identify faults in the system and recover from the faults without negatively impacting on the cloud service (Nazari Cheraghlou, Khadem-Zadeh, & Haghparast, 2016). Chaturvedi and Sharma (2017) also describe fault tolerance as the ability of a cloud computing system to handle failures that can occur during the scheduling process, which may be related to resource failure or unavailability, task failure, network issues, insufficient memory, and overloaded resources. These failures may negatively impact the applications deployed on virtual machines. Consequently, cloud computing must implement fault tolerance to address users' IS reliability and availability concerns. Therefore, this variable helped measure how IT administrators' intentions to adopt cloud computing are affected by their perception of fault tolerance.

Critical Analysis and Synthesis of the Dependent Variables

IT administrators' intentions to adopt cloud computing. This dependent variable represents the likelihood of IT administrators' mental state of commitment to adopt cloud computing in the future. IT administrators' intention to adopt cloud computing is a behavioral intention that can be negatively or positively influenced by the independent variables in this study. According to Reyes-Menendez, Ramon Saura, Palos-Sanchez, and Alvarez-Garcia (2018), Behavioral intention refers to the likelihood of using technology over some time. Therefore, this dependent variable measured the likelihood of IT administrators adopting cloud computing based on their perception of data security and fault tolerance in cloud computing.

Measurement of Variables

This quantitative correlational study used online questionnaires based on a Likert-type scale to measure research variables. The data collected using the online questionnaires formed a numerical basis for conducting further analysis using both descriptive and inferential statistics. In addition to the section that captured participants' demographic information, the questionnaire contained three other sections that captured data related to IT administrators' intention to adopt cloud computing, IT administrators' perception of data security, and IT administrators' perception of fault tolerance. I maintained the validity of the research variables by utilizing a validated survey instrument from previous research.

Compare and Contrast Points of View and Relationship of the Study to Previous Research and Findings

The purpose of this research study was to examine the relationship between IT administrators' perception of data security, IT administrators' perception of fault tolerance, and IT administrators' intentions to adopt cloud computing. This study relates to several previous works of literature, specifically from the point of data security in cloud computing, fault tolerance in cloud computing, and the adoption of cloud computing.

Adoption of cloud computing.

The first point of view of this study was the factors affecting the adoption of cloud computing. This point of view compares and contrasts with other previous literature on the adoption of cloud computing. Qasem, Abdullah, Jusoh, Atan, and Asadi,

(2019) conducted a systematic literature review to analyze extant research on the adoption and usage of cloud computing in higher education institutions to provide a coherent classification of influencers and barriers of cloud computing adoption. The findings of their literature review showed that self-efficacy, subjective norm, perceived ease of use, and perceived usefulness of cloud computing are major influencers of adoption while data security, user privacy, complexity, and lack of knowledge are major barriers of adopting cloud computing. Likewise, Rakesh, Bhaskar, Balkrishna, and Vaibhav (2019) identified the important factors influencing cloud computing adoption in the manufacturing micro, small and medium enterprises (MSMEs) and their findings show that the major influencers of cloud computing are hardware scalability and standardization, cost, innovation, installation and gradation, and quality of service. Dahunsi and Owoseni (2015) conducted a critical analysis of the advantages and challenges of users' adoption and usage of cloud computing in Nigeria. Their findings show that infrastructure issues, data security issues, lack of government policies, lack of awareness, and lack of research and development are barriers to the adoption of cloud computing in Nigeria. Comparing these works of literature with this study shows that users' perception of usefulness, self-efficacy, perception of ease of use, and subjective norm generally influences users' adoption of cloud computing. Conversely, the major barrier to cloud adoption common to the literature, and this study is data security issues.

Perception of data security.

Another point of view of this study was the perception of data security and its effect on the adoption of cloud computing. Rakesh, Pragati, Manoj, Bhaskar, and Sachin

(2018) identified and modeled critical barriers to cloud computing adoption in India's micro, small and medium enterprises using the interpretive structural modeling (ISM) approach. The findings of their research identified 14 barriers, which the researchers later summarized into three barriers, namely lack of confidentiality (data security and privacy), lack of top management support, and lack of sharing and collaboration. The perception of these factors dissuaded users from adopting cloud computing. Likewise, Priyadarshinee, Raut, Jha, and Gardas (2017) developed a hybrid two-stage, structural equation modeling (SEM) artificial neural network (ANN) model to predict factors affecting cloud computing adoption in the Indian private organizations. Their findings show that perceived IT security risk (data security), risk analysis, technology innovation, management style, and trust strongly affect the adoption of cloud computing in Indian private organizations. Comparing these pieces of literature with this study point of view shows that users' adoption of cloud computing is affected by users' perception of data security. Conversely, this study's point of view did not consider other predicting factors such as lack of top management support, lack of sharing and collaboration, risk analysis, technology innovation, and management style.

Perception of fault tolerance.

The last point of view of this study was the perception of fault tolerance and its effect on the adoption of cloud computing. Fault tolerance ensures that heterogeneous components of a cloud system can quickly recover from faults without negatively impacting on cloud users' experience. In other words, fault tolerance in cloud computing affects the reliability of the system, and this may affect IT administrators' intention to

adopt cloud computing. According to Abdulhamid and Latiff (2017), a prominent issue in cloud computing is fault tolerance issues in executing tasks and maintaining the availability of virtual machines. The researchers proposed a checkpoint league championship algorithm, which is a fault-tolerance aware scheduling system to address both time and hardware-dependent task execution failures. Liu et al. (2018) proposed both proactive and reactive fault tolerance schemes to enhance the reliability of cloud computing systems. These fault tolerance schemes ensure coordination among numerous virtual machines that jointly complete a parallel application. The result of the researchers' experiment showed the effectiveness of their proposed fault tolerance schemes at improving the availability and reliability of cloud computing systems. Comparing these pieces of literature with this study's point of view, it is clear that fault tolerance is a major issue in cloud computing. Conversely, these pieces of literature did not emphasize how fault tolerance affects users' intention to adopt cloud computing.

Gaps in Literature

While the literature researched challenges in the adoption of cloud computing in the areas of influencers of adoption of cloud computing, perception of data security, and perception of fault tolerance, there are some gaps in the literature. The literature did not focus on the challenges in the adoption of cloud computing in government organizations. The literature focused on higher education institutions and micro, small, and medium enterprises. Additionally, the literature did not focus on IT administrators as potential adopters of cloud computing. The literature rather focused on end-users and potential

adopters of cloud computing. Finally, the majority of the literature did not focus on cloud computing adoption in Nigeria, except for one literature. The majority of the literature focused on factors affecting cloud computing in India.

Table 1

Previous researches in challenges of cloud computing adoption

Author/Date	Perception of Data Security	Perception of Fault Tolerance	Intentions to use Cloud Computing	Significant Findings
Qasem, Abdullah, Jusoh, Atan, & Asadi, (2019)	Yes	No	Yes	Self-efficacy, subjective norm, perceived ease of use, and perceived usefulness of cloud computing are major influencers of adoption, while data security, user privacy, complexity, and lack of knowledge are major barriers to adopting cloud computing.

(table continues)

Author/Date	Perception of Data Security	Perception of Fault Tolerance	Intentions to use Cloud Computing	Significant Findings
Rakesh, Bhaskar, Balkrishna, & Vaibhav (2019)	No	No	Yes	Major influencers of cloud computing are hardware scalability and standardization, cost, innovation, installation and gradation, and quality of service
Dahunsi & Owoseni (2015)	Yes	No	Yes	Infrastructure issues, data security issues, lack of government policies, lack of awareness, and lack of research and development are barriers to the adoption of cloud computing in Nigeria
Rakesh, Pragati, Manoj, Bhaskar, & Sachin (2018)	Yes	No	Yes	Lack of confidentiality, lack of top management support, and lack of sharing and collaboration are barriers to adoption of cloud computing

(table continues)

Author/Date	Perception of Data Security	Perception of Fault Tolerance	Intentions to use Cloud Computing	Significant Findings
Priyadarshinee, Raut, Jha, & Gardas (2017)	Yes	No	Yes	Perceived IT security risk, risk analysis, technology innovation, management style, and trust strongly affect the adoption of cloud computing in Indian private organizations
Liu et al. (2018)	No	Yes	No	The researchers' experiment showed the effectiveness of their proposed fault tolerance schemes at improving the availability and reliability of cloud computing systems
Abdulhamid & Latiff (2017)	No	Yes	No	The researchers' algorithm is effective at addressing both time and hardware-dependent task execution faults

Transition and Summary

Section 1 provided an introduction to the problem addressed by this research study and also presented information about the background of the problem. The section presented the problem statement, purpose statement, nature of the study, the research question that related to an applied information technology issue, and the hypotheses that the study will subsequently examine. Additionally, section 1 also provided information about the significance of the study, study assumptions, study limitations, and study delimitation information technology. Finally, Section 1 ended by presenting an in-depth literature review that discussed the concept of cloud computing, its benefits, challenges, and the theoretical framework, which serves as an anchor for this study.

Section 2 starts with a restatement of the study's purpose statement and provides information regarding the study's research methodology and design. Additionally, the section provides information on the role of the researcher, study participants, target population, data collection instrument, data collection technique, data organization, and data analysis technique. Finally, section 2 ended with a detailed discussion on the study validity, which includes the identification of threats to validity and strategies to ensure the study's validity.

Section 2: The Project

Purpose Statement

The purpose of this quantitative correlational study was to examine the relationship between IT administrators' (a) perception of data security, (b) perception of fault tolerance, and (c) intentions to adopt cloud computing. The independent variables are IT administrators' perception of data security and perception of fault tolerance. The dependent variable is IT administrators' intentions to adopt cloud computing. The target population of this study consisted of IT administrators from government organizations in the northern part of Nigeria who have (a) adopted cloud computing and having challenges, (b) successfully adopted cloud computing, (c) intentions to adopt cloud computing. The implication for positive social change lies in the potential to improve government service delivery to citizens and businesses. Government services such as tax payment, vehicle registration, drivers' licensing, national identity number registration, passport registration, and so many others can be made available on a cloud-based electronic government (e-government) platform for citizens and businesses to access through a single-window portal. Behind this single-window portal will exist huge amounts of integrated government data, integrated applications, and integrated processes stored in cloud servers that are geo-located around the country. Integrated government data and services hosted on a cloud platform will help the government reduce the cost of IS infrastructure while increasing efficiency, productivity, and performance. When government organizations can successfully adopt cloud computing, then they can worry

less about their information systems and focus more on increasing the performance and efficiency of their services. Consequently, improved services from the government will ensure that citizens and businesses benefit from government policies. For example, citizens can have their passports, driver's licenses, vehicle registration, and health services processed and delivered faster, and businesses can experience a significantly reduced processing time for requests such as tax clearance, company registration, and other useful government information.

Role of the Researcher

As the researcher in this study, my role involved the recruitment of participants through partner organization contact persons, collection of data using an online survey instrument, analysis of data to examine the relationship between IT administrators' perception of (a) data security, (b) fault tolerance, and (c) intentions to adopt cloud computing and dissemination of the results of the analysis. I selected only a survey instrument that conformed to the criteria for the validity of empirical measurements. According to Barry, Chaney, Piazza-Gardner, and Chavarria (2014), researchers should evaluate survey instruments to ensure the integrity of the collected data.

The area of this study, which is cloud computing, is familiar to me due to previous implementations and maintenance of private and public cloud platforms for organizations. As an IT administrator in my organization, one of my roles is to ensure that the organization's cloud computing systems function effectively to support data storage, virtual desktop interface (VDI) implementation, virtual servers, web application

hosting, and software applications. The implication of my familiarity with the topic may introduce bias during data collection and analysis as I may have a preconception of the participants' responses and the result of the analysis. According to East (2016), there is significant evidence that elements such as preferred forms of order, heuristic processes, and mental accounting partly control judgment and decision-making.

I did not have relationships with the participants of this study because the participants exist in organizations that are not personally familiar to me. Additionally, I administered the survey remotely and anonymously using an online questionnaire, which participants accessed through a link sent via e-mail by the partner organizations' contact persons. According to Rowley (2014), participants can complete 44 questionnaires without the need for direct interaction with researchers.

Researchers should ensure participants protection from issues such as security, privacy, confidentiality, and integrity during data collection. Researchers must adhere to the Belmont Report, which states that researchers must exercise their ethical responsibilities by protecting human subjects during research studies (Adashi, Walters, & Menikoff, 2018). I ensured protection for my research participants by submitting my research plan or proposal to Walden University Institution Review Board (IRB). This action ensured that the IRB evaluated the extent of risk that my research participants are vulnerable to before embarking on the research. During data collection, I disclosed full information of the research to the participants and obtained implied informed consent prior to data collection. I also ensured that I read and understood the Belmont Report to

enable me to observe the guidelines for the protection of human subjects in research (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1978). I have already certified the understanding of my ethical requirements and responsibilities during research involving human subjects by completing the National Institutes of Health Protecting Human Research Participants online training course (Certification Number: 2557799). A copy of this certificate is available in Appendix A.

Participants

Researchers' ability to identify, screen, and recruit potential research participants cost-effectively and rapidly is very imperative to the success of research studies (Palac et al., 2018). Therefore, researchers require the engagement of the right participants to reduce the research time frame and ensure high-quality research process and research findings. Researchers must define certain participants' selection eligibility criteria before selecting participants. According to Elo et al. (2014), researchers must define criteria that show the participants' knowledge of the research topic. Participants who fit the criteria of the study topic can be easily identified and accessible using this method (Peterson & Merunka, 2014). The criteria that I defined in selecting my study participants include (a) knowledge of cloud computing, (b) position as an IT administrator, and (c) three years experience as a staff in the Nigerian government sector.

I gained access to the study participants through their heads of the organization and designated contact persons for each partner organization. According to Groves et al.,

(2012), gaining access to participants through sponsors can prevent the non-response bias, which represents the bias between research respondents and nonrespondents. I officially wrote the heads of research partner organizations of my intention to recruit their staff as study participants, and the heads of the organization, in turn, designated contact persons that forwarded my research intent to their staff. Sequel to permission from the heads of research partner designated contacts within each organization forwarded the research invitation letter, informed consent, and online survey link to potential participants. The invitation letter and the informed consent contained information such as the purpose of the research study, how their participation will benefit the study, research ethics, and ways of seeking further clarification on the study. According to McCullagh, Sanon, and Cohen (2014), researchers should inform research participants of the benefits of their participation in the research study.

Additionally, I sent a follow-up e-mail to the designated contact persons in each partner organization for onward delivery to potential participants. The follow-up-e-mail contained information about the study, the reassurance of participants' security and privacy, and assurance of participants' voluntary involvement in the research study. Tinkler, Smith, Yiannakou, and Robinson (2018) sent e-mails to participants assuring them of their voluntary participation in their research; the researchers used this strategy as a way to gain access to their participants.

I established a working relationship with the participants by requesting permission from their heads of the organization. This request for permission included a letter of

intent to conduct research and engage participants, details of the research, the possible risks involved, and an informed consent letter. Additionally, I provided the participants (via the designated contact persons) with all the information regarding the research. Information I provided to participants includes the nature and purpose of the study and the ethical responsibilities of the researcher to ensure that the participants' participation is anonymous. The Belmont report requires researchers to protect research participants by exercising ethical responsibilities such as providing participants with informed consent and ensuring participants' anonymity (Judkins-Cohn & Kielwasser-Withrow, 2014; Regan, 2013; Roberts & Allen, 2015).

Furthermore, I established an excellent rapport with designated contact persons in the partner organizations throughout the study period to enable the trust and retention of the participants. According to Grape, Rhee, Wicks, Tumiel-Berhalter, and Sloand (2018), researchers should establish a good rapport with study participants during screening and consent stages to engender trust and retention of participants. I sent reminders at regular intervals to participants via designated contact persons to help reduce the number of non-responders. In research on the diagnostic study of ovarian cancer conducted by Sun, Gilbert, Ciampi, and Basso (2017), the researchers sent up to two reminders to help reduce the number of non-responders. Finally, I informed the participants via the consent form of how the data collected will be used, kept, and destroyed.

Research Method

According to Sparkes, 2015, the philosophical worldview of the researcher is a significant influencer for the selection of a research method. There are three basic types of research methods that researchers can utilize, these are (a) Quantitative methods, (b) Qualitative methods, and (c) Mixed methods (Abutabenjeh & Jaradat, 2018). Quantitative research is a method that approaches studies from the worldview of post-positivism where researchers engage in objective research that is devoid of bias by testing theories and hypothesis and reporting findings based on tangible near infallible evidence (Tavakol & Sandars, 2014). Conversely, qualitative research methods stem from a constructivism worldview, and it provides researchers the opportunity to explore and capture the knowledge and experiences of humans to acquire an in-depth understanding of a phenomenon (Suzuki & Nagata, 2018). Mixed methods provide the opportunity for researchers to mix both quantitative and qualitative methods in a single study and utilize the best of both single methods in achieving the goals and objectives of the research (Zhou, 2018).

This doctoral study implemented a quantitative research method. Quantitative methods usually use statistical methods to test conceptual models and investigate relationships between variables (Christenson & Gutierrez, 2016). According to Rutberg and Bouikidis (2018), quantitative methods research inclines to accurate measures using statistical numbers. This reason makes the quantitative method appropriate as this study examined the relationship between IT administrators' (a) perception of data security, (b)

perception of fault tolerance, and (c) intentions to adopt cloud computing. A quantitative method was more appropriate for this study as opposed to using a qualitative and mixed-method because this study's goal is to investigate the relationship between independent and dependent variables using statistical methods.

Conversely, a qualitative method explores humans' knowledge and experiences of issues to gain an in-depth understanding of the issue (Malterud, Hamberg, & Reventlow, 2017). According to Malterud et al. (2017), researchers can use qualitative methods to explore meanings of phenomena and a deeper understanding of how and why humans behave within their natural context. This study was not exploratory, and it did not intend to gain an in-depth understanding of people's subjective knowledge or experience; therefore, a qualitative research method was not suitable for this study. Mixed methods research is used by researchers when a single research method cannot effectively explore a phenomenon. Mixed methods research is the fusion of both quantitative and qualitative methods in a single study (Zhou, 2018). According to Singh et al. (2017), mixed methods research involves conducting a quantitative data collection followed by qualitative data collection. The research method requires knowledge of both single research methods and a longer time to complete and can be very lengthy and difficult to publish (Jennifer & Mary, 2011). According to Jennifer and Mary (2011), the tendency for mixed methods study to be lengthy presents a hurdle for publication. This study did not engage in a qualitative study, which is an element of mixed-methods; neither did it combine elements

of quantitative and qualitative methods; therefore, a mixed method was not suitable for this study.

Research Design

A research design is a blueprint created by the researcher to guide the research process by structuring how a study will transition from the research purpose/questions to the outcomes (Abutabenjeh, & Jaradat, 2018). The research design involves a comprehensive planning process that depicts how data will be collected and analyzed by a researcher to increase the understanding of a phenomenon. Generally, selecting a research design begins with the identification of the outcome of the research. Focusing on the research outcome helps researchers design a plan that considers the following research process: research questions formulation, acquisition of data to answer the questions, analysis of the data, and presenting findings to answer the research questions (Abutabenjeh, & Jaradat, 2018). Designs used with the quantitative research methodology include experimental, quasi-experimental, and correlational (Turner et al., 2013).

This study utilized a nonexperimental correlational design. According to Turner, Balmer, and Coverdale (2013), a correlational design is used to discover or examine the strength of relationships between variables. This research design is used to determine the size and direction between variables (Curtis, Comiskey, & Dempsey, 2016). This design was used to determine the strength of the relationship between the research variables (a) perception of data security, (b) perception of fault tolerance, and (c) intentions to adopt

cloud computing. Other designs, such as descriptive, quasi-experimental, and experimental, were not suitable for this study. Experimental and quasi-experimental demonstrates connections in a process chain, showing a causative relationship between variables (Spector & Meier, 2014). The research design helps researchers determine whether a variable caused or influenced the occurrence or behavior of another variable (Turner et al., 2013). Although experimental and quasi-experimental designs show a causative relationship between variables, the former randomly assign participants to different levels of treatment (test group) and control group while the latter does not allow researchers randomly assign participants (Haegele & Hodge, 2015).

