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Walden University

College of Management and Technology

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Felix Aguboshim

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.

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Walden University

2018

Abstract

User Interface Challenges of Banking ATM Systems in Nigeria

by

Felix C. Aguboshim

MSc, Nnamdi Azikiwe University, Nigeria, 2006

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Information Technology

Walden University

April 2018

Abstract

The use of banking automated teller machine (ATM) technological innovations have significant importance and benefits in Nigeria, but numerous investigations have shown that illiterate and semiliterate Nigerians do not perceive them as useful or easy-to-use. Developing easy-to-use banking ATM system interfaces is essential to accommodate over 40% illiterate and semiliterate Nigerians, who are potential users of banking ATM systems. The purpose of this study was to identify strategies software developers of banking ATM systems in Nigeria use to create easy-to-use banking ATM system interfaces for a variety of people with varying abilities and literacy levels. The technology acceptance model was adopted as the conceptual framework. The study's population consisted of qualified and experienced developers of banking ATM system interfaces chosen from 1 organization in Enugu, Nigeria. The data collection process included semistructured, in-depth face-to-face interviews with 9 banking ATM system interface developers and the analysis of 11 documents: 5 from participant case organizations and 6 from nonparticipant case organizations. Member checking was used to increase the validity of the findings from the participants. Through methodological triangulation, 4 major themes emerged from the study: importance of user-centered design strategies, importance of user feedback as essential interface design, value of pictorial images and voice prompts, and importance of well-defined interface development process. The findings in this study may be beneficial for the future development of strategies to create easy-to-use ATM system interfaces for a variety of people with varying abilities and literacy levels and for other information technology systems that are user interface technology dependent.

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Dedication

The fastest runner doesn't always win the race, and the strongest warrior doesn't always win the battle. The wise sometimes go hungry, and the skillful are not necessarily wealthy. And those who are educated don't always lead successful lives. It is all decided by chance, by being in the right place at the right time. It is not of the one willing, nor of the one running, but of God, the One showing mercy. In this race, I have received stupendous help from God. I would like to dedicate this research study to my God, the Almighty God, who by His mercies and divine election has brought me this far, at the appointed time and chance. Thank you, Jesus

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This doctoral study would not have been possible without some human support that I received. I would like to thank Dr. Gail Miles, my first chair, for all her encouragement in getting me through this process. Dr. Miles is impressively concerned about the success of her mentees and has this gift of taking the “risk” out of success. I would like to thank Dr. Jon McKeeby, who served as my 2nd committee member, for his excellent communication of skills, knowledge, and expertise though out this study. I would also like to thank lead DIT professor, Dr. Steven Case, for taking the time to review my work as my URR. Dr. Case was my very first instructor at Walden University, and I found him humble, approachable, and always available to listen and share experiences with me. I would also like to thank the Tertiary Education Trust Fund (TETFUND), Nigeria, who sponsored my study at Walden University. I would also like to thank professor Godwin Onu, the Rector, Federal Polytechnic Oko, Nigeria, for finding me worthy to be a beneficiary of this sponsorship. I would want to thank Aguboshim TrustGod, my last child (aged 10 years), who often joined me to read in the family study room, where she often provided me with activities, including distractions that worked together and inspired me in this study. To God be all the Glory.

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Section 1: Foundation of the Study

The topic of this study was user interface challenges of banking automatic teller machine (ATM) systems in Nigeria. In this section, I presented the following topics: background of the problem, problem statement, purpose statement, nature of the study, research question, interview questions, conceptual framework, definition of terms, assumptions, limitations and delimitations, significance of the study, implications for social change, and review of the professional and academic literature

Background of the Problem

ATM technological innovations have significant importance in Nigeria, especially in the banking sectors (Adjei, 2015; Sahi & Gupta, 2013; Titilope, 2015). Financial services in a Nigeria 2014 Survey report by Enhancing Financial Innovation and Access (EFInA) revealed that only 7.9% of Nigerians use ATMs, and 53% of adults who are bank customers use their ATM cards. Written language level used by software developers in their design is one of the important factors that affect easy-to-use ATM system interfaces (Jimoh & Babatunde, 2014). One significant setback of banking ATM system adoption in Nigeria is that ATMs lack a customized user-friendly interface. This makes the ATMs appear complex and difficult to use. Easy-to-use banking ATM system interfaces are a major dimension of ATM usability (Bedman, 2013; Jain & Naithani, 2014; Sagib & Zapan, 2014). The World ATM Benchmarking Study 2014 and Industry Report also indicated that a relationship exists between ATM interface and usability (as cited in Burelli, Gorelikov, & Labianca, 2014). Usability defines how easy it is for the user to use a product to perform prescribed tasks (Park & Song, 2015).

Since ATM systems are no longer the province of the specialized users, software developers of banking ATM systems must learn to create easy-to-use system interfaces for a variety of people with varying abilities and literacy levels (Kim, Smith-Jackson, & Kleiner, 2014; Oh & Moon, 2013; Omari & Zachary, 2013). Developers should be able to simulate users' needs to gather knowledge about their abilities, limitations, and the most suitable dataset, tools, and techniques in the use of the system (Castillejo, Almeida, & López-de-Ipiña, 2014; Keates, 2015).

Problem Statement

Written language level used by software developers in their design is one of the important factors that affect easy-to-use ATM system interfaces (Jimoh & Babatunde, 2014). United Nations Educational, Scientific, and Cultural Organization (UNESCO) 2015 Statistic Report placed the Nigeria literacy rate for adults aged 15 years and older at 59.67%. Easy-to-use ATM system interfaces for the Nigerian populace should be designed to meet the needs of the illiterate, semiliterate, or literate users (Ilyas, Ahmed, & Alshamari, 2013). The general IT problem is the lack of easy-to-use ATM system interfaces for people with varying abilities and literacy levels. The specific IT problem is that some software developers of banking ATM systems in Nigeria lack strategies to create easy-to-use ATM system interfaces for a variety of people with varying abilities and literacy levels.

Purpose Statement

The purpose of this qualitative case study was to identify strategies software developers of banking ATM systems in Nigeria use to create easy-to-use ATM system

interfaces for a variety of people with varying abilities and literacy levels. The target population for this study was software developers of banking ATM systems who have strategies to create easy-to-use ATM system interfaces for a variety of people with varying abilities and literacy levels. The geographical location was the Enugu State of Nigeria. One ATM system interface developer organization in Enugu served as the case study. The completed study may encourage social change if software developers of banking ATM systems use successful strategies to create easy-to-use ATM system interfaces, which may increase the use of ATM banking in Nigeria. Increased ATM usage may improve user morale and productivity. Software developers may create new innovations and influences that may advance the use of technology in a developing country.

Nature of the Study

The qualitative approach was adopted for this study. My purpose was to identify strategies software developers of banking ATM systems in Nigeria use to create easy-to-use ATM system interfaces for a variety of people with varying abilities and literacy levels. The specific IT problem can be addressed using a quantitative, qualitative, or mixed methods approach. A quantitative study generally involves sampling designs that randomly select large representative samples for researchers to generalize their findings by applying probability sampling theory (Visser, van Biljon, & Herselman, 2017). Sampling theory provides the basis for generalization of relationships among variables and decision making in the face of uncertainty (Anene, 2014; Yilmaz, 2013). Quantitative data posed serious disadvantages for this research in that very important human elements

would be ignored in the study that are tied to gaining in-depth knowledge of strategies and methodologies to create easy-to-use banking ATM interfaces. Therefore, the quantitative approach was not a good option for this study. Qualitative studies, on the other hand, seek to explore participants in their own territory, interact with them in their own language and terms, and attempt to understand the existing complexity, while analyzing and interpreting data from various sources (Basri, 2014; Gelling, 2015). A mixed method approach encompasses the strengths and weaknesses of both qualitative and quantitative designs for complementarity, completeness, developmental, expansion, corroboration, compensation, and diversity (Caruth, 2013; Heyvaert, Maes, & Onghena, 2013). Using a mixed method design requires a working professional knowledge of both quantitative and qualitative methods and designs (Holt & Goulding, 2014; McCusker & Gunaydin, 2015). These processes were likely to demand tangibly more time than allocated for this study, and there was no need for quantitative data to be collected. Therefore, in this study, using a qualitative method appeared to be more appropriate than using a quantitative or mixed method.

Researchers have used a variety of appropriate designs in qualitative research, such as ethnography, narratives, phenomenology, and case studies, to gather, analyze, and report on information that enhances the quality of such research of interest. An ethnographic research approach focuses on the culture of the participants within the community or organization (Feltrin & Velho, 2014). I did not choose this design because my focus was not to study the culture of software developers of banking ATM systems in Nigeria. Narratives are typically focused or related to biographies and historical

information (Green, 2013). This design was not selected because the focus of this study was not on biographies and historical information of software developers of banking ATM systems in Nigeria. A phenomenology study focuses only on the human experience as impacted by the phenomena (Kruth, 2015). I did not choose a phenomenological study because I was not concerned with the study of experience from the perspective of the individual or designed the study to describe an experience as it is actually lived by the person.

In this study, I explored multiple sources of information on strategies software developers of banking ATM systems in Nigeria use to create easy-to-use ATM system interfaces for a variety of people with varying abilities and literacy levels. Case study research offers a level of flexibility required to handle the study research question that is not readily available with grounded theory or phenomenology (Hyett, Kenny, & Dickson-Swift, 2014). It also offers the researcher the opportunity to explore in-depth data collection from multiple sources of information. The analysis methods that are adopted in a case study further develop and explore the case, guided by context and emergent data to generate the expected reports, codes, and themes (Ponelis, 2015). Through analyses of interview data, I identified themes for the expected strategies to create easy-to-use interfaces. A qualitative case study, therefore, was selected for this study.

Research Question

What are strategies used by software developers of banking ATM systems in Nigeria to create easy-to-use ATM system interfaces?

Interview Questions

The following are interview questions to address my research question.

1. What strategies have you used to create an easy-to-use banking ATM system interface for a variety of people with varying abilities and literacy levels?
2. How does culture of users impact your strategies to create easy-to-use ATM system interfaces?
3. How does literacy level of users impact your strategies to create easy-to-use ATM system interfaces?
4. How do you effectively harness cultural and literacy differences to create easy-to-use banking ATM system interfaces for a variety of people with varying abilities and literacy levels?
5. What aspects of your design strategies contributed to an easy-to-use interface for a variety of people with varying abilities and literacy levels?
6. What aspects of your design strategies ensured that banking ATM system interfaces you created will be acceptable by a variety of people with varying abilities and literacy levels?
7. What design process do you employ to ensure easy-to-use banking ATM system interfaces?
8. How do you bring together all developers' design strategies in the organization to ensure one coherent, easy-to-use, and acceptable banking ATM system interface?

9. How do you receive feedback as to whether or not your design is easy-to-use and acceptable by people with varying abilities and literacy levels?
10. Summarize or identify strategies you use to design easy-to-use banking ATM system interfaces that will cater for the illiterate, semiliterate, or literate users.

Conceptual Framework

The conceptual framework adopted for this study was the information system theory called the technology acceptance model (TAM). The TAM was developed by Davis in 1989, based upon the psychology-based theory of reasoned action (TRA) and theory of planned behavior (TPB). The TAM demonstrates how users come to accept and use technology by presuming two variables called perceived ease of use (PEOU) and perceived usefulness (PU) as primary determinants in a complex but mediating relationship between system characteristics (external variables) and potential system usage. PU reflects the expected benefits from using the new technology, while PEOU reflects the perceived behavioral attitude in the theory of planned behavior (Davis, 1989). The TAM has taken the leading role in explaining users' behavior toward technology acceptance (Marangunic & Granic, 2015; Shih & Chen, 2013). The TAM is well established, robust, powerful, and parsimonious for predicting acceptance in the information system domain (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989; Venkatesh & Davis, 2000).

Researchers have made various claims on how PU and PEOU are often determined by a perceived attitude towards technology (Gangwar, Date, & Raoot, 2014; Gao & Bai, 2014); cognitive ability (Chen, Liu, Li, & Yen, 2013); social, cultural, and

political influences (Kaushik & Rahman, 2015; Patsiotis, Hughes, & Webber, 2013); self-efficacy (Teoh, Siong, Lin, & Jiat, 2013); facilitating conditions (Chen & Chan, 2013; Tsai, 2015); usability measurement attributes used (Hsiao & Tang, 2015; Lin, 2013); and effectiveness, efficiency, learnability, and memorability (Chen & Chan, 2013; Lin, 2013). The TAM forecasts users' acceptance and voluntary use of technology (Rauniar, Rawski, Yang, & Johnson, 2014).

A conceptual framework that integrates TAM, TPB and technology-organization-environment (TOE), and the external variables that often influence PU and PEOU enumerated above, were insightful to the understanding of easy-to-use banking ATM system interface design. This is because, according to Joo, Lee, and Ham (2014), user interface and perceived ease-of-use significantly influence PU, and perceived ease-of-use has a significant effect on satisfaction among users. Designing an easy-to-use system interface is equivalent to designing a new technology. It is therefore necessary to incorporate the interface within the design factors that will make the new technology acceptable to users. An understanding of TAM and how PU and PEOU are often determined by how the perceived attitude towards technology acceptance will impact the understanding of the strategies developers in Nigeria use to create easy-to-use Banking ATM user interface that will cater to a variety of people with varying abilities and literacy levels.

Definition of Terms

I identified strategies software developers of banking ATM systems in Nigeria use to create easy-to-use ATM system interfaces for a variety of people with varying

abilities and literacy levels. The following descriptions define some terms that may be unfamiliar to the reader.

Facilitating conditions: The factors that can be stated as perceived enablers or barriers in the environment that influence a person's perception of ease or difficulty of performing a task (Fathema, Shannon, & Ross, 2015).

Interaction: A superficial communication or collaboration between human and systems or internal elements inspiring one another (Kajiyama & Satoh, 2014).

Perceived ease of use (PEOU): "The degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, p. 320). It is the primary precursor that determines the behavioral aim to use a computer system (Venkatesh & Davis, 2000).

Perceived self-efficacy: "An individual's judgment of his or her capability to organize and execute the courses of action required to attain designated types of performances" (Fathema et al., 2015, p. 214).

Perceived usefulness (PU): "The degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989, p. 320).

Social influence: The level to which a person perceives that essential others believe he/she should use the technology. (Venkatesh & Davis, 2000).

Usability: "The effectiveness, the efficiency and the satisfaction with which specified users achieve certain goals in determined contexts" (Conti, Collotta, Pau, & Vitabile, 2014, p. 38).

Assumptions, Limitations, and Delimitations

In this study, there are situations and circumstances that may affect or restrict the methods and analysis of research data. Such restrictions may result from the availability of resources, study boundaries, or my reasoning processes. These possible situations that might restrict the methods and analysis of research data are defined under assumptions, limitations, and delimitations.

Assumptions

Assumptions are conditions related to the study that are taken for granted, accepted as true, or are assumed to be true or at least plausible, without proof or verification (Denscombe, 2013). The following assumptions were noted in this study. The first assumption was that the participants would adequately represent the case selected for inclusion in the study. Another assumption was that the participants would answer the interview questions in an honest and unbiased manner. The next assumption was that participants would participate in the research with a sincere interest without ulterior motives.