Additionally, since quasi-experiments lack control, several rival hypotheses may exist that compete with experimental manipulations for observed results. This study did not show a causative relationship between variables, nor did it create experiment groups; therefore, experimental and quasi-experimental designs were not suitable for this study. Descriptive designs help researchers observe and describe the status of a variable, and may help researchers develop hypothesis sequel to data collection. According to Omair (2015), descriptive research designs are used to provide a simple description of the desired characteristics of a sample under study. I did not base this study on a mere description of attributes of population samples; therefore, descriptive design alone did not suffice this study.

Population and Sampling

According to Haegele and Hodge (2015), population refers to a larger group of people who will serve as a source of study findings for a researcher while sampling refers to the process of selecting samples (participants) from a given population. The target population of this study consisted of IT administrators from government organizations in the Northern part of Nigeria who have: (a) adopted cloud computing and having challenges, (b) adopted cloud computing successfully, (c) intentions to adopt cloud computing. According to Elo et al. (2014), researchers must define criteria that show the participants' knowledge of the research topic.

Probability and nonprobability are two general sampling methods researchers use in acquiring samples of population (Rao et al., 2017). This study utilized a non-probabilistic convenience sampling. Asides from convenience sampling, purposive, snowball, and respondent drive are other types of non-probability sampling methods (Valerio et al., 2016). Convenience sampling is a nonrandom sampling method which allows participants who match predefined criteria of a research study and are usually within the same geographic area (Emerson, 2015). It targets participants who are convenient sources of data, can be easily accessed by the researcher, and can be easily observed and monitored by the researcher (Kivunja, 2015). Brodaty et al. (2014) also describe convenience sampling as a sampling method that engages participants based on their ease of access and willingness to participate. However, convenience sampling may skew the result of the study since the selected participants are similar in one or more

factors (Emerson, 2015). Convenience sampling limits the participation opportunity for every qualified individual in the target population, and study results that may be skewed by this technique may not fully represent the target population (Wu Suen et al., 2014). I chose convenience sampling for this study because my participants fall under predefined criteria; participants must be IT administrators, versed with cloud computing, work for the Nigerian government, and must have working experience of at least three years.

Additionally, my target participants are in the same geographical region, which is the Northern part of Nigeria. Other sampling methods such as purposive sampling may not be suitable for my study because researchers usually use this technique for qualitative studies where the target participants are selected based on the purpose of the study and are not interchangeable (Suen, Huang, & Lee, 2014). I solicited participants through e-mail invitations sent through their organizations. According to Grape et al. (2018), researchers should offer optional modes of data collection, such as mailing and online surveys, to improve participants' retention.

I achieved the sample size from the target population using the G* Power software; I achieved a sample size of 75. The G* Power software is a tool for computing statistical power analyses for many different statistical tests (Faul, Erdfelder, Buchner, & Lang, 2009). The software can also compute effect sizes and graphically display the results of power analyses (Faul, Erdfelder, Buchner, & Lang, 2007). I considered three factors for calculating sample size (n), namely (a) effect size, (b) alpha level, and (c) power level. Effect size depicts the strength between variable and ranges from .02 to.35,

where .02 represents a small effect, .15 represents a medium effect size, and .35 represents a large effect size (Cohen, 1992). I used a medium effect size of ($f = 0.15$) based on usage in similar studies (Green, 1991; Yang, Sun, Zhang, & Wang, 2015). I limited Type I errors by setting the alpha value to .05. An alpha value of .05 depicts that a researcher has 95% confidence in the actual estimate of a variable (MacNell, Driscoll, & Hunt, 2014; Whelan & DuVernet, 2015). However, an alpha value of .05 increases the likelihood of the occurrence of Type II errors. Considering the likelihood of Type II errors, I used a statistical power of .80. According to Cohen (1992), researchers should use a statistical power of .80 to help balance between the increase in Type II errors and acquiring a huge sample size.

This study conducted a power analysis using G* Power 3.1.9.4 to acquire the appropriate sample size for the target population. I conducted an F – Test for multiple linear regression to calculate a priori sample size with a medium effect size of ($f = 0.15$), an error probability of ($\alpha = 0.05$), a power of 0.80, and two predictors (Figure 3). G* Power software computed a minimum sample size of 68 participants to achieve a power of .80 and a maximum sample size of 107 using a power of 0.95. Therefore, this study required a minimum of 68 participants and a maximum of 107 participants.

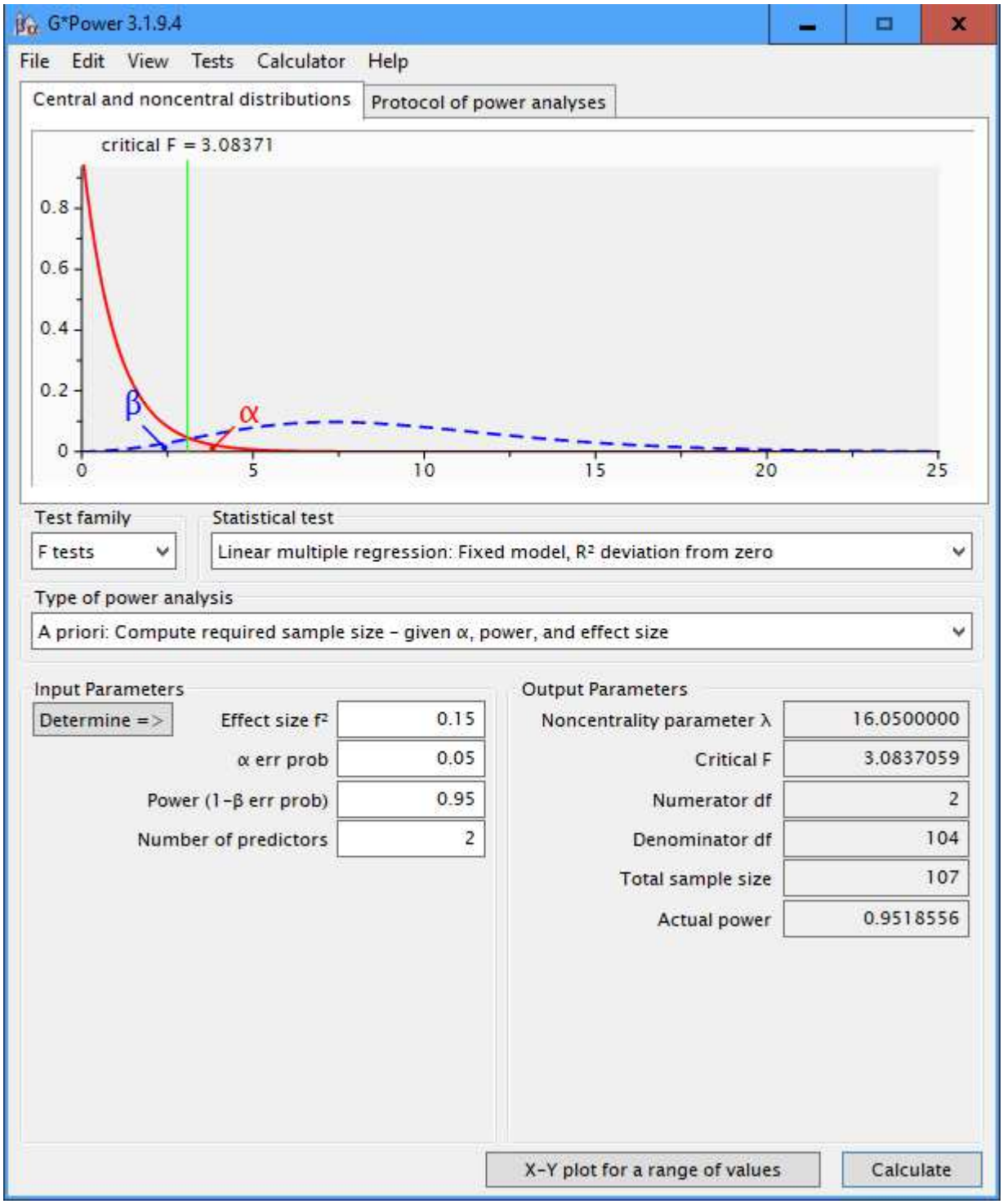


Figure 4. G*Power analysis to compute the required sample size.

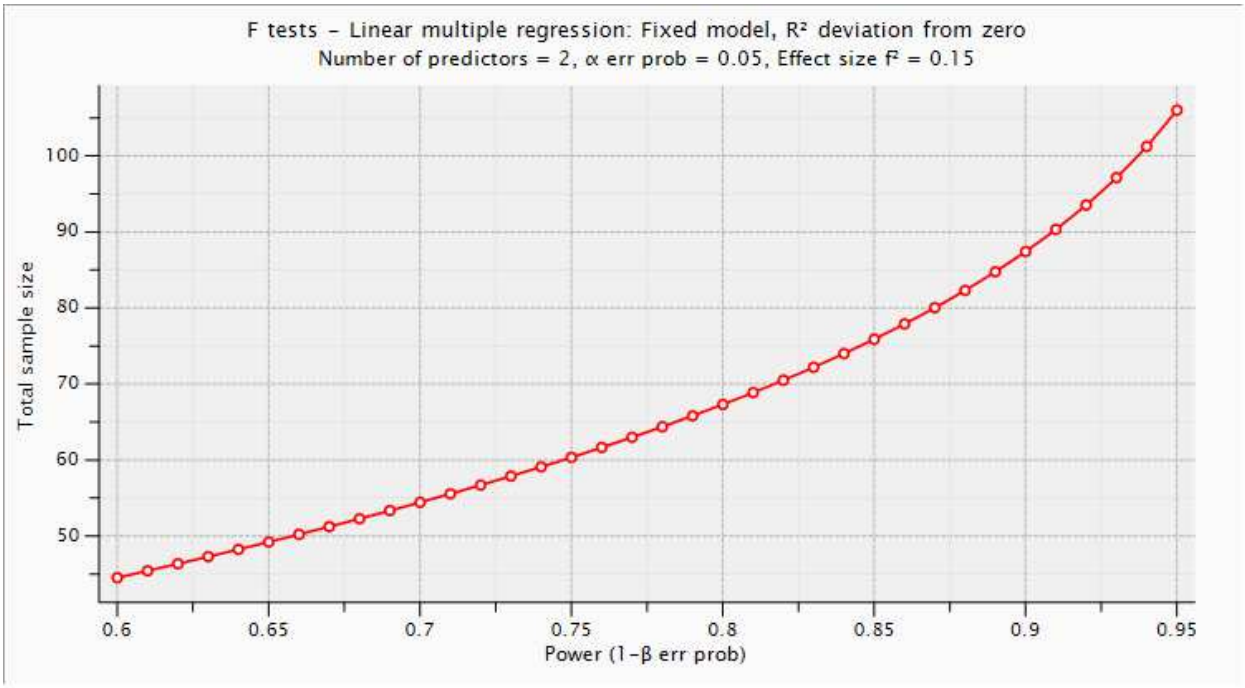


Figure 5. Power as a function of sample size.

An optional method to determine an appropriate sample size uses the formula 50+8(m) = sample size, where m is the number of independent variables (Lo, Chair, & Lee, 2015; Tabachnick & Fidell, 2013). Two independent variables, namely (a) IT administrators' perception of data security and (b) IT administrators' perception of fault tolerance, was used in this study; this means that m will be equal to 2, meaning 50+8(2) = 66. Based on this formula, 66 participants were the required sample size for this study.

Ethical Research

Informed consent is a critical aspect of ethical research practice (Brear, 2018). According to Simon, Schartz, Rosenthal, Eisenstein, and Klein (2018), informed consent is the process through which researchers truthfully communicate information about research and research participation to prospective participants, who, in turn, decide

whether to participate or not in the research study. Research participants must possess the capacity to comprehend the information provided in the informed consent form (ICF) and be able to decide on whether to proceed with research participation (Munley, Buser, Gaudreau, Breault, & Bazzano, 2018). According to Chiumento, Khan, Rahman, and Frith (2016), the use of informed consent in research studies is to uphold ethical standards during research involving human subjects. Participants' rights, such as privacy, security, and personal autonomy, are to be protected and respected by researchers (Hevia & Constantin, 2018).

I made available an Institutional Review Board (IRB) approved ICF containing all information about the research study to potential participants. This action ensured that participants made informed decisions regarding the ICF. Gentry, Lepere, and Opel (2017) state that informed consent involve divulging research information to the potential participants; this information includes but not limited to: description of the research, risks, benefits, assessment of participant's comprehension, and solicitation of preference and decisions.

Participants accessed the consent form via e-mail from their designated contact person and will need to click on a link to complete the online survey. Participants that click on the online survey link automatically provide implied consent. I configured the online survey (Survey Monkey) to collect data anonymously, meaning that Survey Monkey did not collect information such as names of participants, name of participants' organization, IP address, and the location of the participants. Sequel to the completion of

the data collection phase, I deleted all information on the online survey to ensure the security, confidentiality, and privacy of participants. The violation of participants' rights to anonymity and confidentiality are two significant ethical concerns researchers should avoid (Roberts & Allen, 2015). Therefore, researchers' assurance of confidentiality, anonymity, and the purpose of a study to participants are important elements of an informed consent form (Yin, 2014).

I ensured the privacy and confidentiality of study participants. This action is in line with the Belmont Report on the guidelines for the protection of human subjects in research (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1978). I assured the participants of their confidentiality in the informed consent provided to them. I have already certified the understanding of my confidentiality requirements during research involving human subjects by completing the National Institutes of Health Protecting Human Research Participants online training course (Certification Number: 2557799). A copy of this certificate is available in Appendix A.

I explicitly stated in the consent form the free will of the participants to withdraw participation from the study at any time; participants may choose not to start participation if they do not agree to terms and conditions of participation or withdraw during participation. Participants that are willing to withdraw may do so in writing via their organization (although no participant withdrew throughout the data collection process). In a situation where a participant withdraws participation, then his or her participation

will be rendered incomplete and not included for further analysis. Tideman and Svensson (2015) state the need for researchers to ensure that participants' voluntary participation, the option to opt-out of a research, confidentiality assurance, and the understanding to make an informed decision.

Research participation incentives engender motivation in participants, which helps increase the response rate (Göritz & Neumann, 2016; Hsu, Schmeiser, Haggerty, & Nelson, 2017). I did not provide financial incentives to participants. However, I emphasized the importance and benefits of the research as a way of incentivizing participants in this study.

According to Robinson (2014), researchers must inform participants of the purpose of the research study, participation requirements, the voluntariness of participation, and the protection of confidentiality. I ensured the ethical protection of participants by preserving the privacy and security of participants. All participants participated anonymously, and data collected was stored in an encrypted form in a password protected computer. Before engaging participants, I emphasized their autonomy and the purpose of the research, their participation requirements, possible risks of participation, and the preservation of their privacy, security, and autonomy. I will ensure that I securely store all information acquired from participants for five years. Subsequently, I will destroy all data following established destruction procedures at the end of five years. Finally, I did not collect names and other personally identifiable information of research sites and participants.

Data Collection

This study utilized a survey instrument to collect data. To forestall the need for a pilot study to test the reliability and validity of the survey instrument, this study used a pre-existing survey from previous research studies that conform to the reliability and validity criteria for instruments. The data collection utilized online survey tool by Survey Monkey.

Instrument

I utilized an instrument based on the instrument previously developed by other researchers that have met reliability and validity criteria. Although I made minor adjustments to the survey instrument, however, these adjustments will not invalidate them. The researchers clearly state that no permission is required to use their instrument for educational purposes (please see Appendix E); the researchers only require that I give credit to them on the final version of the survey instrument. The final version of my survey instruments measured IT administrators' intention to adopt cloud computing, IT administrators' perception of data security, and IT administrators' perception of fault tolerance.

I adopted and adapted Morosan and DeFranco's survey instrument from their research titled "It's about time: Revisiting UTAUT2 to examine consumers' intentions to use NFC mobile payments in hotels". The authors published their survey instrument in 2016. Their study used the instruments to measure users' adoption of near field communication (NFC) mobile payments in hotels located in the U.S. The researchers'

instrument uses five-point Likert-type scale questions with ordinal values where 1 represents "Strongly disagree," and 5 represents "Strongly agree." Researchers commonly utilize Likert scales in attitude related research projects (Joshi, Kale, Chandel, & Pal, 2015). Researchers such as Garrison, Wakefield, and Kim (2015) and Hsu and Lin (2016) used a five-point Likert-type scale in their studies. Morosan and DeFranco (2016) original survey instrument measured: (a) Performance expectancy (b) Effort expectancy, (c) Social influence, (d) Facilitating conditions, (e) Hedonic motivation, (f) Habit, (g) General privacy, (h) System-related privacy, (i) Perceived security, and (j) Intentions. I only used questions from four variables in the researchers' survey instrument, namely perceived security, intentions, general privacy, and system-related privacy. These questions were modified to measure the constructs in this study, namely IT administrators' perception of data security, IT administrators' perception of fault tolerance, and IT administrators' intentions to adopt cloud computing.

This study presents the original survey instrument with its questions in Appendix C and the adapted version for this study in Appendix D. The instrument measured its constructs using 47 close-ended questions, which elicited responses from participants. According to Quick and Hall (2015b), researchers who use close-ended questions allow the quantification of participants' responses. The instrument measured ten variables using close-ended questions that varied between three and 14 for each variable. The instrument also includes both demographic and behavioral questions. The demographic questions elicited information such as age, gender, income, and education. The behavioral

questions elicited information such as frequency of stay, length of stay, and purpose of stay.

This instrument was appropriate for adaptation to this study because both studies border on factors that may affect the adoption of information systems. Morosan and DeFranco's instrument measures factors that affect the adoption of NFC mobile systems; likewise, this study adapted the researchers' instrument in measuring factors that affect the adoption of cloud computing. Additionally, the variables perceived security and intention are similar to two of this study's variables, which are IT administrators' perception of data security and IT administrators' intentions to adopt cloud computing.

Morosan and DeFranco (2016) administered their instrument by sending invitation requests to 25,356 consumers from the U.S general population, which they obtained by purchasing access from a consumer panel company. The researchers shortlisted the final participants by asking them two filter questions relating to whether they have stayed in a hotel for 12 months before the study and whether they had smartphones. Consequently, the researchers retained a total of 794 participants, which produced a net response rate of 3.1 %. I administered this study's survey instrument by presenting online questionnaires to about 90 participants in the northern part of Nigeria. The questionnaire contained filter questions related to whether the participant is an IT administrator, works in a Nigerian government organization, has knowledge about cloud computing, and has worked for a minimum period of three years.

Other researchers have used similar instruments in their studies. For example, Zhou (2013) used a similar instrument in his study titled "The effect of flow experience on user adoption of mobile TV" to measure the factors affecting the adoption of mobile television. Similarly, Al-Debei, Mutaz, and Al-Lozi (2014) also used similar instruments to measure user adoption of mobile data services in their study titled "Explaining and predicting the adoption intention of mobile data services: A value-based approach." Finally, Gupta, Yun, Xu, and Kim (2017) used a similar instrument to measure user adoption of mobile banking in their study titled "An exploratory study on mobile banking adoption in Indian metropolitan and urban areas: A scenario-based experiment."

Morosan and DeFranco (2016) calculated scores using descriptive statistics, and they presented scores in percentages. The descriptive statistics showed that the sample between males and females had an equal share of this sample with an age group distribution close to the U.S general population. Nearly all participants (38.6%) had annual household incomes between $50,001 and $100,000. Additionally, the majority of the participants have college degrees, stayed in hotels three to six occasions per year (41.5%) for two to three nights (57.9%) mostly for leisure (34.7%). This study represented scores using descriptive statistics; scores include demographic and construct related scores from participants.

Morosan and DeFranco (2016) verified the reliability of their instrument by calculating composite construct reliabilities for each construct; the result of their calculation is greater than .8, indicating appropriate reliability. Additionally, the

researchers verified the validity of the instrument. The researchers confirmed convergent validity by ensuring that: (a) The instrument's factor loadings exceed .5 and are significant, (b) the squared multiple correlations of all items exceeded .4, (c) the average variance extracted (AVE) values for each latent construct is greater than .5. The researchers also confirmed discriminant validity by comparing the AVE values to the squared inter-construct correlations and discovered that the AVE values are greater than the inter-construct correlations, except for two correlations that were partially lower.

Changes I made to this instrument include the replacement of measured variables with my study variables, "NFC mobile payments" with "cloud computing," and hotel with "organization." Morosan and DeFranco (2016) and other researchers such as Hsu and Lin (2016), and Ji and Liang (2016) made changes to their adopted instruments to align with the context of their study. Although changes to the original instrument may potentially affect its reliability and validity, however, I re-confirmed the reliability and validity of the instrument using factor analysis and test for Cronbach's coefficient alpha. This study presented the raw data collected using this instrument in the appendices section.

Data Collection Technique

I engaged the heads of identified government organizations from the Northern part of Nigeria to recruit the IT administrators that will constitute my research participants pool. This strategy helped recruit participants that meet participation criteria and also improve the response rate. According to Groves et al., (2012), gaining access to

participants through sponsors or superordinates can prevent the non-response bias, which represents the bias between research respondents and non-respondents.

I collected anonymous data using Survey Monkey, which is a web-based survey application. Researchers collect data in quantitative studies using survey instruments (Quick & Hall, 2015a). The advantage of using an online survey is that it easily organizes data for statistical analysis, it can cost-effectively reach large participants, and it can elicit honest and objective responses (Roberts & Allen, 2015). According to Rowley (2014), online surveys have the potentials to obtain responses from a larger number of respondents. Additionally, Awosan (2014) used survey monkey, which is an online survey instrument, and he claimed that it allowed him easily administer the questionnaires and also allowed for easier statistical analysis. Furthermore, Hollier, Pettigrew, Slevin, Strickland, and Minto (2016) state that online surveys can be also convenient for researchers as it reduces the time for data entry.

Conversely, an online survey presents a disadvantage of a lower number of responses and engagement from participants since the researcher may not be present to enforce the survey. Mingnan and Wronski (2018), states that while online surveys may elicit truthful and frank responses; the level of participants' engagement is lower in comparison to participants engaged via interview. Similarly, Rice, Winter, Doherty, and Milner (2017) also state that online surveys typically yield low responses regardless of their convenience to respondents and researchers. Online surveys typically yield low

responses, which may lower sample size and eventually reduce statistical power (Sauermann & Roach, 2013).

Sequel to IRB's approval, I approached the designated contact persons in the research partner organizations to further explain the purpose of the study and participants' requirements. Subsequently, I sent an e-mail containing an invitation letter, informed consent, and online survey link to the designated contact persons. I continued to follow up with participants through their designated contact persons, both physically and via e-mail, to help increase the level of participation. Sun, Gilbert, Ciampi, and Basso (2017) sent up to two reminders to participants to help reduce the number of non-responders, thereby increasing the response rate.

Data Analysis Techniques

This research study attempted to answer the research question about the relationships between IT administrators' (a) perception of data security, (b) perception of fault tolerance, and (c) intentions to adopt cloud computing. The null and alternative hypotheses of this research study are:

Null Hypothesis (H_0): There is no statistically significant relationship between IT administrators' perception of data security, IT administrators' perception of fault tolerance, and IT administrators' intentions to adopt cloud computing.

Alternative Hypothesis (H_1): There is a statistically significant relationship between IT administrators' perception of data security, IT administrators' perception of fault tolerance, and IT administrators' intentions to adopt cloud computing.

I tested the hypotheses developed from the study's research question. Subsequently, this study used data collected from the research participants to address the research question and hypotheses. I utilized both descriptive and inferential statistics for the analysis of data. Both descriptive and inferential statistics are subsets of statistics, which is a science of collection, analysis, presentation, and interpretation of data (Mishra et al., 2019). The descriptive statistics I used include the mean, median, mode, and standard deviation, while the inferential statistics I used is multiple regression analysis. I provided an initial description of my data set by measuring central tendency and variability. Researchers use descriptive statistics for the statistical description of data (Jankowski & Flannelly, 2015). I also used inferential statistics to predict the impact of the two independent variables on the dependent variable. According to Bernard (2013), researchers use inferential statistics for statistical predictions. Likewise, Curtis, Comiskey, and Dempsey (2016) also state that researchers use multiple tests such as Person product-moment correlation, regression analysis, t-test, and analysis of variance (ANOVA) to examine relationships between research variables.

Researchers can use multiple regression analysis to examine the variation between dependent and independent variables (Nimon & Oswald, 2013; Uyanık & Güler, 2013). I used multiple regression statistical analysis to determine the relationship between the two independent variables and the dependent variable. Multiple regression analyses go beyond the boundaries of simple linear regression to examine the relations between multiple independent variables and a single dependent variable (Ray-Mukherjee et al.,

2014). Multiple regression statistical analysis was appropriate for this study, as I examined the relationships between multiple variables.

Conversely, other inferential statistical analysis techniques such as t-test and ANOVA were not suitable for this study because this study does not intend to compare mean scores for multiple groups, nor did it examine causality between variables. According to Jupiter (2017), researchers use other inferential statistical techniques such as *t*-test and ANOVA to compare mean scores for multiple groups. This study examined the relationships between independent and dependent variables (ignoring causality between variables) from a single group of participants.

Data cleaning and screening of completed questionnaires are imperative in improving the quality of data analysis. Before data analysis, researchers should screen returned questionnaires to ensure that incomplete questionnaires are discarded to reduce errors in calculation and biases (Curran, 2016; Rowley, 2014). Before data analysis, I screened returned questionnaires for incomplete responses and participant's inclusion criteria. Sequel to questionnaire screening, I exported data to the Statistical Package for the Social Sciences (SPSS) 25.0 software application. I performed validation to ensure that data in the SPSS corresponds with the source data from the questionnaire. This process ensured that I discovered missing data, incorrectly coded data, and incorrectly transcribed data.

Additionally, I identified and eliminated outliers from the data set. Outliers are data that deviate from other members of a data set from a sample (Niven & Deutsch,

2012). According to Niven and Deutsch (2012), researchers should identify and remove outliers before data analysis. I identified outliers using box plots and by comparing the *z* scores standard deviation from the mean and observing values outside the +/- 3.29 range. According to Hazra and Gogtay (2016), researchers can visually identify outliers through box plots and scatter plots. I conducted all the study statistics using the SPSS 25.0 software application. According to Green and Salkind (2014), SPSS software application helps researchers easily compute and analyze simple and complex data without needing to learn and write complex code nor statistics.

I tested the assumptions of homoscedasticity, multicollinearity, outliers, normality, and linearity. The test of these assumptions ensured no violations and guaranteed an accurate analysis of inferential statistics (Benard, 2013). According to Williams, Grajales, and Kurkiewicz (2013), violating assumptions can lead to multiple dire consequences such as biased estimates of relationships, biased standard errors, and biased confidence intervals. In a multiple regression model, multicollinearity occurs if many independent variables are tightly correlated (Dormann et al., 2013). I searched for multicollinearity during data analysis by conducting a correlational analysis, examining Variation Inflation Factor (VIF) scores, and reviewing correlation coefficients between the independent variables. I ensured that bivariate correlations between independent variables do not exceed .90 to eliminate multicollinearity. Bivariate correlations that exceed .90 between independent variables reflect the presence of multicollinearity (Dormann et al. 2013).

The assumption of normality states that populations that generate samples are normally distributed (Ghasemi & Zahediasl, 2012). Data satisfy normality when its highest frequency of occurrence positions at the center of a probability distribution curve, and this frequency of occurrence decreases as it moves away from the center (Kim & Park, 2019). I tested normality by utilizing probability plots (P-P). The assumption of homoscedasticity states that the variance of data analyzed and the independent variables are the same (Zolna, Dao, Staszewski, & Barszcz, 2016). Testing for homoscedasticity involves testing for the constancy of the variance function (Chandler & Polonik, 2017). The violation of assumptions of homoscedasticity may lead to inefficient parameter estimation and exaggerated confidence interval estimation, which leads to wrong data analysis conclusions (Yu, Liu, & Chen, 2019). Additionally, the assumption of linearity states that the relationship between both dependent and independent variables is linear, and this relationship is represented by a straight linear on a graph (Osborne & Waters, 2002). I tested these assumptions using scatter plots. Although the study did not violate any statistical assumption, if it did, I would have addressed the violations using bootstrapping. Bootstrapping helps to address the violation of statistical assumptions. According to Montoya and Hayes (2017), bootstrapping can increase accurate analysis regardless of statistical assumption violation. I interpreted inferential statistical results by presenting the result of the multiple regression analysis, and the p-value helped determine whether relationships exist or not among the independent and dependent variables.

Study Validity

Validity in quantitative studies helps to show the extent or degree to which measures capture variables (Trochim, Donnelly, & Arora, 2015). In other words, validity ensures that a measure measures the variables it's designed for and confirms the legitimacy of the study (Venkatesh et al., 2013). Lee, Kanzawa-Lee, Knoerl, Wyatt, G., and Smith (2019) also state that validity involves the degree to which the research design controls extraneous variables to establish causality between the study's independent variables and the dependent variable. There are specific threats to quantitative research validity, which includes internal threats, external threats, statistical conclusions, and construct adequacy. Internal validity relates to the number of confounding variables other than the defined variables causing the emergence of another variable (Torre & Picho, 2016). External validity involves the generalizability of the relationships between variables beyond the context or requirements of the research (Hales, 2016). External validity also relates to the generalizability of study outcomes across different persons, outcomes, settings, and treatments (Torre & Picho, 2016). Dissimilarities between the sample population and the general population can affect external validity (Costa, Hari, & Kumar, 2016). Construct validity shows the extent to which a test measures intended variables (Morse, 2015). Statistical conclusion validity shows the extent to which conclusions among independent and dependent variables are correct (Gibbs & Weightman, 2014).

According to Flannelly, K. J., Flannelly, L. T., and Jankowski (2018), threats to

internal validity include statistical regression, history, maturation, testing, instrument decay, statistical regression, selection, and mortality. An experimental study with a high level of internal validity must ensure that only the study's independent variables are responsible for the change in the dependent variable (Flannelly, K. J., Flannelly, L. T., & Jankowski, 2018). Regression validity may also affect the internal validity of a study by introducing extreme participants' scores. Internal validity applies to experimental and quasi-experimental studies involving the establishment of causality (Haegele & Hodge, 2015). Since this study is not experimental and does not intend to establish causal relationships between variables, then internal validity did not apply.

Convenience sampling may pose a threat to the external validity of this study by introducing selection bias. Selection bias may prevent researchers from drawing an inference from the population (Bevan, Baumgartner, Johnson, & McCarthy, 2013). While convenience sampling may aid a faster selection of participants, it may also reduce generalizability (Valerio et al., 2016). Other threats to external validity are multiple treatment interference, reactive effects of experimental arrangement, and interaction of selection bias and experimental treatment (Torre & Picho, 2016). I addressed threats to external validity by reducing my influence on participants using an online survey. According to Walter, Dunsmuir, and Westbrook (2015), researchers who use online surveys reduce their interaction and influence on participants' responses.

Threats to statistical conclusion validity of this study may include low statistical power and wrong estimation of effect size, which may lead to type I and type II errors.

According to Neall and Tuckey (2014), threats to statistical conclusion could emanate from the sampling process, statistical power, and statistical analysis methods used by the researcher. Similarly, Suter W.N. and Suter (2015) attributed threats to statistical conclusion to factors that can increase type I and type II errors. Type I error occurs when a researcher rejects a true null hypothesis, while type II error occurs when a researcher accepts a false null hypothesis. I addressed threats to statistical conclusion by using a large sample size determined by the G* Power software. A small sample size can result in type II error and low power (Schweizer & Furley, 2016). Additionally, I used an α value (significance level) lower than 0.05 to reduce the risk of type I error.

Transition and Summary

Section 2 restated the purpose of this research study and also presented information about the target population and the implication for social change. The section discussed the role of the researcher, participants, research method, research design, and population, and sampling. Furthermore, section 2 discussed the ethical requirements of the researcher, survey instruments, and data collection and analysis. Finally, section 2 ended with a detailed discussion on the validity of the study, threats to study validity, and ways to address threats to study validity.

Section 3 will start with a presentation of the overview of the study and the methods for presenting findings from data analysis. Furthermore, this section will end with the application of findings to professional practice, the implication for social change,

recommendations for action and further research, reflections, concluding statements, and appendices.

Section 3: Application to Professional Practice and Implications for Change

This research study used a correlational quantitative research method to examine the relationships between IT administrators' (a) perception of data security, (b) perception of fault tolerance, and (c) intentions to adopt cloud computing. In section 3, I will present the results generated from the analysis of data collected from the study participants.

Overview of Study

The purpose of this quantitative correlational study was to examine the relationship between IT administrators' (a) perception of data security, (b) perception of fault tolerance, and (c) intentions to adopt cloud computing. Using the G*Power software application. I calculated *a priori,* the sample size, the error probability, the power, and the number of variables. The result of the calculation suggested a minimum of 68 participants to achieve a power of .80 and a maximum of 107 participants to achieve a power of 0.95. Therefore, this study required a minimum of 68 participants and a maximum of 107 participants.

Presentation of Findings

In this section of the study, I will describe the statistical tests, the variables, and the purpose of the tests and how they relate to the hypothesis. Additionally, I present the descriptive statistics, the result of inferential statistics, and the evaluation of statistical assumptions. Finally, this section of the study will conclude with a summary of the findings. The research question was:

What is the relationship between IT administrators' perception of data security, fault tolerance, and intentions to adopt cloud computing?

The null and alternative hypotheses addressed in this study were:

H_0: There is no statistically significant relationship between IT administrators' perception of data security, IT administrators' perception of fault tolerance, and IT administrators' intentions to adopt cloud computing.

H_1: There is a statistically significant relationship between IT administrators' perception of data security, IT administrators' perception of fault tolerance, and IT administrators' intentions to adopt cloud computing.

Prior to data analysis, I assessed the data collected for missing data, incomplete data, invalid data, outliers, normality, linearity, homoscedasticity, and multicollinearity. Subsequently, I provided descriptive statistics and conducted multiple regression analysis to examine the relationships between the study variables.

Descriptive Statistics

I collected data from a sample of 91 IT administrators working in the Nigerian government organizations within the northern part of Nigeria ($N = 91$). Table 2 to Table 6 present a description of the demographic data, and Table 7 presents the descriptive statistics of the study independent and dependent variables. The majority of the participants were IT administrators ($n = 80$, 87.91%), while participants that are not IT administrators were very few ($n = 11$, 12.09%). Additionally, the majority of the participants possess minimum working experience of three years in Nigerian government

organizations (*n* = 87, 95.60%), while very few respondents did not possess a minimum of three years of working experience in Nigerian government organizations (*n* = 4, 4.40%). Furthermore, all of the participants had cloud computing knowledge (*n* = 91, 100%). The majority of the participants have used cloud computing systems for their respective organizations (*n* = 60, 65.93%), while few participants have not used cloud computing systems for their respective organizations (*n* = 31, 34.07%). Finally, very few participants work in organizations with less than 50 staffs (*n* = 9, 9.89%), while a handful of participants work in organizations with more than 500 staffs (*n* = 38, 41.76%), and the majority of the participants work in organizations with 300 to 500 staffs (*n* = 44, 48.35%).

Table 2

Frequency and Percent Statistics of Participants' Job Title

Variable	Frequency	%
IT Administrators	80	87.9
Non-IT Administrators	11	12.1
Total	91	100.0

Note. *N* = 91

Table 3

Frequency and Percent Statistics of Participants' Work Experience

Variable	Frequency	%
Participants with minimum of 3 years working experience	87	95.6
Participants with less than 3 years working experience	4	4.4
Total	91	100.0

Table 4

Frequency and Percent Statistics of Participants' Cloud computing Knowledge

Variable	Frequency	%
Participants with cloud computing knowledge	91	100
Participants without cloud computing knowledge	0	0
Total	91	100.0

Table 5

Frequency and Percent Statistics of Participants' Organizational Use

Variable	Frequency	%
Participants that have used cloud computing in their organizations	60	65.9
Participants that have not used cloud computing in their organizations	31	34.1
Total	91	100.0

Table 6

Frequency and Percent Statistics of Participants' Organization IT Users

Variable	Frequency	%
Organizations with less than 50 users	9	9.9
Organizations with between 50 and 300 users	44	48.4
Organizations with more than 500 users	38	41.8
Total	91	100.0

Table 7

Means and Standard Deviations for Study Variables

Variable	Minimum	Maximum	Mean	Std. Deviation
IT Administrators' Perception of Data Security	1.0	5.0	3.4	1.2
IT Administrators' Perception of Fault Tolerance	1.67	5.0	3.5	0.8
IT Administrators' Intention to Adopt Cloud Computing	1.0	5.0	4.0	1.1

Data Cleaning

I conducted data cleaning to address the possibilities of missing data, invalid data, incomplete response, and univariate outliers. I addressed the possibility of missing data using frequency count; I compared the frequency count of cases imported into SPSS to data from Microsoft Excel sheet and data from Survey Monkey. On inspection, I determined that none of the cases had incomplete data. Additionally, I removed 12 cases from the data. These cases were rendered invalid and removed because the respondents

are not in the participant's inclusion list (11 participants are not IT administrators, and four participants did not possess a minimum of three years working experience).

Additionally, I screened data for univariate outliers by comparing the *z* scores standard deviation from the mean and observing values outside the +/- 3.29 range. An outlier is any value that exists outside the +/- 3.29 range standard deviation from the mean (Tabachnick & Fidell, 2013). Using this procedure, I determined that no *z* score was outside the +/- 3.29 range standard deviation from the mean; therefore, the data did not contain outliers.

Reliability Analysis

I assessed the reliability of the composite scores used in this study. I assessed the reliability of each composite score using Cronbach's alpha. Using George and Mallery's (2016) instructions, I interpreted the alpha coefficients generated by each composite score, where coefficients between .70 and .79 are acceptable, coefficients between .80 and .89 are good, and coefficients of .90 and above are excellent. I generated the composite score of IT administrators' perception of cloud computing from the mean of survey questions 1-4, with a good reliability ($\alpha = .89$). Additionally, I also generated the composite score of IT administrators' perception of fault tolerance from the mean of the survey questions 5-10, with acceptable reliability ($\alpha = .73$). Finally, I generated the composite score of IT administrators' intention to adopt cloud computing from the mean of the survey questions 11-14, with excellent reliability ($\alpha = .96$). Table 8 presents a summary result of the reliability assessment.

Table 8

Reliability Statistics

Variable	Cronbach's Alpha	Number of Items
IT Administrators' Perception of Data Security	.894	4
IT Administrators' Perception of Fault Tolerance	.733	6
IT Administrators' Intention to Adopt Cloud Computing	.960	4

Assumptions

In this subsection, I assessed the assumptions of the multiple linear regression. These assumptions include normality, homoscedasticity, linearity, and multicollinearity. Therefore, this subsection presents the result of the assessment of assumptions.

Normality. I assessed normality via a normal P-P plot of the residuals. According to Tabachnick and Fidell (2013), researchers can assume normality when data points follow the diagonal normality line. Therefore, the result of the normality test shows no significant deviation from normality. Figure 6 presents the result of the normality test using the P-P plot of the residuals.