Limitations

Limitations are potential weaknesses or restrictions in the study that are mostly out of the control of the researcher that cannot be reasonably dismissed and can affect the study design and results (Denscombe, 2013). This study was limited by some relatively small banking ATM system interface developers in Enugu State, Nigeria. It was also limited to the perceptions and experiences of participants regarding their responses

during the interviews, which cannot be generalized to all banking ATM system interface developers in Nigeria.

Delimitations

Delimitations are the definitions set by the researcher that define the boundaries of the study so that the goals of the study do not become impossibly large to complete (Denscombe, 2013). The study was confined to Enugu State, Nigeria, to reduce economic and financial stress. The population of participants interviewed was software developers of banking ATM system interface, chosen among qualified and experienced interface developers from a one organization in the state.

Significance of the Study

With banking ATMs, customers can make bank transactions from almost any other ATM system in the world. However, despite the importance attached to ATM systems in Nigeria, their usefulness, usage, and value have not been effectively realized. This is because the banking ATM interface in Nigeria is difficult to use as it does not provide a good understanding and the most suitable tools and techniques that can cater to a broad range of users with varying abilities and literacy levels. User interface design plays an important role in human-computer interaction tasks in ATM technologies (Balatsoukas, Williams, Davies, Ainsworth, & Buchan, 2015; Robertson, McDonald, Leckie, & McQuilken, 2016). This is because people's perception of technology is often about the interface, rather than that which is interfaced (Narteh, 2015; Omotayo & Adebayo, 2015; Zhang, Wang, Deng, & Yin, 2013). An easy-to-use banking ATM

system interface has been found to be a significant dimension of ATM technology usability (Nasir, Wu, Yago, & Li, 2015; Tella & Abdulmumin, 2015).

Contribution to IT Practice

Findings from this study may cause a tremendous technological impact because more users will embrace ATM technology in Nigeria as the interfaces become easy-to-use and cater to a broad range of users with varying abilities and literacy levels, especially among illiterate or semiliterate Nigerians. As a result, more users will be interconnected with banking ATM technology. This may also bring about better communication of technological ideas among developers that will establish best practices and will allow them to create easy-to-use and successful banking ATM system interfaces that may make ATM technology in Nigeria more relevant to the users. A growing number of ATM user interface technologies will also emerge that will provide multiple means of interaction with the banking system. This may lead to a new innovational trend in banking ATM interface technology that may emerge into potential advancement in civilization. Successful results of strategies to create easy-to-use ATM system interfaces may also impact new IT practitioners on strategies to create successful and easy-to-use interfaces that may impact other ITs who are user interface technology dependent, such as electronic voters machines, automobile maintenance devices, and point of sales.

Implications for Social Change

The findings from this study may encourage social change as more software developers of banking ATM systems in Nigeria learn to create easy-to-use interfaces that may improve user morale, preference, attraction, and productivity, and increase the use of

ATM banking in Nigeria. Furthermore, users will perform their tasks with minimal delays, thereby reducing the long queue at banking ATM points. In Nigeria, easy-to-use banking ATM system interface will greatly enrich knowledge in electronic banking and ATM usage. In addition, using successfully implemented easy-to-use ATM interfaces will provide banks and organizations that use bank products with insights on how to improve customer satisfaction (Narteh, 2015). With easy-to-use ATM system interfaces for a variety of people with varying abilities and literacy levels, many more clients will have to use ATM by themselves without mediation. A successful result of this study may bring social change because it may advance the use of other technology outlets that require easy-to-use system interfaces. When incorporated in Nigerian politics, there may be great social change as interfaces would then accommodate all eligible voters, thereby encouraging direct participation of all without mediation. As all eligible voters participate without mediation, trust is encouraged, and more Nigerians will be interested in political affairs to bring about true democracy (Salatin & Fallah, 2014).

Nigerians are likely to be among the top population that stores money in their houses, rather than aligning to the ongoing cashless move (EFInA, 2014). It is estimated that about 65% of the cash in circulation in the Nigerian economy is outside of the banking system (Emengini & Alio, 2014; Ezeamama, Ndubuisi, Marire, & Mgbodile, 2014; Itah & Ene, 2014). One of the major reasons for this might be ignorance and illiteracy. If most people in the country understand and can use the ATM by themselves because it is easy-to-use, they will trust the banks and the ATM, thereby leveraging economic development and social change. Moreover, as technology is becoming

increasingly ubiquitous, with interconnected and interdependent facilities (Murray, Durkin, Worthington, & Clark, 2014), the banking ATM industry in Nigeria should encourage easy-to-use ATM system interfaces for a variety of people with varying abilities and literacy levels, as elements of IT solutions to poor ATM user interfaces cause the penetration of these technologies into different domains apart from the banking sector (Choy et al., 2014).

In summary, social changes are associated with transformations in various spheres of human life. Successful implementation of a transformation in one area has the potential to inform other related areas. Successful results from this study will equip interface developers with strategies to make a tremendous impact on other related services, economic restructuring, societal value systems, spread of media technology, and other areas of national interest that are user interface technology dependent. Avenues for disseminating this research study to these participants and community stakeholders were through verbal presentations via seminars and conferences. Provisions are made for participants and community stakeholders to collect a 1 to 2-page summary of these research results.

Review of the Professional and Academic Literature

In this section, I provide a review of professional and academic literature relevant to user interface challenges of banking ATM systems in Nigeria. My purpose was to review and critically analyze existing research by accredited scholars and researchers to identify what knowledge and ideas impact the various facets of this study. In this literature review, I critically detail the strengths of the conceptual framework to give

professional direction to this study. In the end, this literature review provides readers with all the essential details they need to know to understand the rest of this study. In the end, I examine and unveil the need for software developers of banking ATM systems in Nigeria to acquire strategies to create easy-to-use ATM system interfaces for a variety of people with varying abilities and literacy levels.

Customers are driven to adopt a technological innovation based on how easy it is to use and their perception of the usefulness of that technology (Safeena, Date, Hundewale, & Kammani, 2013). If a system user judges him or herself as more productive because of a technology that is perceived as easy to use, then the user will also perceive that technology as useful (Armenteros, Liawb, Fernández, Díaz, & Sánchez, 2013; Sahi & Gupta, 2013). In other words, ease of use or usability is an important criterion to assess the quality of banking ATM systems (Hoehle, Zhang, & Venkatesh, 2015). It is against this premise that Davis's (1989) TAM conceptual framework was regarded the most suitable for this study aimed at developing easy-to-use banking ATM interfaces that will meet the needs of a variety of people with varying abilities and literacy levels (Ilyas et al., 2013).

Designing an easy-to-use system interface is similar to the goals for introducing a new technology, with PU and PEOU as important in creating an easy-to-use system interface adoptability that may close the gaps created by user interface challenges (Wallace & Sheetz, 2014). The TAM conceptual framework therefore provided the foundation for this qualitative case study and how it was approached. This review is organized in sections comprising of the TAM conceptual framework, contrasting

researchers of the TAM, existing interface design models and frameworks, challenges with the banking ATM system interface design, the existing relationship among usability variables and ATM system service quality, existing strategies for enhancing banking ATM interface security, an historical overview of the ATM in Nigeria, the existing banking ATM interface system in Nigeria, existing tools and strategies for developing easy-to-use system interfaces, and how ATMs in the world differ from those in Nigeria.

This review was based on a literature search of online information obtained from the following international library databases: the ProQuest databases, ScienceDirect, UNESCO database, government and nongovernmental organization reports, Walden University collection of scholarly and peer-reviewed journals, and other related texts. A combination of phrases and terms were used as key search words in the databases for related literature on user interface challenges of banking ATM systems in Nigeria. Such phrases and terms included *application and use of TAM in user interface adoption*, *TAM conceptual framework*, *TAM framework for user interface design*, *historical overview of ATM in Nigeria*, *major determinants of TAM's PU and PEOU*, *strategies for developing user interface for banking ATM*, *usability theory*, and many others.

I conducted a thorough review of the literature and incorporated 189 references into my discussion of the literature. One-hundred eighty-six (98%) of total references incorporated in the literature are peer-reviewed, while 180 (95%) are peer-reviewed journals that are 5 years less than the anticipated year of graduation. A summary of these sources is given in Table 1.

Table 1

Summary of Research Articles Consulted in Lit Review

Sources from review of the professional and academic literature	Number
Total references in lit. review:	189
Total peer-reviewed references in lit. review:	186
Total peer-reviewed in lit. w/in 5 years:	180
% Peer-reviewed references in lit. review:	98%
% Peer-reviewed references in lit. review % w/in 5 years:	95%

TAM Conceptual Framework

Technology users often judge the system acceptability based on how easy they can use the system rather than the system's functionality. Several theoretical or conceptual models have been proposed or adopted that have previously shown promise in examining and understanding how individuals accept technology. One of such conceptual frameworks adopted for this study was the information system theory called the TAM. The TAM is an information system theory developed by Davis in 1989, which models how users accept and use technology (as cited in Safeena et al., 2013). Davis (1989) adapted the TRA and the TPB and proposed the TAM. Davis, as cited in Awa, Ojiabo, and Emecheta (2015), considered that behavior measures the actual use of a system, and therefore, the TRA and the TPB are considered suitable models that can explain and predict that behavior. However, two main changes were made by Davis in the TRA and TPB models to make appropriate inferences. First, the subjective norm was not

considered in predicting an actual behavior; only the attitude of a person toward the system was considered (as cited in Marangunic & Granic, 2015). Second, Davis considered PU and PEOU as sufficient variables to predict the attitude of a user toward the use of a system (Marangunic & Granic, 2015). The TAM has evolved to become a key model in understanding predictors of human behavior toward the potential acceptance or rejection of technology and analyzing the factors influencing technology acceptance that identified two main drivers: PU and PEOU (Marangunic & Granic, 2015; Peiris, Kulkarni, & Mawatha, 2015). Davis developed scales for these factors and tested his model. Davis's model subsequently supported that PU and PEOU have a positive impact on users' acceptance of technology (Bresciani & Eppler, 2015; Sang-Gun, Trimi, & Kim, 2013). Davis's perceived usefulness scale was measured using the following criteria:

- Working more quickly,
- Improving job performance,
- Increasing productivity,
- Enhancing effectiveness,
- Making it easier to do the job, and
- Usefulness.

The perceived ease of use scale was composed of

- Being easy to learn,
- Being controllable,
- Having an interaction that is clear and understandable,

- Being flexible to interact with,
- Being easy to become skillful, and
- Being easy to use (Davis, 1989).

The main idea of the model was to predict the users' intention to accept the new technology based on the results of the relationship between the external and internal factors or attitude (Safeena et al., 2013). According to Jin (2014), when users are presented with a new technology, PU and PEOU influence their decision about how and when they will use the new system. Those researching TAM seek to explain the relationship existing between technology acceptance in line with users' behavioral intention to use the technology (Bhatiasevi & Yoopetch, 2015; Jongchul & Sung-Joon, 2014). The TAM involves two primary predictors for the potential adopter's PU and PEOU of technology as the main determinants of the attitudes toward a new technology (Gangwar, Date, & Ramaswamy, 2015; Jongchul & Sung-Joon, 2014; Tsai, 2015). According to Davis (1989), while PU defines the extent to which a person believes that using a particular system will enhance his or her productivity, PEOU measures the extent to which a person believes that using a particular system will be free of effort.

TAMs fundamental constructs do not fully reflect the specific influences of PU and PEOU because factors that affect the adoption of a new technology vary with users, context and the technology, (Safeena, et al., 2013). Davis suggested that PU is impacted by PEOU, and high PEOU leads to high PU, implying that perceived ease of use may directly influence perceived usefulness, but not vice-versa (Chang-Hyun, 2014; Jin, 2014; Yang, Lee, Park, & Lee, 2014). If user is more productive because of a technology that

he perceived as easy to use, then he will also perceive the technology as useful (Armenteros et al., 2013). This implies that easy-to-use or usability is an important factor to assess the quality of information systems (Hoehle et al., 2015). Safeena et al. (2013) found that consumers are driven to adopt an innovation based on how easy it is to use a technology and determining thereafter, the usefulness of that technology. PU and PEOU influence significantly customers' attitude and intentions to use banking ATMs, and PEOU significant determinant PU (Chen et al., 2013; Davis, 1989; Jin, 2014). The implication here is that consumers are likely to be more satisfied with banking ATM services if they believe that using the system will make them to be more productive (Sahi & Gupta, 2013). TAM conceptual framework is therefore most suitable for this study that is aimed at developing easy-to-use banking ATM interfaces that will meet the needs of variety of people with varying abilities and literacy levels.

The results of a TAM study published in MIS Quarterly, generated a large coverage in diverse fields, and, at present, has nearly 15,000 citations. (Bresciani & Eppler, 2015). TAM has taken the leading role in explaining users' behavior toward technology acceptance (Shih & Chen, 2013). Many research results suggested that TAM is a stable, analytical tool that is universally adopted over region, time, race, and technology (Chen et al., 2013). It is believed that these two constructs of TAM: PU and PEOU, explain about 40 percent of the systems' use (Barrette, 2015). Researchers found TAM model to be well established, robust, powerful and parsimonious for predicting acceptance in the information system domain (Davis, 1989; Davis, et al., 1989; Lin, 2013; Shih & Fan, 2013; Venkatesh & Davis, 2000). Parsimony is considered TAM's

main strength because it helps researchers to broaden the model by introducing additional predictors of intentions and variables to qualify the effects of perceived usefulness and perceived ease of use on those intentions variables or external variables (Sheng & Zolfagharian, 2014).

TAM tends to be a preferred user-acceptance model than constructs resulting from other theories because TAM is parsimonious, which makes it easier to operationalize and test in that, with TAM, many other variables can be measured in a relationship to determine their impact on PU and PEOU (Park, Rhoads, Hou, & Lee, 2014; Wu & Liu, 2015). Thus, TAM has been applied to many different uses. TAM has been used to explain the adoption of mobile digital libraries with results inferring that good system interfaces should be intuitive, interactive, tailor-made and easy-to-use (Chin-Feng, Po-Sheng, Yueh-Min, Chen, & Tien-Chi, 2014). Gao and Bai (2014) applied TAM more broadly to explain customer acceptance of internet of things. Caboral-Stevens, Whetsell, Evangelista, Cypress, & Nickitas (2015) applied TAM in the health arena in a study that presented a framework to determine potential usability of health websites by older adults. The study identified four determinants of usability in the conceptual model that included: efficiency, learnability, perceived user experience, and perceived control. Caboral-Stevens et al. (2015) supported other researchers that usability is key to accepting technology.