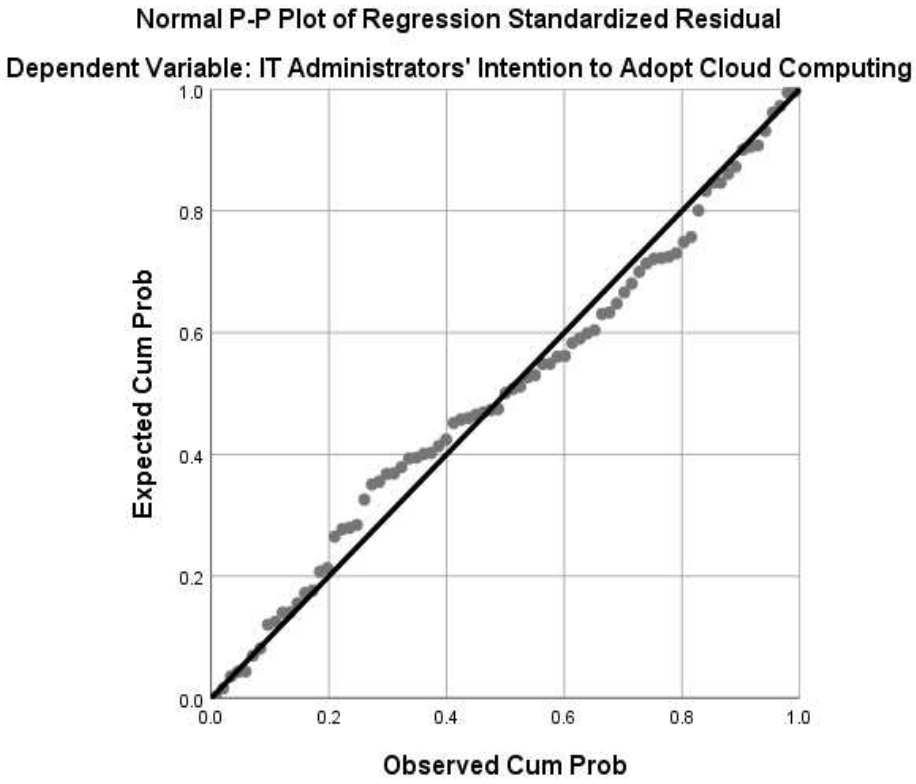


Figure 6. P-P Scatterplot of regression standardized residual testing normality.

Homoscedasticity. I assessed homoscedasticity by plotting the residuals against the predicted values. Araiza-Aguilar, Rojas-Valencia, and Aguilar-Vera (2020) used a similar method in their study. This study met the assumptions of homoscedasticity; the points appear randomly distributed with a mean of zero and are within +/- 3 of the x-axis and y-axis. Figure 7 presents the result of homoscedasticity assessment.

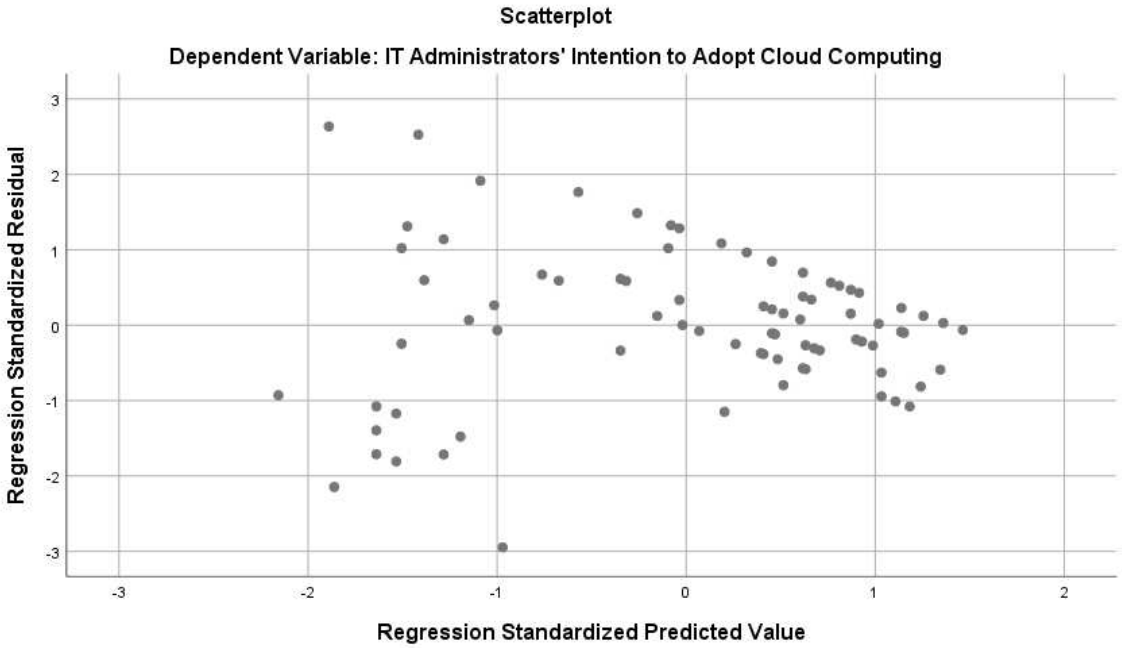


Figure 7. Residuals standardized predicted value testing for homoscedasticity.

Multicollinearity. I determined the absence of multicollinearity in the independent variables by observing their Variance Inflation Factor (VIF) values. The two VIF values for the independent variables were below 5, indicating the absence of multicollinearity between the independent variables. Table 9 presents the result of the multicollinearity assessment.

Table 9

Variance Inflation Factor for Independent Variables

Variable	VIF
IT administrators' perception of data security	1.52
IT administrators' perception of fault tolerance	1.52

The result of the assessment of the assumptions for multiple linear regression showed no violations; therefore, I considered the data collected to be normal, without the need for transformation. Based on this consideration, I conducted inferential statistics using multiple linear regression.

Inferential Statistics Results

I used multiple linear regression analysis to evaluate the relationships between the independent variables (a) IT administrators' perception of data security, (b) IT administrators' perception of fault tolerance, and the dependent variable (c) IT administrators' intention to adopt cloud computing.

Research Question: What is the relationship between IT administrators' perception of data security, fault tolerance, and intentions to adopt cloud computing?

The null and alternative hypotheses addressed in this study were:

H_0: There is no statistically significant relationship between IT administrators' perception of data security, IT administrators' perception of fault tolerance, and IT administrators' intentions to adopt cloud computing.

H_1: There is a statistically significant relationship between IT administrators' perception of data security, IT administrators' perception of fault tolerance, and IT administrators' intentions to adopt cloud computing.

The results of the linear regression model were significant, $F(2, 76) = 31.58$, $p < .001$, $R^2 = 0.45$, showing that approximately 45% of the variance in IT administrators' intention to adopt cloud computing can be explained by (a) IT administrators' perception

of data security, and (b) IT administrators' perception of fault tolerance. The result of the multiple linear regression further revealed that IT administrators' perception of data security (β = .72, p < .001) was a significant predictor of IT administrators' intention to adopt cloud computing. However, IT administrators' perception of fault tolerance (β = .09, p = .37) is not a statistically significant predictor of IT administrators' intention to adopt cloud computing since the p-value is greater than .005 (Table 10). Therefore, I rejected the null hypothesis.

Table 10

Multiple Regression Analysis Among Study Predictors

Variable	*B*	*SE*	95% CI	*β*	*t*	*p*
IT Administrators' Perception of Data Security	0.63	0.09	[0.45, 0.81]	0.72	6.92	0.00
IT Administrators' Perception of Fault Tolerance	0.13	0.14	[-0.16, 0.41]	0.09	0.895	0.37

Note. Results: $F(2, 76) = 31.58$, $p < .001$, $R^2 = 0.45$

a. Dependent Variable: IT administrators' intention to adopt cloud computing

Table 11 presents the Pearson correlation matrix of the independent and dependent variables. IT administrators' perception of data security has a strong and positive correlation with IT administrators' intention to adopt cloud computing. However, IT administrators' perception of fault tolerance has a weak negative correlation with IT administrators' intention to adopt cloud computing.

Table 11

Pearson Correlation Matrix

Variable	IT administrators' intentions to adopt cloud computing	IT Administrators' Perception of Data Security	IT Administrators' Perception of Fault Tolerance
IT administrators' intentions to adopt cloud computing	-	.67	-.33
IT Administrators' Perception of Data Security	.67	-	-.59
IT Administrators' Perception of Fault Tolerance	-.33	-.59	-

Analysis Summary

In this study, I examined the relationship between (a) IT administrators' perception of data security, (b) IT administrators' perception of fault tolerance, and (c) IT administrators' intentions to adopt cloud computing. I conducted a multiple linear regression analysis to assess the relationship between the independent and dependent variables. Before conducting multiple linear regression, I cleaned the survey data and generated descriptive statistics for the demographic data and scale data. Subsequently, I conducted a reliability assessment for the composite scores using Cronbach's alpha. All scale items of the study survey instrument had a Cronbach's alpha value above .7, which indicated that the instrument was reliable for all the scales. I also assessed the assumptions of multiple linear regression to ensure that the study did not violate the assumptions. The result of the multiple linear regression analysis indicated a statistically significant relationship between the independent variables and the dependent variable,

$F(2, 76) = 31.58$, $p < .001$, $R^2 = 0.45$. According to the multiple linear regression analysis results, 45% of the variance in IT administrators' intention to adopt cloud computing can be explained by (a) IT administrators' perception of data security, and (b) IT administrators' perception of fault tolerance. Furthermore, inferential statistics result indicated that IT administrators' perception of data security contributed more as a factor influencing IT administrators' intention to adopt cloud computing. Considering the results of the multiple linear regression analysis, I rejected the study's null hypothesis.

Theoretical Conversation on Findings

The literature review indicated data security and fault tolerance as major technical factors affecting the adoption of cloud computing. Using TAM as a theoretical framework, I surveyed IT administrators in Nigerian government organizations to understand their perception of how data security and fault tolerance factors influence their intention to adopt cloud computing. I used a survey instrument based on three constructs that I adapted from TAM; these constructs were (a) IT administrators' perception of data security, (b) IT administrators' perception of fault tolerance, and (c) IT administrators' intention to adopt cloud computing.

The result of the statistical analysis of this study influenced the rejection of the null hypothesis. The result of the inferential statistical analysis indicated that 45% of the variance in IT administrators' intention to adopt cloud computing can be explained by (a) IT administrators' perception of data security, and (b) IT administrators' perception of fault tolerance ($R^2 = 0.44$).

The findings indicated that IT administrators' perception of data security was statistically significant. In contrast, IT administrators' perception of fault tolerance was not statistically significant based on their *p*-values of .00 and .37, respectively. The findings also indicated that IT administrators' perception of data security had a strong positive correlation with IT administrators' intention to adopt cloud computing. In contrast, IT administrators' perception of fault tolerance had a weak negative correlation with IT administrators' intention to adopt cloud computing.

One of the findings of this study indicated that IT administrators' perception of data security in cloud computing positively influences them to adopt cloud computing. This finding is contrary to various studies conducted by researchers, which indicated that users' perception of data security in cloud computing dissuades them from adopting the technology. For example, Oguntala, Abd-Alhameed, and Odeyemi (2017) examined the factors responsible for the poor adoption of cloud computing in most African enterprises using Nigeria as a case study. The researchers focused on the perception of IT and non-IT employees in government and private organizations towards cloud computing, and their findings reveal that employees' perception of data security is one of the challenges impeding the adoption of cloud computing in Nigeria. Another example is the study conducted by Diaz, Martin, and Rubio (2016), where the researchers state that data security and user privacy are the biggest reasons why users and organizations are hesitant to adopt cloud computing.

Contrary to these previous studies, this study indicated that IT administrators in Nigerian government organizations perceive data security from a positive standpoint, and they are willing to adopt the computing model. Another explanation of this study's findings is that IT administrators in Nigerian government organizations may have considered the usefulness and ease of use of cloud computing over data security issues in their intention to adopt the computing model. This explanation ties back to the TAM, which states that users' intention to adopt technology is influenced by users' perceived ease of use and perceived usefulness.

Conversely, the findings of this study also indicate that IT administrators' perception of fault tolerance in cloud computing slightly dissuades them from adopting cloud computing. This finding is similar to previous studies, which indicated that users perceive fault tolerance as one of the major challenges in the adoption of cloud computing. For example, Nazari Cheraghlou, Khadem-Zadeh, and Haghparast (2016) state that fault tolerance is at the top of the challenges of implementing cloud computing. Hui et al. (2018) also state that fault is also a major challenge in cloud computing due to the increasing complexity of large-scale information systems within a cloud computing platform.

Application to Professional Practice

This research study examined the relationship between IT administrators' (a) perception of data security, (b) perception of fault tolerance, and (c) intentions to adopt cloud computing. The results of the study showed that IT administrators' perception of

data security and IT administrators' perception of fault tolerance had a statistically significant relationship with IT administrators' intent to adopt cloud computing. IT administrators in the Nigerian government organizations may use this knowledge in making decisions when intending to adopt cloud computing. The findings of this study can also help IT administrators understand the importance of considering data security and fault tolerance when adopting cloud computing.

The result of this study may provide a knowledge base from which IT administrators in Nigerian government organizations may be able to address the technical challenges associated with the adoption of cloud computing. Additionally, the result of this study may contribute to IT practice by filling the knowledge gap in the existing literature on the technical challenges of cloud computing adoption in government organizations in Nigeria. The addition of knowledge to existing literature will increase the understanding of cloud computing adoption challenges in government organizations in Nigeria.

It is lucid from the result of the data analysis that IT administrators in government organizations in Nigeria are positively influenced by their perception of data security when making decisions regarding the adoption of cloud computing. IT administrators are concerned about the preservation of the confidentiality, integrity, and availability of data, and they will want to confirm if cloud computing can guarantee these major elements of data security before making decisions to adopt cloud computing. Therefore, this knowledge can be applied by other IT administrators in Nigerian

government organizations to help them assess the data security implications of adopting cloud computing.

Additionally, the findings of the study showed that fault tolerance negatively influenced IT administrators' intention to adopt cloud computing. This finding may mean that IT administrators perceive fault tolerance as an issue in cloud computing that may affect their ability to use IT in achieving their organizational goals and objectives. This perception may dissuade IT administrators from adopting cloud computing. Therefore, this knowledge can be applied by IT administrators in understanding how fault tolerance may affect cloud computing adoption and ways of mitigating the issue.

Implications for Social Change

This research study examined the constructs, IT administrators' (a) perception of data security, (b) perception of fault tolerance, and (c) intentions to adopt cloud computing. The findings from the study showed that IT administrators' perception of data security and perception of fault tolerance can predict their intentions to adopt cloud computing. This finding can serve as a source of valuable information for the Nigerian government in increasing the knowledge of IT administrators managing its cloud computing systems. Consequently, an increase in government IT administrators' knowledge will help improve government cloud computing systems, which will, in turn, improve government service delivery to citizens and businesses. Government services such as tax payment, vehicle registration, drivers' licensing, national identity number registration, passport registration, and so many others can be made available on a cloud-

based electronic government (e-government) platform for citizens and businesses to access through a single-window portal. Integrated government data and services hosted on a cloud platform will help the government reduce the cost of Information Systems (IS) infrastructure while increasing efficiency, productivity, and performance. When government organizations can successfully adopt cloud computing, then they can worry less about their information systems and focus more on increasing the performance and efficiency of their services. Consequently, improved services from the government will ensure that citizens and businesses benefit from government policies. For example, citizens can have their passports, driver's licenses, vehicle registration, and health services processed and delivered faster. Businesses can experience a significantly reduced processing time for requests such as tax clearance, company registration, and other government information.

Recommendations for Action

The findings of this research study show that administrators' perception of data security and fault tolerance predict their intentions to adopt cloud computing. Given this finding, I recommend that researchers and IT leaders use this research study as a pedestal to conduct more research on other technical challenges that may predict IT administrators' intentions to adopt cloud computing. A thorough understanding of the technical challenges considered by IT administrators when deciding to adopt cloud computing will help IT leaders in Nigeria develop policies, capacity development, and strategic action plans in improving the cloud computing ecosystem within the Nigerian

government. Additionally, I recommend that the Nigerian National Information Technology Development Agency (NITDA), in collaboration with relevant stakeholders in the government engage in cloud computing practice audits in all Nigerian government organizations. This action will help create a snapshot of cloud computing practice and maturity in government organizations, which may identify gaps that may be closed by improving extant cloud computing policies and increasing cloud computing awareness and capacity development programs its IT administrators. Finally, I recommend that the NITDA reviews its policy on cloud computing using the information and knowledge in this study.

Recommendations for Further Study

This research study had some limitations. The first limitation of this study is that it was conducted in Nigeria and targeted at only IT administrators in Nigerian government organizations. A second limitation was the size of the sample used, which was fairly small because I sourced the samples from a limited number of IT administrators located in the Northern part of Nigeria. The final limitation is the use of a nonprobabilistic convenience sampling method, which may have reduced the opportunity for participation in the study by all qualified IT administrators in the target population. This limitation may have reduced the generalizability of the study results to the target population.

Further studies may increase the scope of the sample population to include other IT administrators in Nigerian government organizations located in other geo-political

zones in the country. This recommendation may help increase the accuracy and generalizability of the result of the study to the target population. Additionally, this recommendation may help increase the understanding of the technical challenges affecting IT administrators' adoption of cloud computing from a broader perspective.

In the future, researchers can also use this research study as a pedestal to examine technical challenges in the adoption of cloud computing in the private sector of the country. This recommendation is important because the private sector is a significant part of the cloud computing ecosystem in Nigeria, and its cloud computing practice and performance may also affect the Nigerian government. Finally, future researchers can also examine the relationships between the independent variables used in this study and other IT concepts such as the Internet of Things (IoT), big data, and Virtual Reality (VR).

Reflections

This program has been by far my toughest and most challenging academic venture. However, I am delighted indeed that I completed the program despite the many challenges I faced. Some of these challenges include time management, adjusting to scholarly writing, illnesses, and academic research rigor. Additionally, I had to undergo many iterations before getting my doctoral study prospectus and proposal approved.

My major reason for enrolling in this program is to learn advance IT concepts and consolidate my skills and years of experience in the IT field and, more importantly, to establish myself as a renowned IT leader capable of causing a social change in the world. I am glad that I completed the DIT program at Walden university because the

university exposed me to many useful courses. Courses such as communications for IT, which is very important to prepare me for scholarly writing. Core IT courses like fundamentals of IS and system analysis and design, which helped consolidate my technical skills, seminar courses, and IT leadership simulator, which prepared me for IT leadership positions. Additionally, the program exposed me to doctoral research methodologies, where I had the opportunity to learn and engage in rigorous research in IT. Furthermore, the results of my doctoral research will provide me the opportunity to give back to my country and the world regarding technical challenges affecting the adoption of cloud computing.

My achievement of a DIT will positively impact on my carrier and social status. My achievement of a DIT will be a catalyst to promotions and provide opportunities to hold IT leadership positions in every industry; it will earn me respect within the IT community and other professional sectors. Overall, I am indeed grateful for the opportunity to conduct my doctorate program in IT at Walden University.

Summary and Study Conclusion

I conducted a quantitative, correlational research study that examined the relationship between IT administrators' (a) perception of data security, (b) perception of fault tolerance, and (c) intentions to adopt cloud computing. I collected data from 91 IT administrators working in Nigerian government organizations; this sample size fell within the G*Power software recommendation. However, sequel to data cleaning, the final data for analysis was 79. Subsequently, I conducted descriptive statistics, instrument

reliability, assessment of multiple linear regression assumptions, and multiple linear regression analysis to test the hypothesis generated from the research question.

The result from the multiple linear regression supported the rejection of the null hypothesis. Both IT administrators' perception of data security and IT administrators' perception of fault had a correlation with IT administrators' intention to adopt cloud computing; however, IT administrators' perception of fault tolerance was not statistically significant. Despite limitations in this study, IT leaders in Nigerian government organizations can leverage these findings to make informed decisions on technical factors that influence IT administrators' intention to adopt cloud computing. This study contributes significantly to the body of research in the area of adoption of cloud computing.