Dastan and Gürler (2016) deployed the TAM to explain the factors affecting acceptance of Mobile Payment Systems (MPS) and found that perceived ease of use and perceived usefulness influence users' behavior and attitude toward acceptance or

intention to use information systems. Their study findings point out that perceived trust, mobility and attitudes positively affect the acceptance of Mobile Payment Systems (MPS). The result of Dastan and Gürler's study highlighted perceived reputation as positively related to perceived trust, perceived mobility and attitude factors have positive effect on acceptance of MPS. Environmental risk was negatively related to perceived trust (Dastan & Gürler, 2016). Contrary, results from studies from Kanjwani and Singh (2014), Bresciani and Eppler (2015), Kazi and Mannan (2013), and Money et al. (2015), to mention but a few, Dastan and Gürler's study did not show any significant evidence for Perceived Usefulness and Perceived Ease of Use factors on the acceptance of MPS. For instance, Kanjwani and Singh (2014) explored TAM with two variables that are determinants of usability (perceived ease of use and perceived usefulness) and obtained results that confirmed that PEOU and PU positively influence usability. Results from Kazi and Mannan (2013) also showed that the variables social influence, perceived ease of use, and perceived usefulness had strong positive correlation with the intention to adopt mobile banking services. Bresciani and Eppler's (2015) study showed the three dimensions of PEOU, PU and perceived authority as complementary towards the adoption process of visualizations roles which must coexist to impact widespread adoption of a specific IS format. Results from the study by Money et al. (2015) showed that the three key TAM themes used in the analysis (PU, PEOU and actual use of the technology) were among several sub-themes that emerged. A study by Wallace and Sheetz (2014) generated results that claimed that undertaking new initiatives are like the reasons for introducing a new technology, with perceived usefulness and perceived ease

of use still relevant in solving the problem of software acceptability. Results showed that perceived prescriptiveness, perceived language independence, perceived life cycle applicability, and perceived validity were all significant determinants of perceived usefulness and perceived ease of use that are major determinants of actual use (Wallace & Sheetz, 2014).

TAM has proven to be a reliable, valid and robust framework that routinely predicts approximately 40% of variance in technology acceptance, with a basic assumption that technology use is a reasoned action that builds on the premise that users' conscious and deliberate processing of potential benefits expected from the technology use, affect users' behaviors (Park et al., 2014; Venkatesh & Davis, 2000). TAM, though a parsimonious model, has comparable explanatory power to provide more sophisticated intention-based models that are based on the TRA and TPB (Davis et al., 1989; Taylor & Todd, 1995; Zhao, Chen, & Wang, 2016). Additionally, Davis et al. (1989) proposed that the effects of external variables on users' intention to use the technology are mediated by these perceptions.

Researches by various authors under various contexts have confirmed that the two-primary determinant of technological acceptance: PEOU and PU are often determined by some external variables (Chen et al., 2013; Gao & Bai, 2014; Saleh, Ghoneim, Dennis, & Jamjoom, 2013). Jin (2014) adopted TAM as the theoretical basis of the study with a model that differentiated external factors such as compatibility, relative advantage, self-efficacy, and subjective norms from internal factors of PEOU and PU (Kulviwat, Bruner, & Neelankavil, 2014). Results from Jin's (2014) study showed that

compatibility, relative advantage, self-efficacy, and subjective norms positively affect PEOU and PU, but relative advantage did not positively influence PEOU (Jin, 2014). Result also indicated that compatibility play a more important role in PEOU than in PU, but relative advantage and subjective norms play a more important role in PU than in PEOU (Jin, 2014). Also, PEOU positively affects PU, implying that compatibility, usefulness, and relative advantage of technology closely relate to technology acceptance (Jin, 2014).

Technology that is considered easy to use and useful can satisfy consumer demand (Jin, 2014). Two external factors proposed as variables that are determinants of TAM's PEOU and PU (perceived risk and social influence) have been found to have a strong positive correlation with the intention to adopt mobile banking services among low-income sector, while the variable perceived risk was found to have significant negative impact on the customers' intention to adopt mobile banking services (Kazi & Mannan, 2013; Yang, Yu, & Munkee-Choi, 2016). Perceived risk was considered the most important in explaining users' intentions, while facilitating conditions was not deemed important to explain usage (Martinsa, Oliveiraa, & Popovi'ca, 2014). Yang et al. (2014) considered two types of perceived risks (system dependent, and transactional related risk) in their study that led to the finding that system dependent risk was likely ignored by consumers pursuing convenience and usefulness of banking online payment, which points to the fact that e-banking or third-party payment platform designs should focus more on reducing transactional risk (Yang et al., 2014). This result may address the existing gap by including perceived risk to explain users' behavior intention and usage

behavior of product (Martinsa et al., 2014). According to Kazi and Mannan, (2013) and Tawanda-Blessing-Chiyangwa (2016), social influences appear the most significant factor in the intention to adopt mobile banking.

Informing service providers, including ATM system interface developers, of the need to develop special awareness programs for potential adopters of their technology is critical (Kaushik & Rahman, 2015; Kazi & Mannan, 2013; Patsiotis, et al., 2013).

Perceived trust, mobility and attitudes positively affect the acceptance of information system, while perceived reputation and environmental risk were found to be positively related to perceived trust, and negatively related to perceived trust respectively (Dastan & Gürler, 2016). Perceived trust, perceived mobility and attitude factors have a positive effect on acceptance of technology (Dastan & Gürler, 2016). Dastan and Gürler (2016) claimed from their study that there is no significant effect between the perceived ease of use and acceptance of Mobile Payment System (MPS). Moreover, Dastan and Gürler did not detect any significant evidence for PU and PEOU factors on the acceptance of MPS. This result is contrary to results from many researchers claiming that perceived usefulness (PU) and perceived ease of use (PEOU) of technology were the main determinants of acceptance of new technology (Gangwar et al., 2015; Peiris et al., 2015; Sang-Gun et al., 2013).

Environmental risk negatively influences adoption of technology (Alalwan, Dwivedi, Rana, Lal, & Williams, 2015), while perceived trust was observed to be a very strong factor predicting the technology adoption intention, because customers pay considerable attention to the aspects related to trust to support their decision to use such

sensitive services (Alalwan et al., 2015). However, Teoh, et al. (2013) proposed four external variables: Benefits, Trust, Self-efficacy, and Security, and found trust and security not to be significantly associated with consumers' perception toward banking facilities, and trust being marginally or not related to the intention to use. This was explained by the fact that users trust the security system provided by banking institutions (Teoh, et al., 2013). Perceived benefit and perceived self-efficacy were found significant to be driver of technology usage (Teoh, et al., 2013). According to Alalwan et al. (2015) and Kelly (2014), self-efficacy appears to be the most powerful factor influencing users' behavioral intension and trust because users who believe in their ability to effectively use technological services, are more likely to trust using such technology, as well as being more motivated to adopt it in the future. Alalwan et al. (2015) also found habit and motivation as significant determinants of technology usage along with behavioral intention.

Technological characteristics usually include its user interface (Mouakket & Bettayeb, 2015). Good user interface management and usability have been established to be the key determinants of, perceived ease of use, while content value, blog management, and usability on the other hand were found to be the key determinants of perceived usefulness, with entertainment value and content value interacting positively to affect perceived enjoyment (Koenig & Schlaegel, 2014; Melzner, Heinze, & Fritscha, 2014; Wirtz & Göttel, 2016). Usability or easy-to-use interfaces are good strategies for interface developers to adapt corporate interfaces or to target group characteristics for better communication goals (Hsiao & Tang, 2015; Ingham, Cadieux, & Berrada, 2015; Koenig

& Schlaegel, 2014; Lin, 2013). This strategy's effect on usability has been measured by its significant positive association with actual use (Koenig & Schlaegel, 2014; Money, et al., 2015). Asimakopoulos and Asimakopoulos (2014) found that perceived usability and switching costs negatively affect intention to switch to another system, implying a significant insight on the impact of perceived usability and switching costs.

Several researchers found that perceived enjoyment and entertainment value were positively related to PU (Bedman, 2013; Giri, Choudhary, & Verma, 2014; Koenig & Schlaegel, 2014; Rauniar et al., 2014). Specifically, developers of banking ATM system interfaces need to consider users' perceived enjoyment during design because, although perceived usefulness and perceived enjoyment both have significant impact on the adoption intension, perceived enjoyment was found more significant than perceived usefulness among users of hedonic system such as banking ATM system (Jongchul & Sung-Joon, 2014). Joo, et al. (2014) considered how user interface, personal innovativeness, and satisfaction impact PEOU and PU and found that the user interface significantly influences PEOU which in turn, impact learners to easily use the technology. Results from an empirical study by Joo, et al. (2014) also showed that user interface and PEOU had significant effects on PU in technology learning, while personal innovativeness did not affect PU. The study by Caboral-Stevens et al. (2015) identified efficiency, learnability, perceived user experience, and perceived control as four determinants of usability in the TAM conceptual model and concluded from the study that usability is the major key to accepting technology. Similar determinants of usability in the TAM conceptual model that included efficiency and learnability were also

identified by Lin (2013). Chen and Chan (2013) discussed additional two factors of effectiveness, and memorability.

Kanjwani and Singh (2014) explored some external variables of TAM and found that perceived enjoyment, excitement and satisfaction are determinants of usability. According to Kanjwani and Singh (2014), usability of new technology was not affected by customer satisfaction, but by perceived enjoyment and excitement. Similarly, perceived authority was found to mediate significantly in users PEOU and PU, and at the same time coexist to impact widespread adoption of technology (Bresciani & Eppler, 2015). Park and Kim (2014) applied the concept of TAM in the study to investigate users' acceptance of mobile guide services, mobile tourism services, and mobile map services that provided much information for researchers studying car navigation interface systems, ATM interfaces, and designers or developers of similar interface systems. Their study revealed new variables where Perceived Location Accuracy (PLA) and Perceived Processing Speed (PPS) were significant determinants of Perceived Usefulness (PU) and Service Display Quality (SDQ), which in turn, significantly affected users' attitude and intention to adopt new system interfaces (Park & Kim, 2014).

Wallace and Sheetz (2014) suggested that TAM can be used to explain and predict the use of software measures and to operationalize the PU construct according to the desirable properties of software measures. Perceived prescriptiveness, perceived language independence, perceived life cycle applicability, and perceived validity were all found to be significant determinants of PU, PEOU, and actual use (Wallace & Sheetz, 2014). These research studies revealed new variables that reinforced ideas and skills used

to build a modified version of TAM by adding those identified external variables and tenants into the TAM model. Examining and understanding these TAM variables and correctly applying them during interface design, may reveal relevant variables that affect how individuals accept technology. This may impact the design of easy-to-use Banking ATM system interfaces.

Contrasting Researchers of TAM

Not all researchers agreed with TAM's ability to predict behavior. There are contrasting or opposing researches on TAM. Some technology acceptance researchers believe that the acceptance of technology has scarcely been reached (Ifenthaler & Schweinbenz, 2013; Rondan-Cataluña, Arenas-Gaitán, & Ramírez-Correa, 2015; Schwarz, Chin, Hirschheim, & Schwarz, 2014). Others propose that it has been more effective in some cases than others (Tabak & Nguyen, 2013). Ifenthaler and Schweinbenz (2013) are concerned that much of research published to date with regard to the TRA, the TAM, and the Unified Theory of Acceptance, TAM2, TAM3, UTAUT, and UTAUT2 are based on structural equation models that assumed linear relationships between variables. Schwarz et al. (2014) argued that perceptions and attitudes in TAM models emerge and change over time, adding that the nature of the interaction and the process through which these perceptions develop lack a theoretical foundation. Even though prior work on TAM has been longitudinal in nature (Venkatesh & Davis, 2000), not much of TAM development over time has been extended to individual socio-economic characteristics or personality variables as determinants of technology acceptance and adoption (Tabak & Nguyen, 2013). This development seems to have encouraged many researchers to publish

ad hoc models by just mixing concepts of various theories or using only those concepts or variables that are most favorable to their objectives without considering other alternative contributions (Ifenthaler & Schweinbenz, 2013; Rondan-Cataluña et al., 2015; Schwarz, et al., 2014).

Several researchers believe that one major drawback of TAM models is that relations between the variables and constructs in the models are usually assumed as linear and relationship between these variables measured with correlation coefficients (Cariou, Verdun, & Qannari, 2014; Hair, Sarstedt, Hopkins, & Kuppelwieser, 2014; Ifenthaler & Schweinbenz, 2013). Correlation basically measures the degree of linear association (Bakdash & Marusich, 2017; Jiao, Deng, & Liang, 2017). A correlation value of zero, for instance, simply implies that there are no linear association, and does not necessarily imply no relationship (Alm & Mack, 2017; Jiao, et al., 2017). Therefore, basing most models of TAM on linear assumption and consequently judging relationship from correlation values could be misleading, since some strong curve linear relations may exist among TAM predictor variables resulting in a correlation value of zero or close to zero, and consequently being misinterpreted as no association or very poor association respectively (Alm & Mack, 2017; Jiao, et al., 2017). Likewise, there are no absolute correct measurements to construct perceived usefulness (PU) and perceived ease of use (PEOU) at different times and different conditions that the technology is used (Schmiedel, Brocke, & Recker, 2014).

The contrasting views of these researchers on TAM notwithstanding, TAM model is theoretically justified based on measuring instruments that are quite strong, consistent,

valid, and reliable. TAM can easily be operationalized and measured in a relationship with many other variables to determine their impact on PU and PEOU. This property of TAM makes TAM to be the preferred user-acceptance model for this study which focuses on strategies developers use to create easy-to-use banking ATM system interfaces for a variety of people with varying abilities and literacy levels.

Existing Interface Design Models and Frameworks

This section provided a review of existing interface design models and framework whose contexts agree with the two primary determinants of TAM: PEOU and PU.

Interface design that supports TAM should consider the users and tasks, know who they are, and what goals they try to achieve (Bhattacharya & Laha, 2013). Such interface design should be user centered to deploy a task-based approach for design and the evaluation process (Kwan, Paquette, Magee, & Betke, 2014; Pribeanu, 2014). An ideal user-centered interface (UCI) should allow a consistent, intuitive and simple control of a multi-function system with minimal user training, aside being perceived by the user as easy-to-use and useful (Gonzalez-Vargas, Dosen, Amsuess, Yu, & Farina, 2015).

Designing a UCI with these characteristics is a challenging task, especially in meeting the needs of variety of people with varying abilities and literacy levels including users with impaired motor and sensory capacities (Gonzalez-Vargas, et al., 2015; Ilyas et al., 2013).

Usability and user interface quality are the major factors recognized in literature for software to succeed (Bakaev, & Avdeenko, 2013; Bhattacharya, & Laha, 2013; Caine et al., 2015; Chu, & Tanaka, 2015; Pribeanu, 2014). In addition, about 50% of all program code produced when information systems applications are built is devoted to user

interface quality design (Bakaev, & Avdeenko, 2013). Against this background existing interface design models that support TAM will be reviewed to support ATM system interface developers.

Kajiyama and Satoh (2014) proposed an Intuitive Graphical Search Interface (IGSI) model that should go beyond how people interact with computing technology or how easy to use an interface system is and focus more on how users and systems can inspire one another's internal elements. Existing interaction techniques are not catching up with advances in computing, communication and display technologies to make for effective utilization of the available information flow (Rautaray & Agrawal, 2015). Kajiyama and Satoh (2014) defined "interaction" to mean the inspiring of the internal elements of both users and systems rather than the conventional superficial interactions between users and systems. They proposed an Intuitive Graphical Search Interface (IGSI) model with four user elements: information needs, user knowledge, thinking, and feelings, and five system elements: system knowledge, knowledge base, retrieval algorithm, interaction algorithm, and database (Kajiyama & Satoh, 2014). The authors' key point is that the system has the interaction algorithm that explores users' interface needs to select required knowledge needs from the knowledge base, and a system knowledge that can use users' information needs to create their own kind of system knowledge and synchronize it with user knowledge. Usability tests were performed using the system and applied to verify the effectiveness of this model and the design concept. This model provided real intuitive interactions where users and systems simulate one another's internal elements to realize system interfaces that are perceived as useful and

easy-to-use. Some researches that support intuitive interaction but varied in methodology and design are those by Shaer et al. (2014), Huang, Wu, and Liu (2015), Jang, Mallipeddi, and Lee (2014). Jang et al. (2014), and Rautaray and Agrawal (2015).

Huang, et al. (2015) observed that computer technology is widely integrated into ambient or ubiquitous environments that can only be handled with better connections between humans, their memories, and physical space through intuitive interface or “smart” interaction. This is because intuitive interaction with the physical space seems unavoidable. (Huang et al., 2015; van der Vlist, Niezen, Rapp, Hu, & Feijs, 2013). This idea was supported by Yousefi, & Li (2015) and van den Broek (2013). Yousefi, & Li (2015) proposed a novel solution for real-time 3D gesture-based interaction, a model that can find the best match from an extremely large gesture database. Van den Broek (2013), on the other hand, proposed a Ubiquitous Emotion Awareness (UEA) model that explores the rare combination of speech and a self-assessment to measure people’s emotions. However, van den Broek (2013) enumerated some issues that are troubling the development of ubiquitous emotion awareness:

- Physiological signals, speech, and computer vision techniques that affect users’ state of emotions;
- Difficulty in defining measuring or expressing emotion;
- Not accounting for personality traits in trying to express or measure emotion;

- Not considering demographic information such as age, gender, culture social class, and nationality that possibly influence emotions and their accompanying physiological responses.

Yousefi, and Li's (2015) proposed algorithm was very successful and passed the inventive step that qualified it to be filed as a patent application (US Patent pending) in January 2014. The research work by Jang, et al. (2014) supported those of Huang, et al. (2015). Implicit clues or intentions refer to the thoughts one has before producing an action (Jang et al., 2014). An eye tracking system, Tobii 1750, was utilized because it provided a very high-quality tracking system that does not interfere with the user environment. Rautaray and Agrawal (2015) focused on the three main phases of hand gesture recognition such as detection, tracking, and recognition, to adopt hand-based gestures for efficient interaction. Van-Hees and Engelen (2013) recommended Parallel user interface Rendering (PUIR) that can promote the use of complex user interface descriptions such that a user interface that is placed simultaneously in multiple modalities while ensuring that a good relationship between users of different modalities exists and is facilitated. PUIR can be relevant to developers to support the Design-for-All and Universal Access principles for the design of ATM interface system (Van-Hees & Engelen, 2013). However, Van-Hees and Engelen's (2013) proposed universal access design principles did not tackle some interface challenges that must do with sensory substitution applicable to the blind community. This is because, according to Blum, Bouchard, and Cooperstock (2013), the model lacks the strategies to integrate the three factors necessary for a widely deployable system that delivers a rich experience of one's

environment, such as implementation on service device, use of a pre-existing universally acknowledged point of interest (POI) database. Situ Audio Services (ISAS) model proposed by Blum, Bouchard, Cooperstock et al. (2013) delivered the required usability interface for the blind or vision impaired community.

Ilyas et al. (2013) proposed Gadget-Inspired Graphical User Interfaces (GIGI), with completely text-free sign language that can visually transmit sign patterns to convey meaning that meets the International Standard Organization (ISO) definition and standard for Public Information Symbols (PIS), to help users overcome challenges of text intensive user interfaces, as well as possible fear of technology among others. Shaer et al. (2014) designed reality-based interfaces (RBIs) empowered by ideas from embodied cognition that could offer an easy-to-use interaction that minimizes the mental effort required to learn or operate computational systems. Although the domain of the work centered on synthetic biology, the study appears very relevant and can advance ATM interface technology (Shaer et al., 2014). Ssekakubo, Suleman, and Marsden (2013) opined that such interface technology founded on synthetic technological platform may not be easily applicable in developing countries because of system component functionality. However, design services that identify appropriate access strategies to guide design decisions on how to effectively and satisfactorily deliver such services to the users was recommended (Ssekakubo et al., 2013). Chen et al. (2014) proposed a message-based memory system (MIMS) in preference to the traditional bus-based interface that allows the processors to communicate with the memory system through a universal and flexible message packet interface.

A close study of these existing interface design models and frameworks showed that they exhibit one basic characteristic. These existing interface design models and frameworks identified three major areas of concerns that evaluates usability: effectiveness, efficiency and satisfaction, while considering multiple target user groups (e.g. users with differing abilities and literacy levels), as applicable in this study. Overall, usability was the success criterion for all the proposed models.

Challenges with Banking ATM System Interfaces Design

Banking ATM system interfaces in Nigeria do not cater for all who desire and intend to use it. ATM systems in Nigeria have failed to cater for users with differing abilities and literacy levels but appear to cater for only the specialist user. User Interfaces (UI) in the past were developed on the platform of structured and iterative methodologies that involved user task analysis and functional design approach that did not pay attention to users' behavioral intention to use technology or users' varied abilities in every facet of life (Park & Song, 2015). Researchers have conducted studies in the field of UI in various parts of the world to measure users' experience value using useful multimedia technologies (Armenteros et al., 2013; Jung-min, & Nammee, 2013; Vatavu, 2013). Until recently, the studies on system interfaces focused on using user interface pattern models rather than interface generation development that put literacy levels and cultural environment of users into work (Jung-min & Nammee, 2013; Keates, 2013; Oh & Moon, 2013).

One significant setback of banking ATM system adoption in Nigeria is that ATMs lack a customized interface, which makes the ATM appear complex and difficult to use

(Bedman, 2013; Jain & Naithani, 2014; Sagib & Zapan, 2014). In addition, the existing functional design approach does not investigate properties that induce specific behaviors such as PEOU, PU, perceived enjoyment, perceived excitement and satisfaction on the part of users (Park & Song, 2015). The use of customized interface is therefore limited because these TAM variables: PEOU, PU, perceived enjoyment, perceived excitement and satisfaction are not systematically considered in the design process (Kanjwani & Singh, 2014; Koenig & Schlaegel, 2014). This calls for an alternative design method that aligns with TAM for improving usability (Armenteros et al., 2013; Davis, 1989; Hoehle et al., 2015). Existing graphical user interfaces in computer applications have failed to help users with limited literacy and skills to use ATM system (Ilyas et al., 2013). ATM system interface developers in Nigeria have not taken advantage of the new technological innovations designed on high level usability platform to close the existing usability gaps often observed in the ATM systems in Nigeria (Ilyas et al., 2013).

There are about three hundred ATM System interfaces developer organizations in Nigeria that serve as industry consultants and ATM Interface developers for banks and other financial organizations. Many engage in developing and implementing customized, automated, and intuitive software solutions. Among these organizations are

- Insourcing Nigeria Limited, that serves as industry consultants and ATM Interface developers for First Bank of Nigeria Plc.
- Stevfingers Technologies, #3 Presidential Road, (PRODA Compound, Independence Layout, Enugu

- Inlaks Computers Limited that serves as ATM Engineers, Technicians, and Interface developers for banks and other organizations.
- J-Software Management Technology Enugu- a registered company in Nigeria that is made up of ATM software developers.
- Ark Technologies Integrated Services Limited, ATM Software developer organizations based in Nigeria.
- FinTrak Software Nigeria Plc, a global ICT organization providing technology and business solutions to mainly commercial banks, mortgage banks and other financial institutions across Africa.
- Bludel Technologies Nigeria Limited, an organization providing custom software development.
- The Nigeria Software Development Initiative (NSDI), an organization producing software for accounting, legal, banking organizations, etc.

These developers have made remarkable progress in terms of developing easy-to-use ATM interfaces, especially for the elites or literates. The gap to be filled is that these ATM system interfaces do not cater for all who desire and intend to use it but for only the province of the specialist user.

There are only 59.67% of literate Nigerians adults aged 15years and older (UNESCO, 2015). The latest United Nations estimate of current Nigeria population as at March 9, 2017 was put at 190,279,273 with a median age of 18 years (Worldometers, 2017). According to United Nations World Population Prospects the 2015 Revision,

about 62% of Nigeria populations are aged 15 years or older (United Nations World Population Prospects, 2015). The implications of the above statements are:

- 117,973,149.26 (62% of 190,279,273) Nigerians are aged 15 years or older.
- 47,578,571.10 (40.33% of 117,973,149.26) Nigerians aged 15 years or older are illiterate or semiliterate.
- The existing banking ATMs do not adequately cater for about 40.33% illiterate or semiliterate adults aged 15 years and older. That is about 47,578,571.10 adults aged 15 years and older.

The existing ATM system interfaces in Nigeria have failed to provide easy-to-use ATM system interfaces for a variety of people with varying abilities and literacy levels which supports the need for this research to identify strategies to improve ATM interfaces. An interface that fails to incorporate the user, and “compromise” the users’ varying abilities and capabilities that determines whether or not the product will be easy-to-use, has failed. (Hyysalo & Johnson, 2014). This study intends to close this gap.

In the past, the design perspective of ‘look and feel’ was the key issue, but today, educational, social, political, and cultural issues are added to the aesthetic points of view (Gálvez, Valencia, Palomino, Cataldo, & Schwingel, 2015; Reppa & McDougall, 2015). Today’s ATM system interfaces are not flexible, expressive and easy to use (Giri et al., 2014). The design of an ATM should incorporate both its inherent usability and perceived usability (Castillejo et al., 2014). This usability gap contributed to ATM navigation menus that were not intuitive or as efficient as they should (Kajiyama & Satoh, 2014).

Therefore, the challenge is to develop an ATM system user interface generation that has a variety of methods of use that vary according to the usability interaction, experience, purpose, visual and literacy levels of users (Oh & Moon, 2013). Several researchers are studying ATM system interfaces for a variety of people with varying abilities and literacy levels (Kim et al., 2014; Oh, & Moon, 2013; Omari & Zachary, 2013), but such studies are lacking in Nigeria. This structured and iterative user task analysis methodology approach is limited in that intended usability is not appropriately implemented in the design process (Park & Song, 2015). An alternative design method is needed for improving usability values (Hoehle et al., 2015; Sahi & Gupta, 2013).

According to Hoehle et al. (2015), usability value reviews are based on adaptive user interface systems, supported by studying the historical development of UI systems' and comparing current user interface adaptive systems. One important area of research is how interfaces can be designed to know the characteristics of the user (Rebai, Maalej, Mahfoudhi, & Abid, 2016). To design such adaptive system interface, it is necessary to provide personalized users' information or observations that will monitor user's behavior, make generalizations and predictions based on these observations (Rebai, et al., 2016).

Hoffman, Singh, and Prakash (2015) claimed that an adaptive user interface will serve as a guide for useful and easy-to-use actions, achievable by hiding the truth entrenched in the design to effectively guide users' adaptive behaviors and to implement perception is an adaptive user interface. Information theory, computer science, and quantum theory all suggest that perception hide the truth in the sense that useful perception is only feasible because the truth can be hidden to guide adaptive behaviors

(Hoffman, et al., 2015). Thus, perception is an adaptive user interface confirmed to be more comfortable for use than the fixed user interface (Hoffman, et al., 2015). However, this adaptive model which comprised the following components: user model (UM), task model (TM), interaction model (IM), domain model (DM), environment model (EM), and presentation model (PM), according to Feng and Liu (2015), will be too complex to be carried out within the short DIT time frame. Therefore, this study will concentrate on the fixed user interface that centered on system interfaces for a variety of people with varying abilities and literacy levels and culture.

Castillejo et al. (2014) used traditional adaptive user interface to arrive at a detailed and significant model that comprised three main entities in a specific model: users, context and devices. Real interactions where users and systems inspire one another's internal elements via a proposed model have four user elements: user knowledge, information needs, thinking, and feelings, and five system elements: system knowledge, interaction and retrieval algorithms, and database (Feng & Liu, 2015; Kajiyama & Satoh, 2014). The key point of motivation for Kajiyama and Satoh (2014) was that a system can have the interaction algorithm that simulates the interface needs of users to select the required knowledge needs from the knowledge base. System knowledge can use users' information needs to create their own kind of system knowledge and synchronize it with users' knowledge (Feng & Liu, 2015; Kajiyama & Satoh, 2014). Recent studies on user interfaces have also suggested automated user interface (UI) motivated by varied endogenous and exogenous reasons that come from the end users and developers, the goal being to develop an evaluation tool to automate the

process of evaluating advanced human-machine interface (Hoehle et al., 2015; Jain & Naithani, 2014; Koenig & Schlaegel, 2014). Other researchers have suggested user interfaces to come with design principles with a 3-D integrated modeling, design, and system as a way to examine and reflect users' cultural interface and potential culture models (Jung-min & Nammee, 2013; Oh & Moon, 2013). This is important because user interfaces are typically easier to learn when they are designed to be easy to use based on core psychological and cultural properties and standards that are familiar with users or come from people's real-world experience.

Usability design should reflect culture in practice in order to improve user experience in the aspect of human interface design (Hoehle et al., 2015; Jung-min & Nammee, 2013; Oh & Moon, 2013). It is evident from the literature that many researchers and developers of ATM system interfaces have worked to propose or develop an easy-to-use system interfaces in line with TAM (Giri, et al., 2014; Kim, et al., 2014; Mansor & Ripin, 2013; Mi, Cavuoto, Benson, Smith-jackson, & Nussbaum, 2014). The question that appears not to be explicitly addressed or answered by many developers is whether system usability should cater for all who desire and intend to use it or for only the province of the specialist user (Kim et al., 2014; Oh, & Moon, 2013; Omari & Zachary, 2013). It is the system developer's perception of the user, and his willingness to "compromise" the users' varying abilities and capabilities that determines whether or not his product will be easy-to-use (Hyysalo & Johnson, 2014). Hyysalo and Johnson (2014) studied the intersection of human-centered design research and social studies of technology and found a relational entity that portrays a natural scenery or contextual

feature of the design space. These authors suggested that interface developers should work in a sufficiently center stage that provides best intimate understanding of the user to be able to act as user's advocates within the development organization (Hyysalo & Johnson, 2014). Usability can be achieved or improved through better understanding of users through design methods that consisted of the evaluation of series of operations by users on existing interfaces (Gamberini et al., 2013; Ohta, Matsuda, Murata, Hinago, & Fujita, 2014).

According to Keates (2013), an efficient user interface is one that encourages Universal Access to all users. This idea by Keates (2013) was closely supported by Giakoumis, Kaklanis, Votis, and Tzovaras (2014), who added that universal access to all users should leverage diversity in abilities, capabilities and cultural differences. Dos-Reis, Bonacin, and Baranauskas (2014) specifically proposed a system that combined organizational concepts and methods capable of identifying users' profile and language status. This idea of developing a system with Universal Access to all users may inform developers on the essence of easy-to-use interfaces among people with inequalities in access to information due to inequality in educational background. Lisa et al. (2014), Minon, Moreno, and Abascal (2014), Vatavu (2013), and Rautaray and Agrawal (2015) proposed a universal access that advanced further to support gesture recognition and ambient displays. Omari & Zachary (2013) research about universal access appears to be more advanced in that access should include users with visual impairment. Universal access, in summary, should leverage perceived usability that makes it flexible,

expressive and easier to use, within the safety, utility, and usability of systems (Giri et al., 2014; Raj, Lili, & Malcolm, 2013).