References

Abdulhamid, S. M., Abd Latiff, M. S., Madni, S. H. H., & Abdullahi, M. (2018). Fault tolerance aware scheduling technique for cloud computing environment using dynamic clustering algorithm. *Neural Computing & Applications, 29*, 279–293. doi:10.1007/s00521-016-2448-8

Abdullah, M., Al-Muta'a, E. A., & Al-Sanabani, M. (2019). Integrated MOPSO algorithms for task scheduling in cloud computing. *Journal of Intelligent & Fuzzy Systems, 36*, 1823–1836. doi:10.3233/JIFS-181005

Aboelmaged, M., & Hashem, G. (2018). RFID application in patient and medical asset operations management: A technology, organizational and environmental (TOE) perspective into key enablers and impediments. *International Journal of Medical Informatic*s, *118*, 58–64. doi:10.1016/j.ijmedinf.2018.07.009

Abrams, T., & Gibson, B. E. (2017). Putting Gino's lesson to work: Actor–network theory, enacted humanity, and rehabilitation. *Health, 21*, 425–440. doi:10.1177/1363459315628039

Abutabenjeh, S., & Jaradat, R. (2018). Clarification of research design, research methods, and research methodology: A guide for public administration researchers and practitioners. *Teaching Public Administration, 36*, 237–258. doi:10.1177/0144739418775787

Adashi, E. Y., Walters, L. B., & Menikoff, J. A. (2018). The Belmont report at 40: Reckoning with time. *American Journal of Public Health, 108*, 1345–1348. doi:10.2105/AJPH.2018.304580

Aguinis, H., & Edwards, J. R. (2014). Methodological wishes for the next decade and how to make wishes come true. *Journal of Management Studies, 51*(1), 143–174. doi.org/10.1111/joms.12058

Ahmad, W., Wang, S., Ullah, A., Sheharyar, & Mahmood, Z. (2018). Reputation-aware trust and privacy-preservation for mobile cloud computing. *IEEE Access*, 1–20. doi:10.1109/ACCESS.2018.2865539

Ahmed, I. (2020). Technology organization environment framework in cloud computing. *Telkomnika, 18*, 716–725. doi:10.12928/TELKOMNIKA.v18i2.13871

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*, 179–211. doi:10.1016/0749-5978(91)90020-T

Akherfi, K., Gerndt, M., & Harroud, H. (2018). Mobile cloud computing for computation offloading: Issues and challenges. *Applied Computing and Informatics, 14(1),* 1–16. doi: 10.1016/j.aci.2016.11.002

Alami, A., Tavakoly Sany, S. B., Lael-Monfared, E., Ferns, G. A., Tatari, M., Hosseini, Z., & Jafari, A. (2019). Factors that influence dietary behavior toward iron and vitamin D consumption based on the theory of planned behavior in Iranian adolescent girls. *Nutrition Journal, 18*(1), 1–9. doi:10.1186/s12937-019-0433-7

Alamoudi, Y., & Alamoudi, W. (2016). Cloud computing - the future of business. *Journal of information systems technology & planning, 8,* 41–60. Retrieved from http://www.intellectbase.org/JISTP.php

Al-Debei, Mutaz M., and Enas Al-Lozi. (2014).Explaining and Predicting the Adoption Intention of Mobile Data Services: A Value-Based Approach. *Computers in Human Behavior 35,* 326–338. doi:10.1016/j.chb.2014.03.011

Al-Emran, M., Mezhuyev, V., & Kamaludin, A. (2018). Technology acceptance model in m-learning context: A systematic review. *Computers & Education, 125*, 389–412. doi:10.1016/j.compedu.2018.06.008

Alenezi, F. Y. (2019). The role of cloud computing for the enhancement of teaching and learning in Saudi Arabian universities in accordance with the social constructivism theory: A specialist's point of view. *International Journal of Emerging Technologies in Learning, 14*, 70–87. doi:10.3991/ijet.v14i13.9557

Ali, M., Khan, S., Vasilakos, A. (2015). Security in cloud computing: Opportunities and challenges. *Information Sciences, 305*, 357-383. doi:10.1016/j.ins.2015.01.025

Ali, M., Wood-Harper, T., & Mohamad, M. (2018). Benefits and challenges of cloud computing adoption and usage in higher education: A systematic literature review. *International Journal of Enterprise Information Systems (IJEIS), 14*, 64–77. doi:10.4018/IJEIS.2018100105

Ali, O., Shrestha, A., Soar, J., & Wamba, S. F. (2018). Cloud computing-enabled healthcare opportunities, issues, and applications: A systematic

review. *International Journal of Information Management, 43,* 146–158.doi:10.1016/j.ijinfomgt.2018.07.009

Ali, O., Soar, J., & Yong, J. (2016). An investigation of the challenges and issues influencing the adoption of cloud computing in Australian regional municipal governments. *Journal of Information Security and Applications,* 27-28, 19-34. doi:10.1016/j.jisa.2015.11.006

Alonso-Monsalve, S., García-Carballeira, F., & Calderón, A. (2018). A heterogeneous mobile cloud computing model for hybrid clouds. *Future Generation Computer Systems, 87*, 651–666. doi:10.1016/j.future.2018.04.005

Alsmadi, D., & Prybutok, V. (2018). Sharing and storage behavior via cloud computing: Security and privacy in research and practice. *Computers in Human Behavior, 85*, 218–226. doi:10.1016/j.chb.2018.04.003

Anjum, T., Sharifi, S., Nazar, N., & Farrukh, M. (2018). Determinants of entrepreneurial intention in perspective of theory of planned behaviour. *Management Theory & Studies for Rural Business & Infrastructure Development, 40*, 429–440. doi:10.15544/mts.2018.40

Araiza-Aguilar, J. A., Rojas-Valencia, M.N., & Aguilar-Vera, R.A. (2020). Forecast generation model of municipal solid waste using multiple linear regression. *Global Journal of Environmental Science and Management, 6(1)*, 1-14. doi:10.22034/GJESM.2020.01.01

Araya, M., Osorio, M., Díaz, M., Ponce, C., Villanueva, M., Valenzuela, C., & Solar, M. (2018). JOVIAL: Notebook-based astronomical data analysis in the cloud. *Astronomy and Computing.* doi:10.1016/j.ascom.2018.09.001

Arunarani, A. R., Manjula, D., & Sugumaran, V. (2018). Task scheduling techniques in cloud computing: A literature survey. *Future Generation Computer Systems*. doi:10.1016/j.future.2018.09.014

Ashok, A., Steenkiste, P., & Bai, F. (2018). Vehicular cloud computing through dynamic computation offloading. *Computer Communications, 120*, 125–137. doi:10.1016/j.comcom.2017.12.011

Attaran, M., & Woods, J. (2019). Cloud computing technology: Improving small business performance using the Internet. *Journal of Small Business & Entrepreneurship, 31*, 495–519. doi:10.1080/08276331.2018.1466850

Attiya, I., Abd Elaziz, M., & Xiong, S. (2020). Job scheduling in cloud computing using a modified harris hawks optimization and simulated annealing algorithm. *Computational Intelligence & Neuroscience, 2020*, 1–17. doi:10.1155/2020/3504642

Awosan, R. K. (2014). Factor Analysis of the adoption of cloud computing in Nigeria. *African Journal of Computing & ICT, 7*, 33-42. Retrieved from https://afrjcict.net/

Baki, R., Birgoren, B., & Aktepe, A. (2018). A meta analysis of factors affecting perceived usefulness and perceived ease of use in the adoption of e-learning

systems. *Turkish Online Journal of Distance Education (TOJDE), 19*, 4–42. Retrieved from http://tojde.anadolu.edu.tr/

Bala, A., & Chana, I. (2015). Autonomic fault tolerant scheduling approach for scientific workflows in Cloud computing. *Concurrent Engineering, 23*, 27–39. doi:org/10.1177/1063293X14567783

Barman, S., & Barman, A. (2016). Theory of reasoned action in exploring factors affecting lecturers' intention to adopt PBL. *International Medical Journal, 23*, 331–333. Retrieved from http://www.seronjihou.co.jp/imj

Barry, A. E., Chaney, B., Piazza-Gardner, A. K., & Chavarria, E. A. (2014). Validity and reliability reporting practices in the field of health education and behavior: A review of seven journals. *Health Education & Behavior, 41*, 12–8. doi:10.1177/109019811348313

Basahel, A. Yamin, M., & Drijan, A. (2016). Barriers to cloud computing adoption for smes in Saudi Arabia. *BVICAM's International Journal of Information Technology, 8, 1044-1049*. Retrieved from http://bvicam.ac.in/bjit/

Benlian, A., Kettinger, W. J., Sunyaev, A., & Winkler, T. J. (2018). Special section: The transformative value of cloud computing: A decoupling, platformization, and recombination theoretical framework. *Journal of Management Information Systems, 35*, 719–739. doi:10.1080/07421222.2018.1481634

Bernard, H. R. (2013). *Social research methods: Qualitative and quantitative approaches (2nd ed.*). Thousand Oaks, CA: Sage Publications.

Bevan, S., Baumgartner, F. R., Johnson, E. W., & McCarthy, J. D. (2013). Understanding selection bias, time-lags and measurement bias in secondary data sources: Putting the encyclopedia of associations database in broader context. *Social Science Research, 42*, 1750-1764. doi:10.1016/j.ssresearch.2013.08.003

Bhochhibhoya, A., & Branscum, P. (2018). The application of the theory of planned behavior and the integrative behavioral model towards predicting and understanding alcohol-related behaviors: A Systematic review. *Journal of Alcohol & Drug Education, 62*, 39–63. Retrieved from https://www.jadejournal.com/home.aspx

Biswas, R. (2018). A short appraisal on cloud computing. *Scientific Review, 4*, 22–25. Retrieved from https://www.arpgweb.com/journal/journal/10

Bowers, T. (2018). Heterotopia and actor-network theory: Visualizing the normalization of remediated landscapes. *Space & Culture, 21*, 233–246. doi:10.1177/1206331217750069

Brear, M. (2018). Ethical research practice or undue influence? Symbolic power in community- and individual-level informed consent processes in community-based participatory research in Swaziland. *Journal of Empirical Research on Human Research Ethics, 13*, 311–322. doi:10.1177/1556264618761268

Brodaty, H., Mothakunnel, A., de Vel-Palumbo, M., Ames, D., Ellis, K. A., Reppermund, S., … Sachdev, P. S. (2014). Influence of population versus convenience sampling on sample characteristics in studies of cognitive aging. *Annals of Epidemiology, 24*, 63–71. doi:10.1016/j.annepidem.2013.10.005

Buabeng-Andoh, C. (2018). Predicting students' intention to adopt mobile learning: A combination of theory of reasoned action and technology acceptance model. *Journal of Research in Innovative Teaching, 11*, 178–191. doi:10.1108/JRIT-03-2017-0004

Cearnău, D.C. (2018). Cloud computing - Emerging technology for computational services. *Informatica Economica, 22*, 61–69. doi:10.12948/issn14531305/22.4.2018.05

Chandler, G., & Polonik, W. (2017). Residual empirical processes and weighted sums for time-varying processes with applications to testing for homoscedasticity. *Journal of Time Series Analysis, 38,* 72–98. doi:10.1111/jtsa.12200

Chaturvedi, P., & Sharma, S. (2017). Workflow scheduling strategies for achieving fault tolerance in cloud: Review article. *International Journal of Advanced Research in Computer Science, 8*, 750-755. Retrieved from http://www.ijarcs.info

Chatzoglou, P. & Chatzoudes, D. (2016). Factors affecting e-business adoption in SMEs: An empirical research. *Journal of Enterprise Information Management, 29*, 327-358.doi:10.1108/JEIM-03-2014-0033

Chauhan, S. S., Pilli, E. S., Joshi, R. C., Singh, G., & Govil, M. C. (2018). Brokering in interconnected cloud computing environments: A survey. *Journal of Parallel and Distributed Computing*, 1-17. doi:10.1016/j.jpdc.2018.08.001

Chen, Y., Chen, X., Liu, W., Zhou, Y., Zomaya, A. Y., Ranjan, R., & Hu, S. (2020). Stochastic scheduling for variation-aware virtual machine placement in a cloud

computing CPS. *Future Generation Computer Systems, 105*, 779–788. doi:10.1016/j.future.2017.09.024

Chiang, M., Chen, C., & Hsieh, H. (2018). An agreement under early stopping and fault diagnosis protocol in a cloud computing environment. *IEEE Access 6,* 44868-44875. doi:10.1109/ACCESS.2018.2859351

Chiumento, A., Khan, M. N., Rahman, A., & Frith, L. (2016). Managing ethical challenges to mental health research in post-conflict settings. *Developing World Bioethics, 16*, 15-28. doi:10.1111/dewb.12076

Christenson, J. D., & Gutierrez, D. M. (2016). Using qualitative, quantitative, and mixed methods research to promote family therapy with adolescents in residential settings. *Contemporary Family Therapy: An International Journal*, *38*, 52-61. doi:10.1007/s10591-016-9374-x

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*, 155-159. doi:10.1037/0033-2909.112.1.155

Costa, L. J., Hari, P. N., & Kumar, S. K. (2016). Differences between unselected patients and participants in multiple myeloma clinical trials in US: A threat to external validity. *LEUKEMIA & LYMPHOMA, 57*, 2827–2832. doi:10.3109/10428194.2016.1170828

Curran, P. G. (2016). Methods for the detection of carelessly invalid responses in survey data. *Journal of Experimental Social Psychology, 66*, 4–19. doi:10.1016/j.jesp.2015.07.006

Curtis, E. A., Comiskey, C., & Dempsey, O. (2016). Importance and use of correlational research. *Nurse Researcher, 23*, 20–25. doi:10.7748/nr.2016.e1382

Dahunsi, F.M., & Owoseni, T.M. (2015). Cloud computing in Nigeria: The cloud ecosystem perspective. *Nigerian Journal of Technology, 34,* 209-216. doi: 10.4314/njt.v34i1.26

Desai, A., Zoccatelli, G., Adams, M., Allen, D., Brearley, S., Rafferty, A. M., … Donetto, S. (2017). Taking data seriously: The value of actor-network theory in rethinking patient experience data. *Journal of Health Services Research & Policy, 22*, 134–136. doi:10.1177/1355819616685349

Diaz, M., Martin, C., & Rubio, B. (2016). State-of-the-art, challenges, and open issues in the integration of Internet of things and cloud computing. *Journal Of Network And Computer Applications, 62*, 99-117. doi:10.1016/j.jnca.2016.01.010

Dincă, V. M., Dima, A. M., & Rozsa, Z. (2019). Determinants of cloud computing adoption by Romanian SMEs in the digital economy. *Journal of Business Economics & Management*, *20*, 798–820. doi:10.3846/jbem.2019.9856

Ding, Y., Yao, G., & Hao, K. (2017). Fault-tolerant elastic scheduling algorithm for workflow in cloud systems. *Information Sciences, 393*, 47–65. doi:10.1016/j.ins.2017.01.035

Dippel, E., Hanson, J., McMahon, T., Griese, E., & Kenyon, D. (2017). Applying the theory of reasoned action to understanding teen pregnancy with American Indian

communities. *Maternal & Child Health Journal, 21*, 1449–1456. doi:10.1007/s10995-017-2262-7

Dixit, R. V., & Prakash, G. (2018). Intentions to use social networking sites (sns) using technology acceptance model (TAM): An Empirical Study. *Paradigm (09718907), 22*, 65–79. doi:/10.1177/0971890718758201

Dormann, C. F., Elith, J., Bacher, S., Buchmann, C., Carl, G., Carré, G., . . . Marquéz, J. R. G. (2013). Collinearity: A review of methods to deal with it and a simulation study evaluating their performance. *Ecography, 36*, 27-46. doi:10.1111/j.1600-0587.2012.07348.x

East, R. (2016). Bias in the evaluation of research methods. *Marketing Theory, 16*, 219–231. doi:10.1177/1470593115609797

Ebert, N., Weber, K., & Koruna, S. (2017). Integration platform as a service. *Business & Information Systems Engineering, 59*, 375-379. doi: 10.1007/s12599-017-0486-0

Elo, S., Kaariainen, M., Kanste, O., Polkki, T., Utriainen, K., & Kyngas, H. (2014). Qualitative content analysis: A focus on trustworthiness. SAGE Open, 4, 1-10.doi:10.1177/2158244014522633

Emerson, R. W. (2015). Convenience sampling, random sampling, and snowball sampling: How Does sampling affect the validity of research? *Journal of Visual Impairment & Blindness, 109*, 164–168. Retrieved from http://www.afb.org/info/publications/jvib/12

Fagbolu, O. O., & Atoloye, A. O. (2018). Mobile recruitment system for Nigerian civil service commission via cloud computing. *Acta Technica Corviniensis, 3*, 135-138. Retrieved from http://acta.fih.upt.ro

Fathali, S. & Okada, T. (2018). Technology acceptance model in technology-enhanced OCLL contexts: A self-determination theory approach. *Australasian Journal of Educational Technology, 34*, 138–154. Retrieved from https://ajet.org.au/

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods, 41*, 1149-1160.

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*, 175-191.

Ferri, L., Spanò, R., & Tomo, A. (2020). Cloud computing in high tech startups: Evidence from a case study. *Technology Analysis & Strategic Management, 32*, 146–157. doi:10.1080/09537325.2019.1641594

Fishbein, M., & Ajzen, I. (1975). *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research*. Reading, MA: Addison-Wesley.

Flannelly, K. J., Flannelly, L. T., & Jankowski, K. R. B. (2018). Threats to the internal validity of experimental and quasi-experimental research in healthcare. *Journal of Health Care Chaplaincy, 24*, 107–130. doi:10.1080/08854726.2017.1421019

Freeman, M. (2018). The analytic rewards of materializing the effects of actor-networks. *Qualitative Research, 1*-16. doi:10.1177/1468794118778977

Gangwar, H., & Date H. (2016). Critical Factors of Cloud Computing Adoption in Organizations: An Empirical Study. *Global Business Review 17*, 886–904. doi:10.1177/0972150916645692

Gangwar, H., Date, H., & Ramaswamy, R. (2015). Developing a cloud-computing adoption framework. *Global Business Review, 16*, 632–651. doi:10.1177/0972150915581108

Garrison, G., Wakefield, R. L., & Kim, S. (2015). The effects of IT capabilities and delivery model on cloud computing success and firm performance for cloud supported processes and operations. *International Journal of Information Management, 35,* 377–393. doi:10.1016/j.ijinfomgt.2015.03.001

George, D. & Mallery, P. (2016). *SPSS for Windows step by step: a simple guide and reference, 15.0 update (14th ed.)*. New York, NY: Routledge

Gentry, K. R., Lepere, K., & Opel, D. J. (2017). Informed consent in pediatric anesthesiology. *Paediatric Anaesthesia, 27*, 1253–1260. doi:10.1111/pan.13270

Ghasemi, A., & Zahediasl, S. (2012). Normality tests for statistical analysis: A guide for non-statisticians. *International Journal of Endocrinology and Metabolism, 10*, 486-489. doi:10.5812/ijem.3505

Gibbs, N. M., & Weightman, W. M. (2014). An audit of the statistical validity of conclusions of clinical superiority in anaesthesia journals. *Anaesthesia and Intensive Care, 42*, 599–607. Retrieved from http://www.aaic.net.au

Goodhue, D.L., Thompson, R.L. (1995). Task-Technology Fit and Individual Performance. *MIS Quarterly 19*, 213-236. doi: 10.2307/249689

Göritz, A., & Neumann, B. (2016). The longitudinal effects of incentives on response quantity in online panels. *Translational Issues in Psychological Science, 2*, 163-173. doi:10.1037/tps0000071

Grape, A., Rhee, H., Wicks, M., Tumiel-Berhalter, L., & Sloand, E. (2018). Recruitment and retention strategies for an urban adolescent study: Lessons learned from a multi-center study of community-based asthma self-management intervention for adolescents. *Journal of Adolescence, 65*, 123–132. doi:10.1016/j.adolescence.2018.03.004

Green, S. B., & Salkind, N. J. (2014). *Using SPSS for windows and macintosh: Analyzing and understanding data (7th ed.)*. Upper Saddle River, NJ: Pearson.