Therefore, it is imperative for software developers of ATM system interfaces to advance from their past records to create easy-to-use system interfaces for a variety of people with varying abilities and literacy levels (Kim et al., 2014; Oh, & Moon, 2013; Omari & Zachary, 2013), while complying to Central Bank of Nigeria (CBN) standard and guidelines on ATM operations in Nigeria. The CBN defines the basic standard and guidelines on ATM operations in Nigeria. However, there are varying viewpoints from some researchers as to what constitutes easy-to-use system interfaces. Ilyas et al. (2013) proposed easy to use and universal access interface systems that will meet the needs of users with high, moderate or low literacy level. Bouck (2013) shared similar views with Ilyas et al. (2013) but proposed easy to use and universal access interface systems for mild intellectual disabilities. Kim et al. (2014) proposal studied visual impairment users. This is closely supported by Conama (2013) who emphasized the need to create interface systems for signed languages and education recognition. While González-Calleros, Guerrero, and Vanderdonckt (2013), and Van-Hees and Engelen (2013) proposed interfaces that simply contribute to the goal of providing universal access. Kim et al. (2014) and Mi, et al. (2014) proposed the need for a review of an in-depth understanding of user interface design activities involving the three system interface components, namely the computer, human, and interaction. Developers of user interfaces should therefore include the user requirements and device accessibility

extracted from existing standards and guidelines so as to facilitate the inclusion of users with diversity in literacy levels to close these challenging gaps.

Existing Relationship Among Usability Variables and ATM System Service Quality

An empirical study by Joo, et al. (2014) revealed that user interface and perceived ease of use have significant effect on perceived usefulness while perceived usefulness had no significant effect on intention to use. While Armenteros et al. (2013) and Hoehle et al. (2015) claimed that perceived easy to use, or usability is an important criterion to assess the quality of banking ATM systems, Reppa and McDougall (2015) argued that usefulness and ease of use increase satisfaction in adoption and learning. User interfaces with beautiful and aesthetic appeal will normally facilitate task performance by users (Reppa & McDougall, 2015). In summary, a good user interface should be customized, intuitive, interactive, tailor-made and easy-to-use (Chin-Feng, et al., 2014).

Easy-to-use banking ATM system interface design is imperative for high ATM usability levels (Bedman, 2013; Jain & Naithani, 2014; Sagib & Zapan, 2014). User-friendliness or easy-to-use has been considered a critical factor in improving the usability of system interface (Park & Song, 2015). Users with visual impairments can be effectively engaged by designing non-visual interfaces (haptic interfaces) or touch communication methods (touch modality) for their use (Kim et al., 2014). Haptic technology can be an alternative sense to vision and an important component for effectively accessing information systems for most appropriately designed assistive technology to access information for those with visual impairments (Kim et al., 2014).

Easy-to-use interface will normally produce efficient result (Dos-Reis, et al., 2014; Mansor & Ripin, 2013).

Existing Tools and Strategies for Developing Easy-To-Use System Interfaces

In Nigeria, banking ATM system interface design that is customized, tailor-made and easy-to-use, to cater for a variety of people with varying abilities and literacy levels, is imperative for high ATM usability levels. There are contributions in literature that point to existing tools and strategies for developing easy-to-use system interfaces (Giakoumis, et al., 2014; Hyysalo & Johnson, 2014). Hoffmann and Söllner (2014), while incorporating behavioral trust theory into system development for ubiquitous applications claimed that trust was the key factor for technology adoption by users, meaning that, users prefer to use applications they trust. Good user interface that should incorporate good and easy-to-use authentication should embed trust as a major aspect of information security and authentication (Hoffmann & Söllner, 2014). Kapoor, Dwivedi, Piercy, Lal, and Weerakkody (2014) opined that usability or easy-to-use interfaces will influence the user attitude, and system quality which significantly will influence the use of the system services. From Cheng's (2014) study, information quality, system quality, support service quality, and instructor quality contributed significantly to PU. This finding greatly informs this study because information quality, system quality, support service quality, and instructor quality can be embedded in a banking ATM system interface to make the system easy-to-use and useful.

Fillion and Ekionea (2014) in their study considered many socioeconomic variables such as age, utility for work-related use, declining cost, applications for fun,

mobility, perceived ease of use and utility for security, and found perceived ease of use and utility for security as the two most significant variables that influence adoption. Omari and Zachary (2013) focused on visually impaired persons and suggested incorporation of biometric features as essential tools to ensure secured banking ATM systems. This result added to the studies on user interface challenges in banking ATM systems (Kurschl, Augstein, Burger, & Pointner, 2014). Zhang, et al. (2013) contended that banking ATM system developers should consult extensively with banking ATM users to help design and create banking ATM systems which are easy to use and efficient. Banking ATM system interface designers must understand how users can tell whether an interface background display is interactive or not and how they can tell what the interface is intended to achieve with minimal mental efforts (Shaer et al., 2014).

Developers of user interfaces should also use tools to experience accessibility challenges or limitations that can be implemented from various disabilities platform to provide good and realistic simulations over them (Giakoumis, et al., 2014). Banking ATM system interface developers must be human-centered and work in an environment that provides best understanding of the user to be able to act as user advocates within the development organization (Hyysalo & Johnson, 2014). A good system developer should serve as a user advocate within the development domain and use suitable tools and technique to gain good understanding of the abilities and capabilities of the broad range of users, while creating an easy-to-use system interface for users (Keates, 2015). Banking ATM user interfaces that empower usability in terms of speech technology and biometric authentication like finger print verification may encourage non-users to use ATMs,

improve usability for all, and present strategies for developing easy-to-use and efficient banking ATM system interfaces.

Existing Strategies for Enhancing Banking ATM Interface Systems Security

Securing the ATM system interface is important to impact its usability because technology alone is not sufficient to ensure information security. Information security has been defined from multiple perspectives and with a holistic approach that expands beyond the technical security, to comprise the environment, the interface technology, and the people (Narain, Gupta, & Ojha, 2014; Perez, Branch, & Kuofie, 2014; Coronado, 2013; Taylor & Robinson, 2015). According to Kim (2014), information systems have six components:

- Software,
- Hardware,
- Data,
- People (users),
- Procedures, and
- Networks.

Among these six components, users and procedures are often neglected in information security and interface design considerations (Sommestad, Hallberg, Lundholm, & Bengtsson, 2014; Taylor & Robinson, 2015). This results from inability to handle the differences in behavior regarding the intent to implement security measures or administrative errors (Komatsu, Takagi, & Takemura, 2013). End-users should be made aware of information security, the information security techniques and procedures to

avoid being misused or misinterpreted (Komatsu et al., 2013). To protect users' information and systems, not only is proper banking ATM technology required, the human side of security must be incorporated. Usability interfaces should be well managed because technology alone is not sufficient to ensure information security (Carolan, 2016). Some researchers attest to the fact that humans appear to be the most important links to the information security of any organization and invariably constitute the highest risk to the information security measures and information integrity of any organization (Narain et al., 2014; Perez et al., 2014; Coronado, 2013). What contributes to information insecurity has proven to be complex, dynamic and more of psychological in nature (Cottrell, 2016). Security measures required to handle threats to the organizations' data confidentiality, integrity, and availability are complex, dynamic and psychological (Thompson, 2013). Perimeter defenses, control over devices, employee's adherence to policies, control over policy enforcement, and enterprise definitions are no longer reliable as there are no perimeter boundaries and all security platforms are complex, dynamic and psychological (Thompson, 2013; Fenz, Heurix, Neubauer, & Pechstein, 2014). Attackers are personalizing their attacks, but defenses have not been personalized (Thompson, 2013).

Therefore, strategies for enhancing banking ATM interface systems security should adequately incorporate the users and procedures. This is because technology alone cannot solve banking ATM security problems until users understand technology and the problems (Kim, 2014; Carolan, 2016; Shahpasand, Shajari, Hashemi-Golpaygani, & Ghavamipoor, 2015). Users failing to understand technology and the problems can

lead to lack of trust which can undermine even the strongest security countermeasures (Bertino et al., 2014; Pfleeger, 2014; Taylor & Robinson, 2015). Poor banking ATM interface designs affect trust, while lack of trust can lead to security breaches because banking ATM system users are driven to use the system based on their perceived trust level, which determines their perceived usefulness of the system (Kaushik & Rahman, 2015; Kazi & Mannan, 2013; Patsiotis, et al., 2013; Safeena et al., 2013).

Three external variables that are determinants of TAM's PEOU and PU: perceived risk, social influence, and facilitating conditions have been found to have strong positive correlation with the intention to adopt technology services (Kazi & Mannan, 2013; Martinsa et al., 2014; Yang et al., 2014; AlKailani, 2016). Perceived risk was found to have significant negative impact on the customers' intention to adopt technology services (Kazi & Mannan, 2013). Martinsa et al. (2014) found that among the three variables: perceived risk, social influence, and facilitating conditions, perceived risk was the most important in explaining users' intentions, while facilitating conditions was not deemed important to explain usage. Yang et al. (2014) considered two types of perceived risk: system dependent and transactional related risk. Findings from their study claimed that system dependent risk was likely ignored by consumers pursuing convenience and usefulness of banking online payment, which points to the fact that e-banking or third-party payment platform designs should focus more on reducing transactional risk (Astakhova, 2015). Social influence also was a significant factor in the intention to adopt mobile banking (Kazi & Mannan, 2013).

Technology alone is not sufficient to ensure information security (Coronado, 2013). Human vulnerabilities that lead to poorly designed interfaces are increasingly exploiting information systems. This is because interface developers cannot plausibly anticipate all user needs and requirements in detail, while users keep changing their behavior towards the system or change what they want after they started using the system (Thimbleby, 2015). Poorly designed banking ATM interface can affect users' trust, which in turn, can lead to security breaches (Kaushik & Rahman, 2015). This is because banking ATM system users are driven to use the system based on their perceived trust level, which determines their perceived usefulness of the system (Patsiotis, et al., 2013). Therefore, easy-to-use banking ATM system interface that will answer to literacy levels and cultural differences of users should adequately incorporate human aspect of security, and that is, the users and procedures.

Banking ATM system interface developers should therefore be informed that, as part of implementing ATM security function, ATM system interfaces should incorporate facilities that guarantees customers' perceived trust (Kaushik & Rahman, 2015; Kazi & Mannan, 2013; Patsiotis, et al., 2013). Perceived trust, mobility and attitudes positively affect the acceptance of information system, while perceived reputation and environmental risk were found to be positively related to perceived trust, and negatively related to perceived trust respectively (Dastan & Gürler, 2016). Perceived trust, perceived mobility and attitude factors have a positive effect on acceptance of technology (Dastan & Gürler, 2016). Environmental risk negatively influenced adoption of technology (Kaushik & Rahman, 2015; Kazi & Mannan, 2013), while perceived trust was

observed to be a strong factor predicting the technology adoption intention, because customers pay considerable attention to the aspects related to trust to support their decision to use such sensitive services (Kaushik & Rahman, 2015; Kazi & Mannan, 2013). Teoh, et al. (2013), however, found trust and security not significantly associated with consumers' perception toward banking facilities. Trust was found marginally or not related to the intention to use (Teoh, et al., 2013).

There have been all forms of breaches and fraudulent activities that may be perpetrated against banking ATMs, such as skimming attacks, card trapping, pin cracking, phishing/vishing attack, ATM malware, hacking, and physical attack (Nana, & Nana, 2013). Proposed systems to increase the ATM security found in literature were based on various biometric technologies such as hand geometry, fingerprint, voice, and signature verification, retinal and iris scanning, facial recognition, vascular patterns, keystroke recognition, vein pattern achievable with smart camera devices and LED array used to capture these digital images, and applicable with credit card and smart card security, ATM security, etc. (Go, Lee, & Kwak, 2014; Mandot, & Verma, 2015). Fingerprint images and iris images, were often recommended as strong security measures because of their unique physiological traits, convenience, reduction of cash theft, and estimated passwords administrator cost. (Betab & Sandhu, 2014; Kassem, Mekky, & EL-Awady, 2014; Mike & Momodu, 2015). However biometric fingerprint authentication is challenged with difficulty of detecting artificial finger print, required fingerprint image processing resources and time before it can be successfully processed (Mike & Momodu, 2015). Since the ATM service validates a customer at the time of service, it was possible

to send all entry of an ATM customer such as his pin and any other required biometrics to the bank for validation as part of each transaction to make the developed ATM software more secure as compared to the PIN or password authentication software (Betab & Sandhu, 2014).

One disadvantage of a general iris recognition system, as a means of enhancing reliable user authentication at Automated Teller Machines (ATMs) is its vulnerability to a number of threats because templates are typically stored in a database or a smart card in a general iris recognition system, as a means of enhancing reliable user authentication at Automated Teller Machines (ATMs), but a biometric system is vulnerable to a number of threats as a result (Bose, 2013). However, a couple of biometric systems such as fingerprint mechanism and iris recognition technology, can be combined with cryptography (biometric cryptosystems) because of their variability, stability and security advantages to effectively improve the security and privacy of biometric systems in banking ATMs (Bose, 2013). Combined multimodal biometric systems with and without using thresholds have been found to give an accuracy of 96.67% (Ciampa, 2013; Kassem et al., 2014). According to Reno (2013), multifactor authentication factors coupled with the use of risk analysis during authentication can mitigate against ATM skimming and frauds.

However, a combination of several factors including universality, measurability, performance, usability and circumvention during the selection of a biometric for use in a specific application, make it difficult for the trait to be easily imitated using an artifact or substitute (Kumar, et al., 2014). Through facial recognition authentication, each

individual at the ATM center has access to an easy panic button and a sound sensor-cum-alarm that provides autonomous, continuous and secured surveillance system to alert all the security dimensions available (Kumar, et al., 2014). Thus facial identification for authentication provides sufficient data in the event of any discrepancies and mitigates the problems faced in the conventional security system because it identifies the uniqueness and safety of the costumer and machine (Kumar, et al., 2014). Better personal identification number (PIN) authentication can be realized with the use of multi-touch-allowed secret input operation into a PIN authentication that allows more than one number at a time input without lowering usability and acceptability (Bakpo & Ezugwu, 2014; Takada, & Kokubun, 2014).

Over the years there have been enormous advances in the field of technical information security controls with complex and matured technical controls such as anti-virus, client-based firewalls, and real-time patching (Baranwal, Nandi, & Singh, 2017). Some socio-technical trends that are likely to shape the cybersecurity environment in the next decade have been identified (Dupont, 2013), and their possibility to produce great effect in the information security technical controls was suggested (Hinduja & Kooi, 2013). In the last decades, the Institute of Electrical and Electronics Engineers (IEEE) Security& Privacy standards has focused on a wide variety of important policies that has not only contributed to the understanding of security, but also to the innovative and effective solutions to information technical security problems (Kalaimannan & Gupta, 2017). Much prior research has also focused on individual fraud types such as identity

theft, intellectual property fraud or insurance fraud (Rawlings & Lowry, 2017; Warren, 2015).

Despite the implementation of advanced security technical controls, information systems have remained vulnerable. This is because there are evidences that suggest that human vulnerabilities resulting from poorly designed interfaces are increasingly exploiting information systems (Temizkan, Park, & Saydam, 2017). Some researchers have noted many reasons for this, ranging from problems with the usability of information systems (Cristian & Volkamer, 2013; Okesola & Grobler, 2014), compromised decisions by users (Greavu-Serban & Serban, 2014) and limited ability to comply with Knowledge Management Systems or instructions (de Albuquerque & dos Santos, 2015; Shehata, 2015). However, Dwivedi, et al., (2015) summarized and categorized these mistakes into four categories: process (management process and technical project management methodologies), people involved in a project, product (project size and urgency, including its goals, performance, robustness, and reliability), and technology (IS failures resulting from the poor interface, use and misuse of modern technology). Nevertheless, a study by Ho, Hsu, and Yen (2015) proposed three major control items of the Information Security Management System (ISMS): security policy, access control, and secure human interface resources that provides improved strategies for a secure system.

Historical Overview of ATMs in Nigeria

This section provides a brief historical description of ATM in Nigeria. Nigeria is one of the West African countries with an estimated population of over 160 million

inhabitants and is known as the most populous country in Africa (Afaha, 2013). Nigeria became a British protectorate in 1891 and became independent in 1960 (Afaha, 2013). Nigeria has more than 250 different ethnic or linguistic groups, with three major ethnic groups: Igbo (southeast), Yoruba (southwest), and the Hausa Fulani (north). Two religious groups are predominant: Muslim in the north and Christians in the south. Nigeria is a Federal Republic, with the 36 states (Afaha, 2013). Abuja, proclaimed the nation's capital in 1976, is in the Federal capital territory state. Other major cities are Enugu and Owerri in the southeast, Lagos and Ibadan in the southwest, Kano in the north, and Port Harcourt in the southeast (Afaha, 2013).

The Central Bank of Nigeria (CBN) introduced ATM into the Nigerian economy in 1989 (Olowookere & Olowookere, 2014; Oyewo, 2014; Sowunmi, Amoo, Olaleye, & Salako, 2014). The first commercial bank in Nigeria to install ATM in Nigeria was the defunct Societe Generale Bank Nigeria (SGBN) in 1989, and it was installed by National Cash Registers (NCR) (Akomolafe, 2015). Hence Societe Generale Bank Nigeria was the first to introduced ATM in Nigeria in 1989, popularly known as “cash point 24” (Oyewo, 2014). This was followed later in 1991 by First Bank of Nigeria Plc with the name known then as “First Cash” (Olowookere & Olowookere, 2014).

Existing Banking ATM Interface System in Nigeria

Some existing banking ATM user interfaces in Nigeria lack simple and easily understandable design and contents, which rendered them not easy-to-use by all users with varying abilities and literacy levels. Only 7.9% of Nigerians use ATMs and 53% of adults who are bank customers use their ATM cards (EFInA, 2014). Context-aware user

interface (UI) plays an important role in human-computer interaction tasks in location-based services such as bank ATMs. One significant setback of banking ATM system adoption in Nigeria is that ATMs lack customized user-friendly interfaces. This makes the ATMs appear complex and difficult to use by users. To the ATM user, the interface is the product, not necessarily the ATM machine (Zhang, et al., 2013) and the most critical component of the ATM system that determines ATM acceptability (Darejeh & Singh, 2014a).

A relationship exists between concepts of “software non-usability” with complexity arising from user-unfriendly interface designs. ATM interface screen designs differ among the banks depending on the software developer organization engaged by the bank. Generally, there are menu options such as “Withdraw”, “Current”, “Savings”, “Account number of beneficiary” etc., which are not well understood by all people with varying abilities and literacy levels (Darejeh & Singh, 2014a; Jimoh & Babatunde, 2014, p. 116). Most existing ATM systems do not have interface facilities that are easy-to-use by users with varying abilities and literacy levels, such as (a) the ability of zoom in the software; (b) provision of speech recognition for interacting with software, and (c) customized abilities in software for tailoring font size and color (d). applying the principles that will reduce the complexity of the interface such as use of easily understandable words; (e) use of larger icons in preference to small icons; (f) use of attractive avatars (Cruz-Zapata, Hernández-Niñirola, Idri, Fernández-alemán, & Toval, 2014; SathishKumar & Kamalraj, 2014).

These deficiencies made some existing interfaces not easy-to-use by all users with varying abilities and literacy levels. Some existing banking ATM user interfaces in Nigeria lack simple and easily understandable design and contents such as the use of graphical metaphor to encourage those that are weak in vocabularies (Jegade, 2014). Some are not very visible, because they just have a black background screen with illuminated text, which is quite dull and not very visible. This does not go well for the elderly users whether literate, or not. Poorly designed UI is not easy-to-use or usable, no matter how well the machine performs (Alshameri & Karim-Bangura, 2014). According to SathishKumar and Kamalraj (2014), a combination of text and graphical metaphor may be the best UI in this case.

A study by Alfimtsev, Basarab, Devyatkov, and Levanov (2015), analyzed the values of human brainwaves when dealing with UI, and claimed that the brainwaves indicate “calm” when working with a friendly interface and “excited” or “nervous” or “agitated” when dealing with inconvenient UI. According to the study, the average values of brainwaves in calm and excited states depend on the interface usability (Alfimtsev, et al., 2015). When users are agitated because the UI is not easy-to-use, more time is wasted on the ATM machine, resulting in long queue or much crowd at the ATM center (Zhang, et al., 2013). Figure 1 shows a picture of people in Nigeria accessing an ATM. In Nigeria, some ATM user interfaces have remained notoriously user-unfriendly. This is because the developers of these ATM user interfaces have assumed that ATMs are the province of the specialized or literate users (Darejeh & Singh, 2014b). In this case that assumption fails because the ATMs are not easy-to-use by all people of varying abilities and literacy

levels who must not be denied of the use of ATMs (Omari & Zachary, 2013). Hence this study aims at identifying strategies software developers of banking ATM systems use to create easy-to-use ATM system interfaces for a variety of people with varying abilities and literacy levels.



Figure 1. An ATM point in Nigeria. Adapted from “6 categories of people you would meet at a Nigerian ATM point” by Boluakindele (unpublished). Retrieved from <http://naijachristians.com.ng/2017/02/09/6-categories-of-people-you-would-meet-at-a-nigerian-atm-point/>

How ATMs in the World Differ from Those in Nigeria

The ATM user interface remains basically consistent for all ATMs, which includes the main screen, the selection keys, the keypad and several slots (Zhang, et al., 2013). ATMs are important for the further developments of the banking industry. Banking ATM technology utilization and profitability are affected by how the ATM system interface influences users in terms of users’ literacy levels, and cultural differences (Conti et al., 2014; Jegede, 2014). Despite their importance and increasing number of functions, ATM interface in Nigeria often show usability defects and the user

experience issues that can be frustrating (Jegade, 2014). In the design of the ATM, the most important is the ATM system user interface. This is because, to the ATM user, the interface is the product, and not necessarily the ATM machine (Zhang, et al., 2013). For the user of ATM system, the interface is the most critical component of the ATM system. Therefore, the usability of the ATM machine answers to how easy-to-use the interface is. An ATM interface that is easy-to-use in one country may produce a frustrating experience and usability problem in another country (Ilyas et al., 2013). This is because interface usability answers to the literacy level and cultural background of the user, among others (Ilyas et al., 2013).

Besides literacy challenges that frustrate users' ability to achieve their goals, there are security and cultural issues that also hinged on ATM interfaces (Ilyas et al., 2013). Earlier ATM system interfaces introduced in Nigeria were the same in other developed countries and were designed such that if a customer forgot to take his or her cash, the ATM simply retracted the cash and reversed the amount to the customer's account (Oluwafemi & Ola, 2014). In the more civilized society, there might not be any challenge with this because there might be other monitoring gadgets. In Nigeria, the same scenario posed serious security threats as some customers tried to beat the ATM by taking a bit of the cash and leaving the remaining with the ATM. The ATM retracted the remainder and yet reversed the full amount. There were no monitoring cameras or other evidences to trace the shortage of cash to the customer. For this and other reasons the CBN published the approved guidelines on operations of electronic payment channels in Nigeria. In this documentary guidelines, CBN mandated all banks in Nigeria to disable cash retraction on

all ATMs (CBN, 2016, p.4). Also, initial ATM interface does not require multiple input of PIN for multiple withdrawals, if customer's card was already in the machine (Oluwafemi & Ola, 2014). Currently, in Nigeria, it is universally acknowledged that the average ATM transactions will require multiple withdrawals since the ATM can only push out at most 40 notes, a maximum of forty thousand naira (N40,000). In the case where the customer collects his or her cash and forgets his ATM card inside the machine, what happens next depends on the next person on the ATM queue. If the person is nice, he might eject the card and hand it over to the bank. If the person is not, he could clear all the money in the account because the ATM was not designed to ask for PIN as many times as one may want to withdraw. This problem was addressed by CBN guidelines on operations of electronic payment channels in Nigeria (CBN, 2016, p.5-6), and called for a redesign of the ATM interface. Currently, in Nigeria, one must input one's PIN for all multiple transactions, even when one's ATM card is already inserted into the ATM machine. This is not the case with most ATMs in developed countries.

In Nigeria, peculiar usability challenges that are associated with these ATM system interfaces exist that need to be understood and resolved because user interface for ATM systems influence users with respect to their literacy levels, and cultural differences, and may encourage either secure or unsecure behavior (Conti et al., 2014). The ATM user interface should be designed or redesigned with the user in mind, meaning that the principles of human-computer interaction should be incorporated into the ATM interface design process to produce secure authentication interfaces that are effortless, and easier for users (Betab, & Sandhu, 2014; Bose, 2013; Kassem et al., 2014; Kumar, et

al., 2014). Banks in Nigeria may not just take the user interface from ATM builders designed for other countries verbatim, because interface usability answers to the literacy levels, culture and behavior that are peculiar to a locality or country (Ilyas et al., 2013).

ATM interfaces ought to be customized to improve user experience in the aspect of human interface design (Hoehle et al., 2015; Jung-min & Nammee, 2013; Oh & Moon, 2013). Banking ATM system interface developers should therefore be informed that, as part of implementing ATM security functions, ATM system interfaces should incorporate facilities that guarantee customers' perceived trust (Kazi & Mannan, 2013). Banking ATMs are not designed within Nigeria but purchased by the banks from companies that specialize in ATM development. While there might be little or no developers in Nigeria for ATM machines, there are good numbers of ATM interface expert developers in Nigeria. These system interface developers are very much needed to continually customize these ATMs to suit Nigeria's literacy and cultural environmental peculiarities. A good user interface should be customized, intuitive, interactive, tailor-made and easy-to-use (Chin-Feng, et al., 2014).

Re-designing user interfaces of banking ATMs to make them easy-to-use to improve customer satisfaction and user experience is not new in the world, and not peculiar to Nigeria. According to Zhang, et al. (2013, p.23), Wells Fargo, a well-known bank in the US, redesigned their banking ATM user interfaces in 2005, to improve customer satisfaction and user experience. This exercise improved the aesthetic appeal of the interface by implementing touch screens as input/output devices that set up profile-based functions in the system (Zhang, et al., 2013). In Nigeria, system interface experts

have always studied most of these peculiar Nigerian situations that may initiate a redesign process that could serve as feedback to the ATM boulders, if it goes beyond system and terminal interfaces redesign. The results of this literature review showed that the existing ATM system interfaces in Nigeria, although working for the literate group, has failed to cater for the illiterate and semiliterate group, about half the population of Nigerians aged 15 years and older (Ilyas, et al., 2013; UNESCO, 2015). The existing system failed to cater for a variety of people with varying abilities and literacy levels. findings from this study should have greater applicability by Nigerian software developers, who may use it to develop more user-friendly ATM user interfaces that will cater for a variety of people with varying abilities and literacy levels.

Successful result from this study may bring a social change because it may advance the use of other technology outlets aside ATM, that require easy-to-use system interfaces for a variety of people with varying abilities and literacy levels. It may equip interface developers with strategies to make tremendous impact on other related services, economic restructuring, societal value systems, the spread of media technology, and other areas of National interest that are user interface technology dependent, including building of ATMs. This is encouraging for a developing country such as Nigeria.

Transition and Summary

Section 1 provided the foundation for this qualitative case study. This section defined the IT problem and provided the background of the problem, the problem statement, and the purpose statement. The literature review addressed the current and existing interface design models and conceptual frameworks relevant to this study. TAM

conceptual framework was considered insightful to address this study on strategies developers of banking ATM system interfaces use to create easy-to-use system interfaces for a variety of people with varying abilities and literacy levels. Section 2 covered the following topics: role of the researcher, participants, research methodology, research design, population and sampling, ethical research, data collection techniques/instruments, data organization techniques/data analysis, and reliability and validity. Section 3 discussed the research findings and how the conceptual framework ties to the findings. This section also discussed the implications of the findings for social change expressed in terms of tangible improvements to individuals, communities, institutions and professional bodies. This section also discussed recommendations for actions and further study, and reflections with strong concluding statement.

Section 2: The Project

In this study, I intended to identify strategies developers of banking ATM system interfaces use to create easy-to-use system interfaces for people with varying abilities and literacy levels. In this section, the following topics are covered: the role of the researcher, participants, research methodology, research design, population and sampling, ethical research, data collection techniques/instruments, data organization techniques/data analysis, and reliability and validity.

Purpose Statement

The purpose of this qualitative case study was to identify strategies software developers of banking ATM systems in Nigeria use to create easy-to-use ATM system interfaces for people with varying abilities and literacy levels. The target population for this study was software developers of banking ATM systems who have strategies to create easy-to-use ATM system interfaces for people with varying abilities and literacy levels. The geographical location was the Enugu State of Nigeria. One ATM system interface developer organization in Enugu served as the case study. The completed study may encourage social change if software developers of banking ATM systems use successful strategies to create easy-to-use ATM system interfaces, which may increase the use of ATM banking in Nigeria. Increased ATM usage may improve user morale and productivity. Software developers may create new innovations and influences that could advance the use of technology in a developing country.

The Role of the Researcher

In this section, I described the role of the researcher in data collection. In a qualitative case study, the researcher is considered the primary instrument of data collection (Baillie, 2015; Sorsa, Kiikkala, & Åstedt-Kurki, 2015). This is because the data are mediated through the human instrument (researcher), rather than through questionnaires or machines or inventories (Pugh, 2013; Sorsa et al., 2015). According to Fink (2000), a qualitative researcher's role is derivable from the research process for a qualitative method, which is comprised of seven stage processes: theming, designing, interviewing, transcribing, analyzing, verifying, and reporting. As the primary instrument for data collection, I was involved in the design of the interview questions, interview protocol guide (Appendix A), and selection of participants. I conducted the interviews with open ended semistructured interview questions and the interview protocol guide (Appendix A) that allowed me to probe further as the participants responded to the questions. I put in place a favorable interview platform that can accommodate any unforeseen moments including interrupting noises during the unstructured qualitative interview. According to Peters and Halcomb (2015), this approach can produce powerful data that are insightful to the participants' perceptions or opinions. In addition to in-depth interviews with open ended semistructured questions, I collected data from case organizations' regulations, policies, and design guideline documents that are focused on strategies to create an easy-to-use banking ATM system interface, both from participant case organizations and from other nonparticipant case organizations. I reviewed the CBN documentary guidelines for ATM software designs in Nigeria, published in April 2016, to

note how the guidelines of the organization match the CBN documentary guidelines for ATM software designs. This was necessary because the CBN defined the basic standard and guidelines on ATM operations in Nigeria. I reviewed data from my field notes and reflective journals that contained some major issues raised during the interviews. I also observed participants' reactions or challenges while responding to the interview questions to know when to ask follow-up or probing questions. I recorded the data collected during the interview, transcribed and reviewed the data collected, conducted data analysis using ATLAS.ti7 (version7) to qualitative analysis software, and identified the themes.