Groves, R. M., Presser, S., Tourangeau, R., West, B. T., Couper, M. P., Singer, E., … Couper, M. P. (2012). Support for the survey sponsor and nonresponse bias. *Public Opinion Quarterly, 76*, 512–524. doi: 10.1093/poq/nfs034

Gümüşoğlu, E. & Akay, E. (2017). Measuring technology acceptance level of teachers by using unified theory of acceptance and use of technology. *International Journal of Languages' Education and Teaching, 5*, 378-394. doi:10.18298/ijlet.2239

Guo, R., Hermanson, P. M., Berkshire, S. D., & Fulton, L. V. (2019). Predicting intention to use evidence-based management among U.S. healthcare administrators: Application of the theory of planned behavior and structural equation modeling. *International Journal of Healthcare Management, 12*, 25–32. doi:10.1080/20479700.2017.1336856

Gupta, S., Yun, H., Xu, H., & Kim, H. (2017). An exploratory study on mobile banking adoption in Indian metropolitan and urban areas: A scenario-based experiment. *Information Technology for Development, 23*, 127–52. doi:10.1080/02681102.2016.1233855

Haegele, J. A., & Hodge, S. R. (2015). Quantitative methodology: A guide for emerging physical education and adapted physical education researchers. *Physical Educator, 72*, 59-75. doi:10.18666/tpe-2015-v72-i5-6133

Hales, A. H. (2016). Does the conclusion follow from the evidence? Recommendations for improving research. *Journal of Experimental Social Psychology, 66*, 39-46. doi:10.1016/j.jesp.2015.09.011

Hallová, M., Polakovič, P., Šilerová, E., & Slováková, I. (2019). Data protection and security in SMEs under enterprise infrastructure. *Agris On-Line Papers in Economics & Informatics, 11*, 27–33. doi:10.7160/aol.2019.110103

Hanifi, M., & Ali, D. (2017). Unified theory of acceptance and use of technology: The adoption of mobile messaging application. *Megatrend Revija*, 14, 169-186. doi:10.5937/MegRev1701169M

Han, J., Zang, W., Liu, L., Chen, S., & Yu, M. (2018). Risk-aware multi-objective optimized virtual machine placement in the cloud. *Journal of Computer Security, 26*, 707–30. doi: 10.3233/JCS-171104

Hasan, M., & Goraya, M. S. (2018). Fault tolerance in cloud computing environment: A systematic survey. *Computers in Industry, 99*, 156–172. doi:10.1016/j.compind.2018.03.027

Hasan, M., & Goraya, M. S. (2019). Flexible fault tolerance in cloud through replicated cooperative resource group. *Computer Communications*, 1-25. doi:10.1016/j.comcom.2019.06.005

Hassan, H., Nasir, M. H. M., Khairudin, N., & Adon, I. (2017). Factors influencing cloud computing adoption in small and medium enterprises. *Journal of Information & Communication Technology, 16*, 21–41. Retrieved from www.jict.uum.edu.my

Hathout, B., Ghoniemy, S., & Ibrahim, O. (2017). A Modified Cloud-Based Cryptographic Agent for Cloud Data Integrity. *International Journal Of Interactive Mobile Technologies, 11*, 6-23. doi:10.3991/ijim.v11i2.6553

Hazra, A., & Gogtay, N. (2016). Biostatistics series module 6: Correlation and linear regression. *Indian Journal of Dermatology, 61*, 593-601. doi:10.4103/0019-5154.193662

He, H. (2018). Research on prediction of internet public opinion based on grey system theory and fuzzy neural network. *Journal of Intelligent & Fuzzy Systems, 35,* 325-332. doi:10.3233/JIFS-169591

He, J., Dong, M., Ota, K., Fan, M., & Wang, G. (2016). NetSecCC: A scalable and fault-tolerant architecture for cloud computing security. *Peer-To-Peer Networking and Applications, 9*, 67–81. doi:10.1007/s12083-014-0314-y

He, J., Zhang, Z., Li, M., Zhu, L., & Hu, J. (2019). Provable data integrity of cloud storage service with enhanced security in the internet of things. *IEEE Access, 7,* 6226-6239. doi:10.1109/ACCESS.2018.2889296

Hevia, M., & Constantin, A. (2018). Gendered power relations and informed consent: The I.V. v. Bolivia case. *Health & Human Rights: An International Journal, 20,* 197–203. Retrieved from https://www.hhrjournal.org

Hollier, L. P., Pettigrew, S., Slevin, T., Strickland, M., & Minto, C. (2016). Comparing online and telephone survey results in the context of a skin cancer prevention 126 campaign evaluation. *Journal of Public Health, 39,* 193–201. doi:10.1093/pubmed/fdw018

Howard, R., Restrepo, L., & Chang, C.Y. (2017). Addressing individual perceptions: An application of the unified theory of acceptance and use of technology to building information modeling. *International Journal of Project Management, 35,* 107–120. doi:10.1016/j.ijproman.2016.10.012

Hsu, C. L., & Lin, J. C. (2016). Exploring factors affecting the adoption of Internet of things services. *Journal of Computer Information Systems, 58*, 49–57. doi:10.1080/08874417.2016.1186524

Hsu, J., Schmeiser, M., Haggerty, C., & Nelson, S. (2017). The effect of large monetary incentives on survey completion. *Public Opinion Quarterly, 81*, 736-747. doi:10.1093/poq/nfx006

Hui, Y., Xiaomin, Z., Huangke, C., Hui, G., Wen, Z., Weidong, B. (2018). DEFT: Dynamic fault-tolerant elastic scheduling for tasks with uncertain runtime in cloud. *Information Sciences, 477*, 30-46. doi:10.1016/j.ins.2018.10.020

Hung, A. C. Y. (2016). Beyond the player: A user-centered approach to analyzing digital games and players using actor-network theory. *E-Learning and Digital Media, 13*, 227–243. doi:10.1177/2042753017691655

Holubnycha, L., Kostikova, I., Kravchenko, H., Simonok, V., & Serheieva, H. (2019). Cloud computing for university students' language learning. *Revista Romaneasca Pentru Educatie Multidimensionala, 11*, 55–69.doi:10.18662/rrem/157

Isaias, P., Reis, F., Coutinho, C., & Lencastre, J. A. (2017). Empathic technologies for distance/mobile learning: An empirical research based on the unified theory of acceptance and use of technology (UTAUT). *Interactive Technology and Smart Education, 14*, 159–180. doi:10.1108/ITSE-02-2017-0014

Ismail, H., Ammar, G., Samer, N., & Issa K. (2019). An integrated methodology for big data classification and security for improving cloud systems data mobility. *IEEE Access, 7*, 9153 - 9163. doi: 10.1109/ACCESS.2018.2890099

Iwuchukwu, U.C., Atimati, E.E., Ndukwe, C.I., & Iwuamadi O. C. (2017). The state of cloud computing in Nigeria. *IOSR Journal of Electrical and Electronics Engineering, 12,* 84–93. doi: 10.9790/1676-1203028493

Iyamu, T., & Mgudlwa, S. (2018). Transformation of healthcare big data through the lens of actor network theory. *International Journal of Healthcare Management, 11,* 182–192.doi:10.1080/20479700.2017.1397340

Jain, P., Pandey, U. (2018). Trending security mechanism in cloud computing. International *Journal of Computer Engineering & Technology, 9*, 259-269. Retrieved from http://www.iaeme.com/IJCET/index.asp

Jankowski, K. R. B., & Flannelly, K. J. (2015). Measures of central tendency in chaplaincy, health care, and related research. *Journal of Health Care Chaplaincy, 21*, 39–49. doi:10.1080/08854726.2014.989799

Jeferry, K., Kousiouris, G., Kyriazis, D., Altmann, J., Ciuffoletti, A., Maglogiannis, I., … Zhao, Z. (2015). Challenges emerging from future cloud application scenarios. *Procedia Computer Science, 68*, 227–237. doi:10.1016/j.procs.2015.09.238

Jennifer, G., & Mary A., M. (2011). Lessons learned: Advantages and disadvantages of mixed method research. *Qualitative Research In Accounting & Management*, 8, 238-264. doi:10.1108/11766091111124702

Ji, H., & Liang, Y. (2016). Exploring the determinants affecting e-government cloud adoption in China. *International Journal of Business and Management, 11*, 81. doi:10.5539/ijbm.v11n4p81

Joe-Wong, C., & Sen, S. (2018). Harnessing the power of the cloud: revenue, fairness, and cloud neutrality. *Journal of Management Information Systems, 35*, 813–836. doi.org/10.1080/07421222.2018.1481639

Joo, Y. J., Park, S., & Lim, E.(2018). Factors influencing preservice teachers' intention to use technology: TPACK, teacher self-efficacy, and technology acceptance model. *Journal of Educational Technology & Society, 21*, 48–59. Retrieved from https://www.j-ets.net/ETS/index.html

Judkins-Cohn, T. M., & Kielwasser-Withrow, K. (2014). Ethical Principles of Informed Consent: Exploring Nurses' Dual Role of Care Provider and Researcher. The *Journal of Continuing Education in Nursing, 4545*, 35–42. doi: 10.3928/00220124-20131223-03

Jupiter, D. (2017). Assumptions of statistical tests: What lies beneath. *Journal of Foot and Ankle Surgery, 56*, 910-913. doi:10.1053/j.jfas.2017.05.022

Karnowski, V., Leonhard, L., & Kümpel, A. S. (2018). Why users share the news: A theory of reasoned action-based study on the antecedents of news-sharing behavior. *Communication Research Reports, 35*, 91–100. doi:10.1080/08824096.2017.1379984

Kathuria, A., Mann, A., Khuntia, J., Saldanha, T. J. V., & Kauffman, R. J. (2018). A strategic value appropriation path for cloud computing. *Journal of Management Information Systems,* 35, 740–775. doi:10.1080/07421222.2018.1481635

Kaur, G. (2018). Efficient data confidentiality and portability in cloud storage. *International Journal of Advanced Research in Computer Science, 9*, 40–45. doi:10.26483/ijarcs.v9i2.5535

Khan, I. U., Hameed, Z., Yu, Y., Islam, T., Sheikh, Z., & Khan, S. U. (2018). Predicting the acceptance of MOOCs in a developing country: Application of task-technology fit model, social motivation, and self-determination theory. *Telematics and Informatics, 35*, 964–978. https://doi.org/10.1016/j.tele.2017.09.009

Kim, L., & Amran, A. (2018). Factors leading to the adoption of business continuity management (BCM) in Malaysia. *Global Business & Management Research, 10*, 179–196. Retrieved from http://www.gbmr.ioksp.com/

Kim, T., K., & Park, J., H. (2019). More about the basic assumptions of t-test: Normality and sample size. *Korean Journal of Anesthesiology,72*, 331-335. doi:10.4097/kja.d.18.00292

Kivunja, C. (2015). Innovative methodologies for 21st century learning, teaching and assessment: A convenience sampling investigation into the use of social media technologies in higher education. *International Journal of Higher Education, 4(2)*, 1–26. doi:10.5430/ijhe.v4n2p1

Koul, S., & Eydgahi, A. (2018). Utilizing technology acceptance model (TAM) for driverless car technology adoption. *Journal of Technology Management & Innovation, 13*, 37–46. Retrieved from http://jotmi.org

Kumar, P. R., Raj, P. H., & Jelciana, P. (2018). Exploring data security issues and solutions in cloud computing. *Procedia Computer Science, 125*, 691–697. doi:10.1016/j.procs.2017.12.089

Kumari, P., & Kaur, P. (2018). A survey of fault tolerance in cloud computing. *Journal of King Saud University - Computer and Information Sciences*, 1-18. doi:10.1016/j.jksuci.2018.09.021

Law, S., NazatulAini, A., & Elankovan, A. (2020). A principal component analysis and clustering based load balancing strategy for cloud computing. *TEM Journal, 9*, 93–100. doi:10.18421/TEM91-14

Lebeda, F. J., Zalatoris, J. J., & Scheerer, J. B. (2018). Government cloud computing policies: Potential opportunities for advancing military biomedical research. *Military Medicine, 183*, e438–e447. doi:10.1093/milmed/usx114

Lee, D., Kanzawa-Lee, G., Knoerl, R., Wyatt, G., & Smith, E. M. L. (2019). Characterization of internal validity threats to phase III clinical trials for chemotherapy-induced peripheral neuropathy management: A systematic review. *Asia-Pacific Journal of Oncology Nursing, 6*, 318–332. doi:10.4103/apjon.apjon_14_19

Li, R., Li, Q., Huang, N., & Kang, R. (2017). A simplified reliability analysis method for cloud computing systems considering common-cause failures. Proceedings of the Institution of Mechanical Engineers, *Part O: Journal of Risk and Reliability*, *231,* 324–333. doi:10.1177/1748006X17703863

Li, X., Wang, Q., Lan, Q., Chen, X., Zhang, N.,& Chen, D. (2019). Enhancing Cloud-Based IoT security through trustworthy cloud service: An Integration of Security and Reputation Approach. *IEEE Access, 7,* 9368 - 9383 doi: 10.1109/ACCESS.2018.2890432

Lips-Wiersma, M., & Mills, A. J. (2014). Understanding the basic assumptions about human nature in workplace spirituality: Beyond the critical versus positive divide. *Journal of Management Inquiry, 23,* 148-161. doi:10.1177/1056492613501227

Liu, S., Chan, F. T. S., Yang, J., & Niu, B. (2018). Understanding the effect of cloud computing on organizational agility: An empirical examination. *International Journal of Information Management, 43*, 98–111. doi:10.1016/j.ijinfomgt.2018.07.010

Liu, S., Yang, Y., Qu, W. G., & Liu, Y. (2016). The business value of cloud computing: The partnering agility perspective. *Industrial Management and Data Systems, 116*, 1160-1177. doi: 10.1108/IMDS-09-2015-0376

Liu, Y., & Li, S. (2019). An analysis of promotional programs for cloud computing: Coupons or free trials? *International Journal of Electronic Commerce, 23*, 405–426. doi:10.1080/10864415.2019.1619910

Lo, S. W. S., Chair, S. Y., & Lee, F. K. (2015). Factors associated with health-promoting behavior of people with or at high risk of metabolic syndrome: Based on the

health belief model. *Applied Nursing Research, 28*, 197–201. doi:10.1016/j.apnr.2014.11.001

Lorenzo-Blanco, E.I., Schwartz, S. J., Unger, J.B., Zamboanga, B.L., Des Rosiers, S.E., Baezconde-Garbanati, L,...Pattarroyo, M. (2016). Alcohol use among recent immigrant Latino/a youth: acculturation, gender, and the Theory of Reasoned Action. *Ethnicity & Health, 21*, 609-627. doi:/10.1080/13557858.2016.1179723

Louati, T., Heithem A., & Christophe C. (2018). LXCloudFT: Towards high availability, fault tolerant cloud system based linux containers. *Journal of Parallel and Distributed Computing 122*, 51–69. doi:10.1016/j.jpdc.2018.07.015

Macheridis, N., & Paulsson, A. (2017). Professionalism between profession and governance: how university teachers' professionalism shapes coordination. *Studies in Higher Education,* 1-16. doi:10.1080/03075079.2017.1378633

MacNell, L., Driscoll, A., & Hunt, A. N. (2014). What's in a name: Exposing gender bias in student ratings of teaching. *Innovative Higher Education, 40*, 291–303. doi:10.1007/s10755-014-9313-4

Madni, S. H., Latiff, M. A., Coulibaly, Y., & Abdulhamid, S. M. (2016). Review: Resource scheduling for infrastructure as a service (IaaS) in cloud computing: Challenges and opportunities. *Journal of Network And Computer Applications, 68*, 173-200. doi:10.1016/j.jnca.2016.04.016

Malterud, K., Hamberg, K., & Reventlow, S. (2017). Qualitative methods in PhD theses from general practice in Scandinavia. *Scandinavian Journal Of Primary Health Care*, *35*, 309-312. doi:10.1080/02813432.2017.1397257

Marchisotti, G. G., Joia, L. A., & De Carvalho, R. B. (2019). The social representation of cloud computing according to Brazilian information technology professionals. *RAE: Revista de Administração de Empresas, 59*, 16–28. doi:10.1590/S0034-759020190103

McCullagh, M. C., Sanon, M. A., & Cohen, M. A. (2014). Strategies to enhance participant recruitment and retention in research involving a community-based population. *Applied Nursing Research, 27*, 249–253. doi:10.1016/j.apnr.2014.02.007

McNaughton, D., & Light, J. (2013). The ipad and mobile technology revolution: Benefits and challenges for individuals who require augmentative and alternative communication. *Augmentative and Alternative Communication*, *29*, 107–116. doi:10.3109/07434618.2013.784930

Mesbahi, M. R., Rahmani, A. M., & Hosseinzadeh, M. (2018). Reliability and high availability in cloud computing environments: A reference roadmap. *Human-Centric Computing and Information Sciences, 8(1)*, 1–31. doi:org.ezp.waldenulibrary.org/10.1186/s13673-018-0143-8

Mingnan, L., & Wronski, L. (2018). Trap questions in online surveys: Results from three web survey experiments. *International Journal Of Market Research, 60*, 32-49. doi:10.1177/1470785317744856

Mishra, P., Pandey, C., Singh, U., Gupta, A., Sahu, C., & Keshri, A. (2019). Descriptive statistics and normality tests for statistical data. *Annals of Cardiac Anaesthesia, 22,* 67-72. doi:10.4103/aca.ACA_157_18

Mohammed, F., Alzahrani, A. I., Alfarraj, O., & Ibrahim, O. (2017). Cloud computing fitness for e-Government implementation: Importance-performance analysis. *IEEE Access, 6,* 1236–1248.doi: 10.1109/ACCESS.2017.2778093

Mohammed, F., Ibrahim, O., & Ithnin, N. (2016). Factors influencing cloud computing adoption for e-government implementation in developing countries: Instrument development. *Journal of Systems and Information Technology, 18*, 297–327. doi: 10.1108/JSIT-01-2016-0001

Mollah, M. B., Azad, M. K., & Vasilakos, A. (2017). Security and privacy challenges in mobile cloud computing: Survey and way ahead. *Journal Of Network & Computer Applications, 84,* 38-54. doi:10.1016/j.jnca.2017.02.001

Montoya, A. K., & Hayes, A. F. (2017). Two-condition within-participant statistical mediation analysis: A path-analytic framework. Psychological Methods, 22, 6–27. doi:10.1037/met0000086

Moore, G. C., & Benbasat, I. (1991). Development of an instrument to measure the perceptions of adopting an information technology innovation. *Information systems research, 2*, 192-222. Retrieved from https://www.informs.org/Publications

Morosan, C., & DeFranco, A. (2016). It's about time: Revisiting UTAUT2 to examine consumers' intentions to use NFC mobile payments in hotels. *International Journal of Hospitality Management, 53*, 17-29. doi:10.1016/j.ijhm.2015.11.003

Morse, J. M. (2015). Critical Analysis of strategies for determining rigor in qualitative inquiry. *Qualitative Health Research, 25,* 1212–1222. doi:10.1177/1049732315588501

Munley, B., Buser, A. T., Gaudreau, S., Breault, J. L., & Bazzano, L. A. (2018). An analysis of informed consent form readability of oncology research protocols. *Journal of Empirical Research on Human Research Ethics, 13*, 363–367. doi:10.1177/1556264618795057

Mwakisole, K. F., Kissaka, M. M., & Mtebe, J. S. (2019). Cloud computing architecture for elearning systems in secondary schools in Tanzania. *African Journal of Information Systems, 11*, 299–313. Retrieved from http://www.ajisonline.com/

Nagy, J. T. (2018). Evaluation of online video usage and learning satisfaction: An extension of the technology acceptance model. *International Review of Research in Open & Distance Learning, 19*, 160–184. doi:10.19173/irrodl.v19i1.2886

Naik, C. N., & Rajana, M. (2015). Survey on functional minimum storage regenerating codes for fault tolerance cloud storage. *International Journal of Advanced Research*

in Computer Science; 6, 64-67. Retrieved from http://search.proquest.com/computing/docview/1674899436/abstract/370725F8B8664264PQ/21

Namasudra, S., Devi, D., Kadry, S., Sundarasekar, R., & Shanthini, A. (2020). Towards DNA based data security in the cloud computing environment. *Computer Communications, 151*, 539–547. doi:10.1016/j.comcom.2019.12.041

National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research. (1978). The Belmont report: Ethical principles and guidelines for the protection of human subjects of research. Washington, DC: U.S. Department of Health and Human Services

Nazari Cheraghlou, M., Khadem-Zadeh, A., & Haghparast, M. (2016). A survey of fault tolerance architecture in cloud computing. *Journal of Network and Computer Applications, 61*, 81–92. doi:10.1016/j.jnca.2015.10.004

Neall, A. M., & Tuckey, M. R. (2014). A methodological review of research on the antecedents and consequences of workplace harassment. *Journal of Occupational and Organizational Psychology*, 87, 225–257. doi:10.1111/joop.12059

Ngah, A. H., Zainuddin, Y., & Thurasamy, R. (2017). Applying the TOE framework in the Halal warehouse adoption study. *Journal of Islamic Accounting & Business Research, 8*, 161-181.doi:10.1108/JIABR-04-2014-0014

Nikolopoulos, M., Karampela, I., Tzortzis, E., & Dalamaga, M. (2018). Deploying cloud computing in the Greek healthcare system: A modern development proposal

incorporating clinical and laboratory data. *Studies in Health Technology and Informatics, 251*, 35–38. doi:10.3233/978-1-61499-880-8-35

Nimon, K. F., & Oswald, F. L. (2013). Understanding the results of multiple linear regression: Beyond standardized regression coefficients. *Organizational Research Methods, 16*, 650-674. doi:10.1177/1094428113493929

Niven, E., & Deutsch, C. (2012). Calculating a robust correlation coefficient and quantifying its uncertainty. *Computers & Geosciences, 40*, 1-9. doi:10.1016/j.cageo.2011.06.021

Noguerol, L., & Branch, R. (2018). Leadership and electronic data security within small businesses: An exploratory case study. *Journal of Economic Development, Management, IT, Finance & Marketing, 10*, 7-35. Retrieved from https://trove.nla.gov.au

Nowakowski, P., Bubak, M., Bartyński, T., Gubała, T., Harężlak, D., Kasztelnik, M., … Meizner, J. (2018). Cloud computing infrastructure for the VPH community. *Journal of Computational Science, 24,* 169–179. doi:10.1016/j.jocs.2017.06.012

Ogiela, U., Takizawa, M., & Ogiela, L. (2018). Cognitive approaches for medicine in cloud computing. *Journal of Medical Systems, 42*, 70–70. doi:10.1007/s10916-018-0918-5

Oguntala, G. A., Abd-Alhameed, R. A., & Odeyemi, J.O. (2017). Systematic analysis of enterprise perception towards cloud adoption in the african states: The Nigerian

perspective. *African Journal of Information Systems, 9*, 213-231. Retrieved from https://publons.com/journal/58209/the-african-journal-of-information-systems

Omair, A. (2015). Selecting the appropriate study design for your research: Descriptive study designs. *Journal of Health Specialties, 3*, 153-156.doi:10.4103/1658-600X.159892

Oredo, J., Njihia, J., & Iraki, X. N. (2019). Adoption of cloud computing by firms in Kenya: The role of institutional pressures. *African Journal of Information Systems, 11*, 133–156. Retrieved from http://www.ajisonline.com/

Osborne, J., & Waters, E. (2002). Four assumptions of multiple regression that researchers should always test. *Practical Assessment, Research and Evaluation, 8,* 1-5. Retrieved from http://pareonline.net/

Palac, H. L., Alam, N., Kaiser, S. M., Ciolino, J. D., Lattie, E. G., & Mohr, D. C. (2018). A practical do-it-yourself recruitment framework for concurrent ehealth clinical trials: Simple architecture (Part 1). *Journal of Medical Internet Research, 20 (11)*, 1-11. doi:10.2196/11049

Parker, E. (2017). An actor-network theory reading of change for children in public care. *British Educational Research Journal*, *43*, 151-167. doi:10.1002/berj.3257

Patel, K., & Alabisi, A. (2019). cloud computing security risks: Identification and assessment. *Journal of New Business Ideas & Trends, 17*, 11–19. Retrieved from http://www.jnbit.org

Peterson, R. A., & Merunka, D. R. (2014). Convenience samples of college students and research reproducibility. *Journal of Business Research, 67*, 1035–1041. doi:10.1016/j.jbusres.2013.08.010

Priyadarshinee, P., Raut, R. D., Jha, M. K., & Gardas, B. B. (2017). Understanding and predicting the determinants of cloud computing adoption: A two staged hybrid SEM - neural networks approach. *Computers in Human Behavior, 76*, 341–362.doi:10.1016/j.chb.2017.07.027

Qasem, Y. A. M., Abdullah, R., Jusoh, Y. Y., Atan, R., & Asadi, S. (2019). Cloud computing adoption in higher education institutions: A systematic review. *IEEE Access, 7*, 63722–63744. doi:10.1109/ACCESS.2019.2916234

Quick, J., & Hall, S. (2015a). Part one: An introduction to the research process. *Journal of Perioperative Practice, 25*, 78–82. doi:10.1177/175045891502500404

Quick, J., & Hall, S. (2015b). Part three: The quantitative approach. *Journal of Perioperative Practice, 25*, 192-196. doi: 10.1177/175045891502501002

Rafal, M., Xie, M. Dong, W. (2019). Classification of research problems in grey system theory based on grey space concept. *Journal of Grey System, 31*, 100-111. Retrieved from www.researchinformation.co.uk

Rahi, S., Ghani, M., Alnaser, F., & Ngah, A. (2018). Investigating the role of unified theory of acceptance and use of technology (UTAUT) in internet banking adoption context. *Management Science Letters, 8*, 173-186. doi:10.5267/j.msl.2018.1.001

Rakesh, D. R., Bhaskar, B. G., Balkrishna, E. N., Vaibhav S. N. (2019). To investigate the determinants of cloud computing adoption in the manufacturing micro, small and medium enterprises: A DEMATEL-based approach. *Benchmarking: An International Journal, 26*, 3, 990-1019. doi:10.1108/BIJ-03-2018-0060

Rakesh, R., Pragati, P., Manoj, J., Bhaskar, B. G., & Sachin K. (2018). Modeling the implementation barriers of cloud computing adoption : An interpretive structural modeling. *Benchmarking: An International Journal, 25,* 2760-2782. doi:10.1108/BIJ-12-2016-0189

Ramachandra, G., Iftikhar, M., & Khan, F. A. (2017). a comprehensive survey on security in cloud computing. *Procedia Computer Science, 110*, 465–472.doi:10.1016/j.procs.2017.06.124

Rao, A., Stahlman, S., Hargreaves, J., Weir, S., Edwards, J., & Rice, B., … Baral, S. (2017). Sampling key populations for HIV surveillance: Results from eight crosssectional studies using respondent-driven sampling and venue-based snowball 137 sampling. *JMIR Public Health and Surveillance, 3*, e72. doi:10.2196/publichealth.8116

Ray-Mukherjee, J., Nimon, K., Mukherjee, S., Morris, D., Slotow, R., & Hamer, M. (2014). Using commonality analysis in multiple regressions: a tool to decompose regression effects in the face of multicollinearity. *Methods In Ecology And Evolution, 5*, 320-328. doi:10.1111/2041-210x.12166

Regan, J. A. (2013). Risks to informed consent in pedagogic research. *Journal of Perspectives in Applied Academic Practice, 1*, 25–29. doi:10.14297/jpaap.v1i1.36

Reyes-Menendez, A., Ramon Saura, J., Palos-Sanchez, P. R., & Alvarez-Garcia, J. (2018). Understanding user behavioral intention to adopt a search engine that promotes sustainable water management. *Symmetry, 10(11),* 1-21. doi:10.3390/sym10110584

Rice, S., Winter, S. R., Doherty, S., & Milner, M. (2017). Advantages and disadvantages of using Internet-based survey methods in aviation-related research. *Journal of Aviation Technology and Engineering, 7,* 58-65. doi:10.7771/2159-6670.1160

Rienties, B., Herodotou, C., Olney, T., Schencks, M., & Boroowa, A. (2018). Making sense of learning analytics dashboards: A technology acceptance perspective of 95 teachers. *International Review of Research in Open & Distance Learning*, 19, 186–202. doi:10.19173/irrodl.v19i5.3493

Roberts, L. D., & Allen, P. J. (2015). Exploring ethical issues associated with using online surveys in educational research. *Educational Research and Evaluation, 21*, 95–108. doi:10.1080/13803611.2015.1024421

Robinson, O. C. (2014). Sampling in interview-based qualitative research: A theoretical and practical guide. *Qualitative Research in Psychology, 11*, 25–41. doi:10.1080/14780887.2013.801543

Rowley, J. (2014). Designing and using research questionnaires. *Management Research Review, 37,* 308-330. doi:10.1108/MRR-02-2013-0027

Rutberg, S., & Bouikidis, C. D. (2018). Exploring the evidence. Focusing on the fundamentals: a simplistic differentiation between qualitative and quantitative research. *Nephrology Nursing Journal, 45*, 209–213. Retrieved from https://www.annanurse.org/resources/products/nephrology-nursing-journal

Salookolaei, D. D., Liu, S., & Nasseri, S. (2018). A new approach in animal diet using grey system theory. *Grey Systems: Theory and Application, 8*, 167-180. doi:10.1108/GS-11-2017-0040

Saritha, V., & Raju, D. (2016). Architecture for fault tolerance in mobile cloud computing using disease resistance approach. *International Journal of Communication Networks and Information Security, 8,* 112-18 Retrieved from http://www.ijcnis.org/index.php/ijcnis

Sauermann, H., & Roach, M. (2013). Increasing web survey response rates in innovation research: An experimental study of static and dynamic contact design features. *Research Policy, 42*, 273–286. doi:10.1016/j.respol.2012.05.003

Schweizer, G., & Furley, P. (2016). Reproducible research in sport and exercise psychology: The role of sample sizes. *Psychology of Sport and Exercise, 23*, 114–122. doi:10.1016/j.psychsport.2015.11.005

Scott, S., & McGuire, J. (2017). Using diffusion of innovation theory to promote universally designed college instruction. *International Journal of Teaching & Learning in Higher Education, 29*, 119–128. Retrieved from http://www.isetl.org/ijtlhe/

Shaikh, A. A., & Ahmad, S. (2018). Fault tolerance management for cloud environment: A critical review. *International Journal of Advanced Research in Computer Science, 9*, 34–36. doi:org.ezp.waldenulibrary.org/10.26483/ijarcs.v9i0.6133

Sharma, G., & Kalra, S. (2018). A lightweight multi-factor secure smart card based remote user authentication scheme for cloud-IoT applications. *Journal of Information Security and Applications, 42*, 95–106. doi:10.1016/j.jisa.2018.08.003

Sharma, M., Gupta, R., & Acharya, P. (2017). Prioritizing the critical factors of cloud computing adoption using multi-criteria decision-making techniques. *Global Business Review, 20*, 1-20. doi:10.1177/0972150917741187

Sharma, S. K., Al-Badi, A. H., Govindaluri, S. M., & Al-Kharusi, M. H. (2016). Predicting motivators of cloud computing adoption: A developing country perspective. *Computers in Human Behavior, 62*, 61–69. doi:10.1016/j.chb.2016.03.073

Shun-Jhe J., & Chung-Tai W. (2018). Utilization of cloud computing app for homestay operation - Design and analysis. *International Journal of Organizational Innovation, 11*, 31–44. Retrieved from http://www.ijoi-online.org/

Shynu, P., & Singh, K. J. (2018). Privacy preserving secret key extraction protocol for multi-authority attribute-based encryption techniques in cloud computing. *International Journal of Embedded Systems, 10,* 287–300.doi:10.1504/IJES.2018.093687

Si, H., Ke, H., & Shouyi, Z. (2019). A data sharing protocol to minimize security and privacy risks of cloud storage in big data era. *IEEE Access, 7*, 60290 - 60298. doi:10.1109/ACCESS.2019.2914862

Simon, C. M., Schartz, H. A., Rosenthal, G. E., Eisenstein, E. L., & Klein, D. W. (2018). Perspectives on electronic informed consent from patients underrepresented in research in the United States: A focus group study. *Journal of Empirical Research on Human Research Ethics, 13*, 338–348. doi:10.1177/1556264618773883

Singh, A. R., Pakhare, A., Kokane, A. M., Shewade, H. D., Chauhan, A., Singh, A., … Thakur, P. S. (2017). 'Before reaching the last mile'- Knowledge, attitude, practice and perceived barriers related to tuberculosis directly observed therapy among ASHA workers in Central India: A mixed method study. Journal *of Epidemiology and Global Health, 7*, 219–225. doi:10.1016/j.jegh.2017.07.002

Smara, M., Aliouat, M., Pathan, A. & Aliouat, Z. (2017). Acceptance test for fault detection in component-based cloud computing and systems. *Future Generation Computer Systems, 70*, 74–93. doi:10.1016/j.future.2016.06.030

Smith, S., Kempster, S., & Barnes, S. (2017). Up the ANTe: Understanding entrepreneurial leadership learning through actor-network theory. *Industry and Higher Education, 31*, 132–139. doi:10.1177/0950422217691667

Soltanshahi, M.(2016). Improving the palbimm scheduling algorithm for fault tolerance in cloud computing. *Journal of Advances in Computer Engineering and Technology, 2,* 9-14. Retrieved from http://jacet.srbiau.ac.ir/

Sparkes, A. C. (2015). Developing mixed methods research in sport and exercise psychology: Critical reflections on five points of controversy. *Psychology of Sport and Exercise, 16,* 49–59. doi:10.1016/j.psychsport.2014.08.014

Spector, P. E., & Meier, L. L. (2014). Methodologies for the study of organizational behavior processes: How to find your keys in the dark. *Journal of Organizational Behavior, 35,* 1109-1119. doi:10.1002/job.1966

Strömmer, S., Lawrence, W., Rose, T., Vogel, C., Watson, D., Bottell, J. N., … Barker, M. (2018). Improving recruitment to clinical trials during pregnancy: A mixed methods investigation. *Social Science & Medicine, 200*, 73–82. doi:10.1016/j.socscimed.2018.01.014

Subramanian, N., & Jeyaraj, A. (2018). Recent security challenges in cloud computing. *Computers & Electrical Engineering, 71,* 28–42. doi: 10.1016/j.compeleceng.2018.06.006

Sun, P. J. (2019). Privacy protection and data security in cloud computing: A survey, challenges, and solutions. *IEEE Access, 7*, 147420–147452. doi:10.1109/ACCESS.2019.2946185

Sun, Z., Gilbert, L., Ciampi, A., & Basso, O. (2017). Recruitment challenges in clinical research: Survey of potential participants in a diagnostic study of ovarian cancer. *Gynecologic Oncology, 146*, 470–476. doi:10.1016/j.ygyno.2017.06.021

Sutaria, V., Prasad, V. K., & Bhavsar, M. (2017). Fault prediction and mitigation in cloud computing. *International Journal of Advanced Research in Computer Science, 8*, 1042-1050. Retrieved from http://www.ijarcs.info

Suter, W. N., & Suter, P. M. (2015). How research conclusions go wrong. *Home Health Care Management & Practice, 27*, 171–177. doi:10.1177/1084822315586557

Suzuki, L. A., & Nagata, D. K. (2018). Qualitative methods in Asian American psychology: Part II. *Asian American Journal of Psychology, 9(1)*, 1–3. doi: 10.1037/aap0000112

Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics*. *Pearson Education 6th ed.* doi:10.1037/022267

Tamura, Y., & Yamada, S. (2016). Reliability computing and management considering the network traffic for a cloud computing. *Annals of Operations Research, 244*, 163–176.doi:10.1007/s10479-016-2140-5

Tavakol, M., & Sandars, J. (2014). Quantitative and qualitative methods in medical education research: AMEE Guide No 90: Part I. *Medical Teacher, 36*, 746–756. doi:10.3109/0142159X.2014.915298

Tideman, M., & Svensson, O. (2015). Young people with intellectual disability—the role of self-advocacy in a transformed Swedish welfare system. *International journal of qualitative studies on health and well-being*, 10. doi:10.3402/qhw.v10.25100

Tinkler, L., Smith, V., Yiannakou, Y., & Robinson, L. (2018). Professional identity and the clinical research nurse: A qualitative study exploring issues having an impact

on participant recruitment in research. *Journal of Advanced Nursing, 74*, 318–328. doi:10.1111/jan.13409

Tomás, S., Thomas, M., & Oliveira, T. (2018). Evaluating the impact of virtualization characteristics on SaaS adoption. *Enterprise Information Systems, 12*, 259–278.doi:10.1080/17517575.2017.1355484

Torre, D. M., & Picho, K. (2016). Threats to Internal and external validity in health professions education research. *Academic Medicine, 91*, e21.doi:10.1097/ACM.0000000000001446

Trochim, W., Donnelly, J., & Arora, K. (2015). *Research methods: The essential knowledge base (2nd ed.).* Wadsworth Publishing.

Turan, A., Tunç, A. Ö., & Zehir, C. (2015). A theoretical model proposal: Personal innovativeness and user involvement as antecedents of unified theory of acceptance and use of technology. *Procedia - Social and Behavioral Sciences, 210*, 43–51. doi:10.1016/j.sbspro.2015.11.327

Turner, T. L., Balmer, D. F., & Coverdale, J. H. (2013). Methodologies and study designs relevant to medical education research. *International Review of Psychiatry, 25*, 301-310. doi:10.3109/09540261.2013.790310

Uyanık, G. K., & Güler, N. (2013). A study on multiple linear regression analysis. *Procedia - Social and Behavioral Sciences, 106,* 234-240. doi:10.1016/j.sbspro.2013.12.027

Vafamehr, A., & Khodayar, M. E. (2018). Energy-aware cloud computing. The Electricity Journal, 31, 40–49. doi:10.1016/j.tej.2018.01.009

Valerio, M. A., Rodriguez, N., Winkler, P., Lopez, J., Dennison, M., Liang, Y., & Turner, B. J. (2016). Comparing two sampling methods to engage hard-to-reach communities in research priority setting. *BMC Medical Research Methodology, 16(1)*, 1-11. doi:10.1186/s12874-016-0242-z

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science, 46*, 186–204. doi:10.1287/mnsc.46.2.186.11926

Venkatesh, V., Brown, S. A., & Bala, H. (2013). Bridging the qualitative-quantitative divide: Guidelines for conducting mixed methods research in information systems. *MIS Quarterly*, 37, 21-54. Retrieved from http://misq.org/misq/downloads.

Venkatesh, V., Morris, M. M. G., Davis, G. G. B., & Davis, F. D. F. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*, 425–478. doi:10.2307/30036540

Volkov, S., & Sukhoroslov, O. (2017). Simplifying the use of clouds for scientific computing with Everest. *Procedia Computer Science, 119*, 112-120. doi:10.1016/j.procs.2017.11.167

Walter, S. R., Dunsmuir, W. T. M., & Westbrook, J. I. (2015). Studying interruptions and multitasking in situ: The untapped potential of quantitative observational studies.

International Journal of Human-Computer Studies,79, 118–125. doi:10.1016/j.ijhcs.2015.01.008

Wang, C., Fu, Z., & Cui, G. (2019). A neural-network-based approach for diagnosing hardware faults in cloud systems. *Advances in Mechanical Engineering, 11(2),* 1-10. doi:1687814018819236.