I live in Enugu, one of the towns in the Enugu State of Nigeria, where I selected the case organization for this study. Living in Enugu had no adverse effect whatsoever on either the selection of the participants or the conduction of this study. I had no previous relationship with my participant organization or with my participants. Before the commencement of this study, I had no previous expert knowledge of this study topic. However, I have gained some level of expertise through the research I carried out on this topic. I set aside what I know and any assumptions so that I could focus on participants' subjectively described viewpoints and experiences that I recorded verbatim. Finally, I maintained the focus of the study while remaining sensitive to cues.

I adopted the Belmont Report's three principles for ethical research: respect for persons, beneficence, and justice (The Belmont Report, 1979) as the standard for conducting this study and for providing the ethical principles required for this study. I also considered recommendations by Judkins-Cohn, Kielwasser-Withrow, Owen, and Ward (2014) and Bristol and Hicks (2014), suggesting that participants should be treated

as autonomous agents in a manner that accords them the capacity to be treated with respect and the right to hold views, make choices, and act based on personal values and beliefs. As a researcher, I ensured that all human participants were treated ethically and protected before, during, and after my study was conducted. I conducted ethical research by treating participants in an ethical manner, respecting them, and taking steps that ensured their well-being by minimizing any harm to the participants. I completed the National Institute of Health Office of Extramural Research web-based training course on protecting human research participants (Appendix B).

One important issue in qualitative data collection is how to mitigate bias and view data from a personal lens. Qualitative research is usually accompanied with the researcher's bias during the interview (Lucas, 2014; Morrison & Stomski, 2015; Reid & Mash, 2014). Moreover, a participant's bias is present in all qualitative case study research, both intentionally and unintentionally (Fusch & Ness, 2015). However, both biases can be handled by using interview protocol and proper interview recording, among others. (Castillo-Montoya, 2016; Frels & Onwuegbuzie, 2013). I minimized these biases by following the interview protocol and guidelines (Appendix A), and by recording verbatim the responses to the research question as given by the participants. I also handled all applicable aspects of reflexivity as proposed by Baillie (2015): assumptions, expectations, behavior or emotional reactions, and unconscious responses.

The interview started with a welcome note that included the explanation of the procedure and the length of time expected for the interview, as well as the purpose of the study. I gave enough explanation of the purpose of the study and the process of the

interview to the participants, repeating what was written in the information consent form, and allowing for questions and clarification before the commencement of interviews.

This mitigated bias by ensuring trust and confidentiality. Lack of confidentiality can introduce bias. It has been argued that participants can bias data collected if they do not understand the questions put to them (Dikko, 2016; Khan, 2014). I mitigated this type of bias by making sure each participant understood the interview questions in line with the research question before interviews.

Making sure each participant understood the questions helped me to identify unclear or ambiguous statements both in the research interview questions and protocol. I also neutralized or canceled the biases that might have crept in through data collection methods by triangulation of the sources of data collection, as suggested by Yüzbasioğlu and Babadogan (2016). To address the concept of a personal lens, as recommended by Fusch and Ness (2015), I made sure that the interpretations of the phenomena represented that of participants and not mine, especially when checking for data saturation. The process of ensuring that the phenomena represented was that of participants and not mine was also facilitated by member checking to enhance trustworthiness and ultimately the quality of the research.

One of the rationales for the interview protocol in this study was to overcome researcher bias during interviewing. One recognized feature of qualitative research is that it is usually accompanied with the researcher's bias during the interview (Morrison & Stomski, 2015; Reid & Mash, 2014). The interview protocol (Appendix A), was used as a procedure guide to the purpose of the study and as the algorithm (step-by-step procedure)

for the interview. The interview protocol prompted me, especially at the beginning, to share critical details about the study such as the purpose of the study, confidentiality, and consent form, making a little introduction about myself to establish good rapport. With the interview protocol, bias can be eliminated or minimized by ensuring that the same questions, in the same order, are asked to all participants. According to Dikko (2016), an interview protocol provides guided conversations with the participants by ensuring that the method of data collection was consistent and without any adverse influence on the reliability or validity of the interview data. An interview protocol consists of pre- and post-interview guidelines as well as a set of questions to be asked during the interview (Dikko, 2016). At the end of the interview, going back to the interview protocol helped me to make further contacts where there was a need for clarifications or feedback, to ask additional questions, or to perform member checking, based on the findings from participants' responses.

Participants

This qualitative case study consisted of one organization that has successfully demonstrated experience and strategies in creating easy-to-use banking ATM system interfaces for people with varying abilities and literacy levels. Several such ATM system interface developer organizations exist in Enugu State. I contacted a few of these ATM system interface developer organizations and selected one organization that served as my case study organization. The choice of one organization was based on the understanding that there was some heterogeneity of strategies within the organization or among the participants. Moreover, the interview questions were designed to elicit from each

participant's in-depth understanding about the case. I used purposeful sampling. I requested permission to interview employees who meet my study eligibility criteria.

For this study, eligibility criteria included participants from one banking ATM interface developer organization who have the required English proficiency, are 18 years or older, have strategies to create easy-to-use ATM system interfaces for people with varying literacy levels, within the last three years, and live in Enugu, Nigeria. A set of techniques that clearly defines the boundaries for participants by stating a set of inclusion or exclusion criteria for the samples is important (Dixon, 2015; Robinson, 2014). Such eligibility criteria, which are formally documented as part of the protocol for the study are perceived to be necessary for selecting participants in a qualitative case study because they majorly result to less varied populations (Morar, et al., 2015; Noyes, et al., 2016). According to Hanson et al. (2016), eligibility criteria in a qualitative case study minimizes the heterogeneity of the study population, thereby providing the required case participants. My contact with the case study organization provided an estimated population size of twelve developers who meet the participation eligibility criteria. Because of the small population size, resulting from the eligibility criteria that defined the population of the study, I interviewed all the twelve participants who were eligible for individual in-depth interviews. Where the number of cases being investigated is relatively small, census sampling, a type of purposeful sampling is generally chosen (Etikan, Musa, & Alkassim, 2016). I used purposeful census sampling and identified all twelve members of the eligible participants that meet the eligibility criteria.

Prior to any communication with eligible participants, I obtained approval from the Walden University Institutional Review Board (IRB). The ethical foundation of research in the United States rests on two major documents: (a) the Belmont Report, that identified three elements of informed consent: information, comprehension, and voluntariness, and (b) the Institutional Review Boards (IRB) that assesses the risks and the benefits of research (Lantos & Spertus, 2014; O'Brien & Steele, 2017; Ciolfi & Kasen, 2017). I obtained IRB approval from Walden University's Center for Research Quality before contacting or recruiting individual study participants. Walden University's approval number for this study was 11-10-17-0512580.

After receiving IRB approval, I contacted the head of the case study organization who served as the gatekeeper and signed the letter of cooperation (Appendix C). Where government engagement in a data collection process was necessary to influence policy, a sporadic engagement from government officials represented in the study, is necessary, as experienced in countries like Ghana and Uganda (Buckland-Merrett, Kilkenny, & Reed, 2017). Nigeria is not an exception. According to Dunger, Schnell, and Bausewein (2017), complex tasks could be directed to a gatekeeper who has the expertise to do the work and can help to get permission to the organization and its relevant stakeholders. Using the head of the case study organization as a gatekeeper was worthwhile because he had the expertise to help get permission to use the organization and its relevant stakeholders that will enrich the overall delivery of the product or service. Gatekeepers might hold the liberty to exercise authority, the risk of abusing that authority for personal gain or turn the whole exercise into bureaucracy and unproductiveness especially when

they create policies that generate unnecessary work or disagree with the organization or civil society policies (Gilissen et al., 2017).

Using a gatekeeper might require a wait time for the work to be completed or increase the work load of the head of organization. Nevertheless, a gatekeeper who have extensive experience with the case study, will lend credibility to the case study and improve the quality of the study because error rate is likely to go down. This approach also streamlined the case study workflow and minimized frustration because it provided a single point of contact should any issues arise. It also addressed any central communication problems and needs for essential messages, especially that of providing list of eligible participants. Therefore, I used the head of my case organization to produce the names, emails, and contact addresses of eligible participants. With the signed letter of cooperation, and the names, emails, and contact addresses of eligible participants, I then identified these eligible participants via email or phone calls. I sent to each identified eligible participant, a copy of the signed letter of cooperation (Appendix C) from the participants' organization, and a copy of the participants' informed consent form via email, to initiate the participants consent signing process, and to gain access to the participants. I then coordinated interview scheduling process with each consented participant.

I set up a working relationship with participants to facilitate effective and efficient data collection. Establishing a working relationship with participants has been described as the essential part of data collection process in a qualitative research (Alami, 2015; Haahr, Norlyk, & Hall, 2014; Hoover & Morrow, 2015). To establish a working

relationship with participants, I introduced myself to them, and briefed all eligible participants on the purpose of the study, the recruitment procedure, the inclusion criteria for selecting participants, and the projected duration of the study, and the role of the researcher in the study. In a qualitative research, open communication and honesty with the participants during the interview process is essential to foster good working relationship (Bennett, Czech, Harris, & Todd, 2016; MacNaughton, Chreim, & Bourgeault, 2013). I collected a copy of the signed consent form from the eligible participants. I gave each eligible participant an invitation to participate in the interview, with an opt-out card. This was an important activity that ensured cooperation of the participants and addressed any potential areas of fear or confusion.

I gave each consented participant a copy of the interview question guide to study to avoid being interviewed unprepared. I duly informed them on the date and venue of interview which was scheduled through phone calls at the convenience of the participant, not later than two weeks after the consent form was signed. Disclosing to the participants what the researcher will do with the data collected, will establish good interpersonal and working relationships with participants (Ying, Thai, & Sathivellu, 2016). I let all consented participants know that all data collected, including the transcribed records, or any report from this study would not be made public, including any audio recorded interviews, and any information that will make it possible to identify the participant or the organization.

Participants' professional knowledge of strategies to create easy-to-use banking ATM system interfaces for people with varying abilities and literacy levels was perceived

and used as a positive resource for their inclusion in this study. The inclusion criteria for participation in this study qualified all participants to address the overarching research question of this study. Participants' professional experiences that align them with the overarching research question are explored and addressed within a three-dimensional space of time, context, and place (Bowden, Caine, & Yohani, 2017). Therefore, participants' professional experiences that align them with the overarching research question for this study was based on the following facts: (i) the participants demonstrated experience and strategies for creating banking ATM system interfaces for people with varying abilities and literacy levels, (ii) participants are from one banking ATM interface developer organization who have strategies to create easy-to-use ATM system interfaces for people with varying abilities and literacy levels, and (iii) participants have worked successfully as ATM interface developer with the case study organization for at least 3 years in Enugu state.

Research Method and Design

In this section, I established methods of approaching my study research question and provided specific outline or design detailing how my chosen methods were applied to answer my research question. I carefully chose my research methods and design to leverage a reciprocal process between the two, extending well into my study.

Research Method

I selected a qualitative single case study approach to understand strategies software developers of banking ATM systems in Nigeria use to create easy-to-use ATM system interfaces for people with varying abilities and literacy levels. Research

methodology has been classified as qualitative, quantitative, or involving both qualitative and quantitative methods, typically referred to as mixed methods (Molina-Azorin, 2016; Hewege & Perera, 2013). I chose qualitative approach because this study is intended to gain subjective in-depth knowledge of strategies developers use to create easy-to-use banking ATM system interfaces. Subjective in-depth gathering of knowledge to explore and discover meaning are often associated with data generally gathered in words, texts, and images (Odeyemi, 2017). The study interview questions in this study are concerned with how and what strategies are used by participants. This is because my interest was centered on the participant's thoughts, aimed to create understanding and to reflect the diversity in the population of study.

Qualitative case study research method was deemed suitable when the proposed study was intended to gain in-depth understanding and richness of insights from participants' thoughts, to the generalizability of the results from data (Dey & Lehner, 2017). In other words, the choice of qualitative case study research method was appropriate if the research is largely exploratory in nature (Odeyemi, 2017). The exploratory nature of qualitative studies often allows qualitative case study researchers to focus on relatively few participants who can describe their in-depth experiences or knowledge to form the basis of addressing qualitative research goals (Baškarada, 2014). Where interview questions involve the gathering of data that are subjective in nature and are generally gathered in words, texts, images, including non-verbal cues, to explore in-depth thoughts of participants, qualitative approach will be suitable. (Odeyemi, 2017). These features that deemed qualitative case study research method suitable all supported

gaining in-depth understanding and richness of insights from participants' thoughts in other to gain in-depth knowledge of strategies and methodologies used by participant. That is the main features that describes my study, hence my consideration in selecting qualitative research method for this study.

I did not choose quantitative method because of some of its features that do not support my study research method. Quantitative methodology, is about measurements and generalization of relationships among variables (Hesse-biber, 2016). According to Yilmaz (2013), these data variables are numerically measured, and analyzed using mathematically based methods especially statistics to explain the phenomena. In this study, data was gathered in words, texts, images, including non-verbal cues, to explore phenomena but not to explain phenomena. Moreover, analysis was done through identification of themes and subthemes with no need for any statistical modeling or any extreme severity of mathematization, as remarkably evident in quantitative method. Quantitative studies generally involve sampling methods that randomly select large representative samples (Abu-Auf, Md Salleh, & Yusoff, 2016). Random selection of samples is a major factor in a quantitative study (Annamdevula & Bellamkonda, 2016). The sampling method engaged in this study was non-random (non-probability), purposive census sampling. Patton (2015) defined purposeful sampling as distinctively engaged and precise qualitative approach to case selection. Sampling is central to the practice of most researches, because high quality results are dependent on effective and efficient data collection, which in turn, are dependent on good sampling practices (Robinson, 2014). The use of probability sampling technique (random sampling) in this study is contrary to

this study's principle of reflectiveness of intended participants, and those willing to share with the researcher. I did not choose quantitative method for this study because random sampling was not applicable. Quantitative studies are confirmatory in nature, meaning that their primary aim is to measure variables and to test hypotheses (Charalampous, et al., 2016). This study has one research question and is not intended to test any hypothesis, but instead to explore and gain subjective in-depth knowledge of strategies developers use to create easy-to-use banking ATM system interfaces. For these reasons, I did not choose the quantitative method.