Wang, X., & Goh, D. H. (2017). Video game acceptance: A Meta-analysis of the extended technology acceptance model. *CyberPsychology, Behavior & Social Networking, 20*, 662–671. doi:10.1089/cyber.2017.0086

Wang, Z., Wang, N., Su, X., & Ge, S. (2020). An empirical study on business analytics affordances enhancing the management of cloud computing data security. *International Journal of Information Management, 50*, 387–394. doi: 10.1016/j.ijinfomgt.2019.09.002

Wei, H., & Pei-Li, Q. (2016). Reliability Assessment of cloud computing platform based on semiquantitative information and evidential reasoning. *Journal of Control Science and Engineering,* 1-10.doi:10.1155/2016/2670210

Whelan, T. J., & DuVernet, A. M. (2015). The big duplicity of big data. *Industrial and Organizational Psychology, 8*, 509–515. doi:10.1017/iop.2015.75

Widjaja, A. E., Chen, J.V., Sukoco, B.M., & Ha, Q. (2018). Understanding users' willingness to put their personal information on the personal cloud-based storage applications: An empirical study. *Computers in Human Behavior*, 1-36.doi:10.1016/j.chb.2018.09.034

Williams, M., Grajales, C. A. G., & Kurkiewicz, D. (2013). Assumptions of multiple regression: Correcting two misconceptions. *Practical Assessment, Research & Evaluation, 18*, 1-14. Retrieved from http://pareonline.net/ getvn.asp?v=18&n=11

Wu Suen, L. J., Huang, H. M., & Lee, H. H. (2014). A comparison of convenience sampling and purposive sampling. *Journal of Nursing, 61*, 105-111. doi:10.6224/JN.61.3.105

Wu, B., & Chen, X. (2017). Continuance intention to use MOOCs: Integrating the technology acceptance model (TAM) and task technology fit (TTF) model. *Computers in Human Behavior*, 67, 221–232. https://doi.org/10.1016/j.chb.2016.10.028

Xiong, L., & Xu, Z. (2018). High-capacity and lossless reversible data hiding for encrypted multimedia data in cloud computing. *Journal of Internet Technology, 19*, 1187–1193. Retrieved from http://jit.ndhu.edu.tw

Yan, Q., Yu, F. R., Gong, Q., & Li, J. (2016). Software-defined networking (SDN) and distributed denial of service (DDOS) attacks in cloud computing environments: A survey, some research issues, and challenges. *IEEE Communications Surveys and Tutorials*, 18, 602-622. doi:10.1109/COMST.2015.2487361

Yan, X., Zhang, D., & Yang, J. (2016). An adaptive fault tolerance strategy for cloud storage. *Transactions on Internet and Information Systems, 10*, 5290-5304. doi: 10.3837/tiis.2016.11.005

Yeatman, S., Trinitapoli, J., & Hayford, S. (2013). Limitations of clinic-based studies on HIV and fertility preferences. *American Journal of Public Health, 103*(6), e5.doi:10.2105/AJPH.2013.301333

Yeh, C., & Chen, Y. (2018). Critical success factors for adoption of 3D printing. *Technological Forecasting and Social Change, 132*, 209–216. doi:10.1016/j.techfore.2018.02.003

Yin, R. K. (2014). *Case study research: Design and methods (5th ed.)*. Thousand Oaks, CA: Sage Publications.

Yousef, Rusli, Rodziah, & Yusmadi. (2018). Towards developing a cloud-based education as a service (ceaas) model for cloud computing adoption in higher education institutions. *Acta Informatica Malaysia, 2*, 19–20. doi:10.26480/aim.02.2018.19.20

Yu, L., Liu, L., & Chen, D.G. (2019). A homoscedasticity test for the accelerated failure time model. *Computational Statistics, 34*, 433–446. doi:10.1007/s00180-018-0840-9

Yu, Y., Cao, R. Q., & Schniederjans, D. (2017). Cloud computing and its impact on service level: a multi-agent simulation model. *International Journal of Production Research, 55*, 4341–4353. doi:10.1080/00207543.2016.1251624

Yuha, Y., Jin, C., & Kyungmook, L. (2018). Theory of planned behavior and different forms of organizational change behavior. *Social Behavior & Personality, 46*, 1657–1671. doi:10.2224/sbp.6832

Zawawi, N. H. M. (2018). Actor-network theory and inter-organizational management control. *International Journal of Business & Society, 19,* 219–234. Retrieved from http://www.ijbs.unimas.my

Zheng, W., Wang, Y., Xia, Y., Wu, Q., Wu, L., Guo, K., … Zhu, Q. (2017). On dynamic performance estimation of fault-prone Infrastructure-as-a-Service clouds. *International Journal of Distributed Sensor Networks, 13(7),* 1-11.doi:10.1177/1550147717718514

Zhixin, L., Lei, L., & Zeyu, T. (2017). Study on fault tolerance method in cloud platform based on workload consolidation model of virtual machine. *Journal of Engineering Science and Technology Review, 10*, 41-49. doi: 10.25103/jestr.105.05

Zhou, T. (2013). The Effect of Flow Experience on User Adoption of Mobile TV. *Behaviour & Information Technology, 32*, 263–72. doi:10.1080/0144929X.2011.650711

Zhou, Y. (2018). A survey on Chinese scholars' adoption of mixed methods. *International Education Studies*, *11*, 27-37

Zhuang, J., Jacob, D. J., Gaya, J. F., Yantosca, R. M., Lundgren, E. W., Sulprizio, M. P., & Eastham, S. D. (2019). Enabling immediate access to earth science models through cloud computing: Application to the geos-chem model. *Bulletin of the American Meteorological Society, 100*, 1943–1960. doi:10.1175/BAMS-D-18-0243.1

Zolna, K., Dao, P. B., Staszewski, W. J., & Barszcz, T. (2016). Towards homoscedastic nonlinear cointegration for structural health monitoring. *Mechanical Systems and Signal Processing, 75*, 94-108. doi:10.1016/j.ymssp.2015.12.014

Appendix A: NIH Human Subject Research Certificate of Completion

Certificate of Completion

The National Institutes of Health (NIH) Office of Extramural Research certifies that **Ayodele Bakare** successfully completed the NIH Web-based training course "Protecting Human Research Participants".

Date of completion: 11/12/2017.

Certification Number: 2557799.

Appendix B: Reprinted Diagrams Author's Permission

Ayodele Bakare
Tue 5/5/2020 1:56 PM
vvenkatesh@vvenkatesh.us; fdavis@walton.uark.edu; vvenkate@mbs.umd.edu

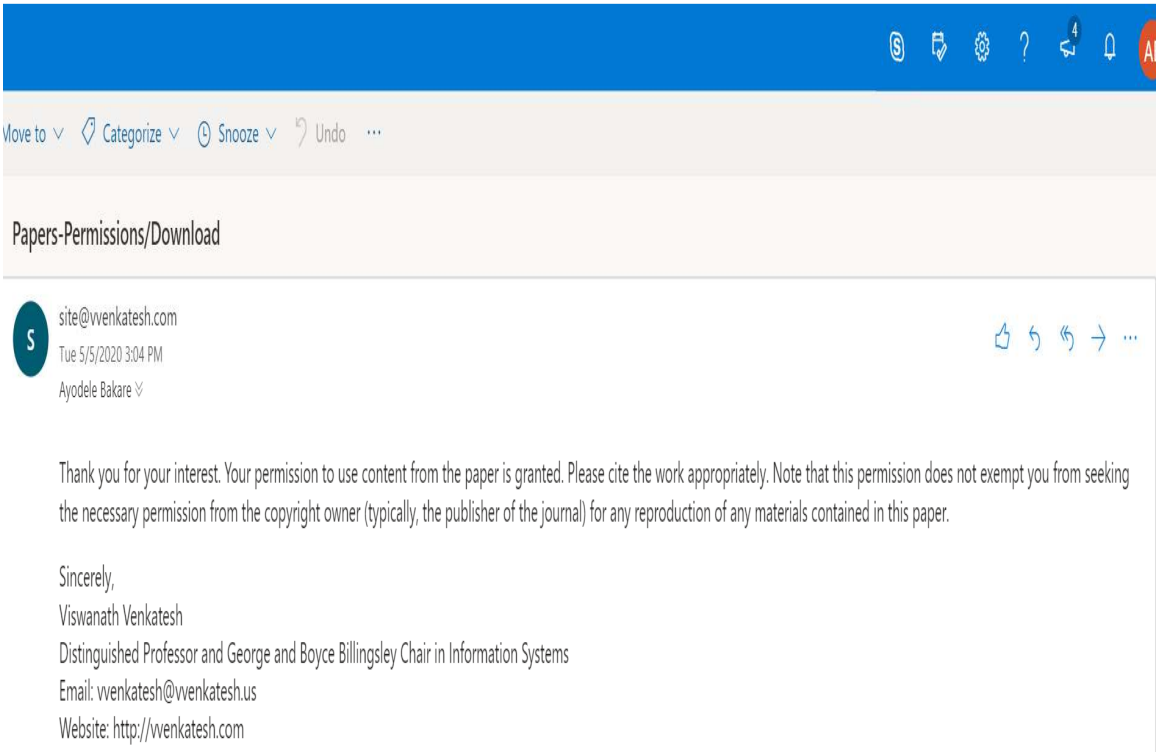
Dear Sir,

I trust that you and your family are doing great. My name is Ayodele Bakare and I am a doctorate student at Walden University, USA. I am currently writing my dissertation titled "The Challenges of Adopting Cloud Computing in Nigerian Government Organizations". I kindly seek your permission to reprint your TAM 2 diagram in your article titled " A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies".

Thank you very much and do have a blessed week.

Warm Regards,

Bakare Ayodele



Journal of Research in Innovative Teaching & Learning
Vol. 11 No. 2, 2018
pp. 178-191
Emerald Publishing Limited
2397-7604
DOI 10.1108/JRIT-03-2017-0004

Appendix C: Morosan and DeFranco's Original Survey Instrument

Performance expectancy

PE1: Using NFC mobile payments in hotels would enhance the effectiveness of my interactions with the hotel (for example, purchasing products/services, making reservations)
PE2: Using NFC mobile payments would increase the efficiency of my hotel stay
PE3: Using NFC mobile payments in hotels would improve the quality of my hotel stay
PE4: Using NFC mobile payments would allow me to access products/reservations faster in hotels)
PE5: Using NFC mobile payments would allow me to make more accurate purchases/reservations in hotels
PE6: Using NFC mobile payments would allow me to purchase/reserve products with an overall better value in hotels
PE7: Using NFC mobile payments would allow me to better manage my money when staying in hotels
PE8: Using NFC mobile payments would allow me to have better control over my expenses in hotels
PE9: Using NFC mobile payments would allow me to have a better view of my purchasing history in hotels
PE10: Using NFC mobile payments would provide me with a more secure method of payment in hotels
PE11: Using NFC mobile payments would lower the need to carry multiple methods of payment with me when staying in hotels
PE12: Using NFC mobile payments would allow me to choose more effectively among my methods of payment
PE13: Using NFC mobile payments would allow me to obtain benefits beyond the hotel stay (for example, using a preferred credit card).
PE14: Overall, I believe that NFC mobile payments are useful when staying in hotels
Effort expectancy (adapted from Venkatesh et al., 2012)
EE1: Learning how to use NFC mobile payments for my purchases in hotels is easy for me
EE2: My interactions with my mobile phone and transaction terminals when using NFC mobile payments in hotels are clear and understandable
EE3: I find it easy to use NFC mobile payments in hotels
EE4: It is easy for me to become skillful at using NFC mobile payments in hotels

Social influence

SI1: People who are important to me think that I should use NFC mobile payments in hotels
Si2: People who influence my behavior think that I should use NFC mobile payments in hotels
Si3: People whose opinions that I value prefer that I use NFC mobile payments in hotels

Facilitating conditions

FC1: I have the resources necessary to use NFC mobile payments in hotels
FC2: I have the knowledge necessary to use NFC mobile payments in hotels
FC3: NFC mobile payments are compatible with other technologies I use
FC4: I can get help from others when I have difficulties using NFC mobile payments in hotels

Hedonic motivation

HM1: Using NFC mobile payments in hotels is fun
HM2: Using NFC mobile payments in hotels is enjoyable
HM3: Using NFC mobile payments in hotels is entertaining
HM4: Using NFC mobile payments in hotels is pleasant

Habit

HA1: Generally, the use of mobile phones for payment has become a habit for me
HA2: I am addicted to using mobile phones for general payment
HA3: I must use mobile phones for payment
HA4: Using mobile phones for payment has become natural to me

General privacy

GP1: Compared to others, I am more sensitive about the way companies handle my personal information
GP2: To me, it is most important to keep my privacy intact from companies
GP3: I am concerned about threats to my personal privacy today

System-related privacy

SP1: Using NFC mobile payments makes me concerned about my personal privacy
SP2: Using NFC mobile payments would make me personally uncomfortable

SP3: Using NFC mobile payments would make me have privacy concerns

Perceived security

PS1: NFC mobile payment systems are secure systems through which to send sensitive information in hotels
PS2: I would feel secure providing personal information when using NFC mobile payments in hotels
PS3: I am not worried that information I provide when using NFC mobile payments could be used by other people
PS4: Overall, NFC mobile payment systems are safe to transmit sensitive information

Intentions

IN1: I intend to use NFC mobile payments in hotels in the future
IN2: I will always try to use NFC mobile payments in my hotel stays
IN3: I will recommend to others using NFC mobile payments in hotels
IN4: NFC mobile payments would be one of my favorite technologies for payment

Appendix D: Proposed Survey Instrument on Cloud Computing Adoption by IT Administrators in Nigerian Government Organizations

This survey will address the extent to which IT administrators' perception of (a) data security, and (b) fault tolerance, influence their intentions to adopt cloud computing in Nigerian government organizations. The data captured from this survey and further data analysis will allow the examination and understanding of the strength of the relationships among the variables. The final result of this survey may help provide a knowledge base for the understanding of the factors affecting IT administrators' intentions to adopt cloud computing in Nigerian government organizations. Additionally, the result of the survey may provide valuable information to the government in improving service delivery to citizens and businesses through the effective adoption of cloud computing.

This survey has four sections, with three sections corresponding to the variables and a section for demographic information. For each statement, please respond on a scale of 1 to 5. The definition of the scale is as follows. 1 = strongly disagree, 2 =disagree, 3 = neutral (neither agree nor disagree), 4 = agree, 5 = strongly agree. Note: All items are based on a 5-point scale except those noted *. Please kindly call my attention if you require an explanation/clarification on any of the questions. Thank you.

This survey instrument is based on Morosan and DeFranco's survey instrument published in 2016. Please, see full description of source below:

Morosan, C., & DeFranco, A. (2016). It's about time: Revisiting UTAUT2 to examine consumers' intentions to use NFC mobile payments in hotels. *International Journal of Hospitality Management, 53*, 17-29. doi: https://dx.doi.org/10.1016/j.ijhm.2015.11.003,

		Please Tick The Appropriate Responses Below				
Item No	**Part 1 – IT administrators' perception of data security**	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
1.	Cloud computing systems are secure systems through which to send sensitive information in my organization.	1	2	3	4	5
2	I would feel secure providing personal information when using cloud computing systems in my organization.	1	2	3	4	5
3	I am not worried that information I store, process, and transmit when using cloud computing systems could be hacked and used by other people	1	2	3	4	5
4	Overall, cloud computing systems are safe to transmit, store, and process sensitive information	1	2	3	4	5
	Part 2- IT administrators' perception of fault tolerance	1	2	3	4	5
5	Using cloud computing systems makes me concerned about its tolerance to faults.	1	2	3	4	5
6	Using cloud computing systems would make me personally uncomfortable regarding its tolerance to faults.	1	2	3	4	5
7	Using cloud computing systems would make me have system reliability and availability concerns.	1	2	3	4	5
8	Compared to others, I am more sensitive about the way cloud computing systems handle faults.	1	2	3	4	5
9	I am concerned about threats to the availability and reliability of the information systems handling my data and applications	1	2	3	4	5
10	To me, it is most important to have 24hours and 365 days access to my data and applications.	1	2	3	4	5
	Part 3- IT administrators' intentions to adopt cloud computing					

11	I intend to use cloud computing systems in my organization in the future	1	2	3	4	5
12	I will always try to use cloud computing systems in my organization	1	2	3	4	5
13	I will recommend to other IT administrators to use cloud computing in their organizations.	1	2	3	4	5
14	Cloud computing would be one of my favorite technologies for managing my organizations data and applications.	1	2	3	4	5

Part 4- Demographic Questions

		Please Tick The Appropriate Responses Below		
15	Are you an IT administrator in any Nigerian government organization?	Yes	No	
16	Do you have up to three years of experience working in Nigerian government organizations	Yes	No	
17	Do you know about cloud computing?	Yes	No	
18	Have you used cloud computing systems for your organization before?	Yes	No	
19	How many users does your organization support?	Less than 50 users	50 – 300 users	More than 300 user

Appendix E: Survey Instrument Authors' Permission Statement

PsycTESTS®

Information Systems Adoption Survey

Note: Test name created by PsycTESTS

PsycTESTS Citation:
Morosan, C., & DeFranco, A. (2016). Information Systems Adoption Survey [Database record]. Retrieved from PsycTESTS. doi: https://dx.doi.org/10.1037/t49008-000

Instrument Type:
Survey

Test Format:
The Information Systems Adoption Survey is comprised of 47 items, which are rated for agreement with 5-point, Likert-type scales.

Source:
Morosan, Cristian, & DeFranco, Agnes. (2016). It's about time: Revisiting UTAUT2 to examine consumers' intentions to use NFC mobile payments in hotels. International Journal of Hospitality Management, Vol 53, 17-29. doi: https://dx.doi.org/10.1016/j.ijhm.2015.11.003, © 2016 by Elsevier. Reproduced by Permission of Elsevier.

Permissions:
Test content may be reproduced and used for non-commercial research and educational purposes without seeking written permission. Distribution must be controlled, meaning only to the participants engaged in the research or enrolled in the educational activity. Any other type of reproduction or distribution of test content is not authorized without written permission from the author and publisher. Always include a credit line that contains the source citation and copyright owner when writing about or using any test.

Appendix F: Confidentiality Agreement

Name of Signer: Ayodele Bakare

During my activity in collecting data for this research: "The Challenges of Adopting Cloud Computing in Nigerian Government Organizations," I will have access to information, which is confidential and should not be disclosed. I acknowledge that the information must remain confidential and that improper disclosure of confidential information can be damaging to the participant.

By signing this Confidentiality Agreement, I acknowledge and agree that:

1. I will not disclose or discuss any confidential information with others, including friends or family.

2. I will not in any way divulge, copy, release, sell, loan, alter, or destroy any confidential information except as properly authorized.

3. I will not discuss confidential information where others can overhear the conversation. I understand that it is not acceptable to discuss confidential information, even if the participant's name is not used.

4. I will not make any unauthorized transmissions, inquiries, modification, or purging of confidential information.

5. I agree that my obligations under this agreement will continue after the termination of the research that I will perform.

6. I understand that a violation of this agreement will have legal implications.

Signing this document, I acknowledge that I have read the agreement, and I agree to

comply with all terms and conditions stated above.

Signature: <Insert Signature Here> Date: xx/xx/2020

Appendix G: Participants' E-mail Invitation

Dear Recipient,

My name is Ayodele Bakare and I am a doctoral student at Walden University, pursuing a Doctor of Information Technology degree (DIT). I am conducting a research study titled "The Challenges of Adopting Cloud Computing in Nigerian Government Organizations". I am writing you to request your participation in my study. Participation involves completing a brief online survey which will not take you more than 10 minutes.

The goal of my study is to examine the relationship between IT administrators' perception of data security, IT administrators' perception of fault tolerance, and IT administrators' intentions to use cloud computing. I would like to help IT administrators and IT leaders in the Nigerian government organizations understand the technical challenges involved in adopting cloud computing so that they can make informed decisions on the adoption of cloud computing.

If you are an IT administrator working in a Nigerian government organization with at least 3 years working experience, then your participation will be valuable to my research.

Please be rest assured that your participation will be treated with the utmost privacy and other research ethical standards. Data collection will be 100% anonymous, meaning that your participation will not be known to me, fellow participants, colleagues, and other third parties. The online survey application (Survey Monkey) will be configured to ensure that you are not tracked in any way. No participant's personally identifiable information will be part of the research records. Reports coming out of this study will not share the identities of individual participants. Details that might identify participants, such as the location of the study, also will not be shared. Data will be kept secure by storing survey response information electronically in password-protected documents located on an encrypted hard drive. Data will be kept for 5 years, as required by the university.

You will be presented with a consent form prior to completing the survey. The consent form will help you understand information regarding the research and your participation requirements. Sequel to reading the consent form, you may decide to continue with the survey or not.

Thanks for your consideration.

Sincerely,

Ayodele Bakare
DIT Student, Walden University