I considered selecting mixed methods because it combines the application of both qualitative and quantitative approach. Using mixed method will require a working professional knowledge of both quantitative and qualitative methods (Holt & Goulding, 2014). The implication of this is that mixed method processes are likely to demand tangibly more time and resources than allocated to plan and implement this study. The mixed method approach requests the inclusion of quantitative method in the basic definition of mixed method approach (McCusker, & Gunaydin, 2015). The fact that this study has no need for quantitative method, precludes the applicability of mixed methods that combines both quantitative and qualitative methods. Data collection in a mixed method approach, is either concurrent, whereby the same individuals provide both qualitative and quantitative data to make the data more easily compared, or sequential in which data are collected in an iterative process such that the data collected in one phase contribute to the data collected in the next (Almalki, 2016; Khaldi, 2017). This study emphasized the use data collection from multiple data sources, a strategy to gain multiple

perspectives from participants. Mixed method is often embedded with the challenge of integrating quantitative and qualitative data during analysis, interpretation, and presentation of results (Schiazza, 2013). This aspect of the mixed method approach made it inappropriate for my study that involves a single case and handled by one researcher. For these reasons, I deemed it not appropriate to choose the mixed method for this study.

Research Design

For this research, I used the case study design. A case study design is an in-depth exploration of the object of study or phenomenon of interest, with a pre-defined population within a specific geographic area (Navroodi, Zarkami, Basati, & Limaie, 2016). The major characteristic that distinguished case study design from other qualitative designs is that it provides tools for researchers to explore in-depth study of a contemporary phenomenon within some real-life context, that allow researchers focus on the interest of specific case itself and not on the participants (Yohannes, 2017). Case studies are typically designed to answer "how" or "why" questions (Fagerholm, Kuhrmann, & Münch, 2017). This study was designed to answer "how" or "why" questions and tied to gaining in-depth knowledge of strategies and methodologies to create easy-to-use banking ATM interfaces. A case study design allows the researcher to understand the complexity in the participants' thoughts concerning the phenomenon of interest by emphasizing the use multiple data sources to gain multiple perspectives and validation of data (Carter, Bryant-Lukosius, Blythe, & Neville, 2014). The phenomenon of interest (the case) is the strategies used by ATM system interface developers to create easy-to-use ATM system interfaces for people with varying abilities and literacy levels. The analysis

methods that are adopted in a case study further develop and explore the case, guided by context and emergent data to generate the expected reports, codes and themes (Brobeck, Odencrants, Bergh, & Hildingh, 2014). The analysis methods adopted in this study further developed and explored the case because the analysis process of interview data, generated reports, codes that will continue to impact new understanding of the study topic, as revealed by the themes and sub-themes. Case study design was deemed appropriate for this study.

A couple of specific type of case study designs guided by the overall study purpose were considered. Case study designs are categorized as explanatory, exploratory, and descriptive (Lekunze & Strom, 2017, p. 152). Explanatory case study seeks to explain the presumed causal links or mechanism in real-life interventions that are too complex for the survey or experimental strategies (Kreindler, 2017). On the other hand, descriptive case study is used to describe the phenomenon and the real-life context in which it occurred or to simply identify the essential structure of the phenomenon (Englander, 2014). Exploratory case study seeks to gain in-depth knowledge of the phenomenon of interest, often with the use of face-to-face interviews conducted in open-ended semistructured questions (Lekunze & Strom, 2017). This study is exploratory because it is tied to gaining in-depth knowledge of strategies and methodologies to create easy-to-use banking ATM interfaces with face-to-face interviews conducted in open-ended semistructured questionnaires. Killingback, Tsofliou, & Clark (2017) differentiated between single, holistic case studies and multiple-case studies. In multiple-case approach, each case is studied as if it is a singular study and is then compared to other cases, with

the intention of analyzing each following case based on the knowledge obtained in the analysis of previous cases (Starman, 2013). In contrast, a holistic single case approach explores the same issue not by the generalization of findings, but by the different decisions and opinions explored from different case participants within one specific case (Vesna, Vugec, & Lovrić, 2017). I did not choose multiple-case studies because this study did not focus on understanding differences and similarities between strategies used by ATM system interface developers either between or within organization or among developers. I selected a holistic single case approach because this study is focused on a specific case. Therefore, single case study was selected for this study.

I considered using other designs in qualitative research such as ethnographic, narratives, and phenomenological for this study. According to Sirek (2016), ethnographic study is based on the notion that knowledge of all cultures is valuable, and centers on the systematic collection, description, and analysis of cultural group or phenomena. My study was not intended to study the culture of easy-to-use ATM system interfaces or developers, but strategies developers use to create easy-to-use banking ATM system interfaces. Ethnographic research approach is intended to describe the nature of phenomena and how the researcher can explore its reach through detailed investigation of individual cases or phenomena over a timeframe (Jowsey, 2016). My study was intended to explore the case or phenomenon. Typical of an ethnographic study is that it concerns itself with the detailed of people and cultures at the level of individuals (Dutoit, 2016). My study was intended for an in-depth understanding of single event, case or

phenomenon. Ethnographic research approach was not considered appropriate for my study.

Narrative research design was not selected for this study because this study is exploratory, in-depth, and not focused on the biographies and historical information of software developers of banking ATM systems in Nigeria. Narrative inquiry researchers adopt the use biographies, historical information (Green, 2013). Narrative research design engages storytelling as a method of inquiry (Happel-Parkins & Azim, 2017). The method of enquiry for my study was basically in-depth interview. A narrative study approach is best suited to understanding participant's life experiences, that can be described as descriptive or explanatory (Bell, 2017). This study was exploratory and was not intended to study life experiences. Therefore, narrative research design was not appropriate for this study.

Phenomenology research design was not selected for this study because this study is not focused on understanding strategies ATM interface developers use to create easy-to-use ATM interfaces based on the developer's lived experiences while strategizing how to create easy-to-use ATM interfaces but based on exploring in-depth understanding of strategies they use to create easy-to-use ATM interfaces. Phenomenological study is conceptualized as the way to understand the context of the 'lived experiences' of research participants, and the meaning of their experiences (Alase, 2017). This was not the concept of my study. Phenomenological study describes the phenomena as they appear to the person that is experiencing the concept or phenomena (Haegele, Sato, Zhu, & Avery, 2017). The concept or phenomena in my study was easy-to-use ATM interfaces.

Describing the phenomena of easy-to-use ATM interfaces as it appears to the person experiencing the concept or phenomena was not the target of this study. In a Phenomenological study, interviews are the main data collection methods which is focused on the 'lived experiences' of research participants (Kruth, 2015). This study required multiple data sources and multiple data collection methods that included interviews observations, documentaries policies, and design guidelines documents that are focused on the phenomena. I did not choose phenomenological research design for my study.

To ensure data saturation, I continued data collection with available consented participants and asked the questions that generated rich (high quality) and thick (enough quantity) data until input from new participants do not continue to generate new information or major emerging codes and categories. Also, I reviewed data from my field notes and reflective journals that contained some major issues raised during the interviews. Data saturation is reached when additional input from new participants do not continue to generate new information, or generate new themes, or continue to impact new understanding of the study topic, as revealed by the themes and sub-themes (Kline, 2017). I ensured data saturation by engaging in the following processes. First, I asked all participants the same interview questions, and in the same order, otherwise saturation would be difficult to achieve as the target would be constantly shifting. Second, I used member checking to ensure accurate and complete interpretation of the data. Third, I analyzed the semistructured interviews proceeded through coding. Coding prioritized the identification of consistent themes guided by pre-defined categories. Fourth, I established

a framework that contained all categories and subcategories used to tag the interview transcripts. This framework was expanded as the coding process continued by adding codes to capture concepts that participants brought up in the interviews. Fifth, I assessed the level of data saturation in interview data by assessing each new code or theme with the previous one for the appearance of new codes or theme, until no new information appeared in the transcript. Data saturation was reached when the transcripts are no longer revealing new information or new themes in the subsequent interview data.

I further ensured data saturation by gathering multiple sources of data from participant interviews, case organizations' regulations, policies, and design guidelines documents that are focused on strategies to create easy-to-use banking ATM system interface from participant case organization and from other non-participant case organizations. A case study approach permits an in-depth study of a contemporary phenomenon with the use of multiple sources of data from participant observation, interviews, field notes and reflective journals, and documentary (Killingback, et al., 2017). Methodological triangulation is the use of multiple sources of data that pertains to a case or phenomenon, in a case study, to gain multiple perspectives, maximize reliability and validation of data and build coherent justification of data interpretation (Durif-Bruckert, et al., 2014). I reviewed CBN documentary guidelines for ATM software designs in Nigeria as a way to ensure methodological triangulation.

Population and Sampling

The population for this research comprised ATM system interface developers within one case organization who have strategies to create easy-to-use banking ATM

system interface for people with varying abilities and literacy levels. The organization engaged for this case study was in Enugu State, Nigeria. The population consisted of ATM system interface developers who have worked successfully as ATM interface developer with the case study organization for at least 3 years and have knowledge about strategies for creating easy-to-use banking ATM system interfaces for people with varying abilities and literacy levels. This was in line with the participation eligibility criteria for selecting participants from the case organization. According to Hanson et al. (2016), eligibility criteria is necessary for selecting participants in a qualitative case study because they help define the required case participants or population. Following the eligibility criteria, the population size was estimated at 12 as the case organization is estimated to have 12 developers that meet the participation eligibility criteria.

Based on the small population size, resulting from the eligibility criteria that defines the population and the peculiarity of the study, I selected a form of purposeful sampling known as census sampling for this study. A good sampling technique is one that deploys strategies that are coherent, achievable, appropriate, and can explicitly and systematically address greater validity and stronger quality of the study (Neuman, 2014; Roy, Zvonkovic, Goldberg, Sharp, & LaRossa, 2015). Purposeful sampling is distinctively engaged as precise qualitative approach to case selection (Patton, 2015). Moreover, purposeful sampling was used mostly by qualitative case study researchers (Bogaert, Bochenek, Prokop, & Pilc, 2015; Gokmen, et al., 2017), especially where it is quite difficult to select samples by random to represent the measuring tools in the case study (Palinkas, et al., 2015), and where the intent is to sample information-rich or in-

depth cases (Benoot, Hannes, & Bilsen, 2016). According to Etikan, et al. (2016, p.3), where the number of cases being investigated is relatively small, census sampling, a type of purposeful sampling is generally used. The selection of census sampling implies the inclusion of the entire population of 12 developers as eligible participants for my study. I then requested the list of all eligible participants. I did not use random sampling method to select eligible participants from the study population because it is not coherent or appropriate with a qualitative case study. According to Annamdevula & Bellamkonda (2016), random selection of samples is a major factor in a quantitative study. This study is not a quantitative.

I ensured data saturation within this study. The consensus of many qualitative case study researchers on data saturation, is that data saturation is achieved by continuous collection of enough data to the point where additional input from further sources of data do not continue to generate new information (Marshall, Cardon, Poddar, & Fontenot, 2013; Veletsianos, & Shepherdson, 2016), or continue to impact the research question (Suárez-Guerrero, Lloret-Catalá, & Mengual-Andrés, 2016), or generate new themes (Coorey, et al., 2017). To ensure data saturation I interviewed all the participants and ensured that I asked the questions that will generate rich (high quality) and thick (enough quantity) data that there will be no more information to get. The idea of securing data saturation based on rich (high quality) and thick (enough quantity) rather than the size of the sample alone is widely approved (Azmat, & Rentschler, 2017; Morse, Lowery, & Steury, 2014). Hence, qualitative case study approach generally calls for the use of multiple sources of data (Kandasamy, et al., 2017). This is because, in a

single case study that is limited to one case organization, the external validity, which is related to generalizability, can be lacking (Stålberg & Fundin, 2016), except if the case study was strengthened with other multiple sources of data aside participant interviews, such as case organizational documents that focused on the case or phenomenon. Researchers that supported this view recommended various strategies to ensure data saturation that included methodological triangulation and member checking to secure data saturation (Hoque, Covaleski, & Gooneratne, 2013; O'Donnell, Tierney, Austin, Nurse, & MacFarlane, 2016), and to build coherent justification of data interpretation (Hoque, et al., 2013; Seth, Mustonen-ollila, Taipale, & Smolander, 2015; Yilmaz & Özkan, 2016).

I further ensured data saturation by gathering multiple sources of data from participant interviews, case organizations' regulations, policies, and design guidelines documents that are focused on strategies to create easy-to-use banking ATM system interface, both from participant case organization and from other non-participant case organizations. I reviewed Central Bank of Nigeria (CBN) documentary guidelines for ATM software designs in Nigeria. Also, I reviewed data from my field notes and reflective journals that contains some major issues raised during the interviews. I engaged member checking as a means of achieving saturation, by giving participants the ability to read the transcribed data, interpretations and by providing any corrections or additional information.

Member checking establishes a back and forth conversation between the researcher and her participants around every stage of the process of data collection as a

means achieving saturation, by giving participants the ability to read the researcher's interpretations and provide any corrections or additional information (Burda, van den Akker, van der Horst, Lemmens, & Knottnerus, 2016; Simpson & Quigley, 2016).

Methodological triangulation for a case study that employs both interviews data and data from other sources have been recommended to further secure data saturation (Ray, 2017; Visser, Bleijenbergh, Benschop, Van Riel, & Bloem, 2016). I employed methodological triangulation to facilitate validation of multiple sources of data collected through interviews, observations, and documents.

All the 12 developer participants in my case study organization were selected for semistructured, face to face interviews. Researchers have claimed that while conducting semistructured, face to face interviews, it is expedient that the interview location be determined according to participant's preference (Foley, Boyle, Jennings, & Smithson, 2017; Power, Kiezebrink, Allan, & Campbell, 2017; Spillane, Larkin, Corcoran, Matvienko-Sikar, & Arensman, 2017). This is because determining interview location according to participant's preference, serves as a methodological function that provides an opportunity to shape the research process (Ecker, 2017). However, providing appropriate interview location should not be based on technical matter of convenience and comfort alone but should be examined within the social context of the study (Ecker, 2017), and regarded as an integral part of the interpretation of the findings from the study (Foley, et al., 2017). I worked with participants to ensure that interviews were held in a suitable and quiet location at the participants' choice place with no other individuals present. This allowed participants to share personal views more freely in a setting that

will suit their comfort, convenience, confidence, and privacy. I approved a setting with the least distraction. I addressed the terms of confidentiality, explained the purpose of the interview, and made sure that all eligible participant had his consent form signed before the interview. I also informed the participants how long the interview will last. I provided my contact information (phone number and email) to participants and in like manner collected theirs. I also requested participants to clarify any doubts about the interview before commencement. I got the interview recording device and note takers ready and confirmed they are in good working condition before commencing the interview.

Ethical Research

I started recruitment of participants and data collection after Walden University Institutional Review Board (IRB) approved the study proposal and issued approval certificate. My study's IRB approval number was 11-10-17-0512580. Interviews in a qualitative case study are often considered an intrusion into participants' privacy with regard to the level of sensitivity of questions asked, and participants' time taken (Alshenqeeti, 2014). Therefore, I maintained a high standard of ethical considerations throughout the stages of the interview process. I ensured that the three major ethical principles of respect for persons, beneficence, and justice representing the key ethical concerns for human subject protection in research were fully adopted as identified in The Belmont Report (1979). The Belmont Report was considered the basic ethical principles for the protection of human subjects in this research (The Belmont Report, 1979). I also took the NIH training course for conducting research while protecting human subjects (see Appendix B). Also, Walden's IRB guidelines and application of ethical principles

were considered in several activities performed during the execution of the study.

Belmont Report on respect to persons was based on two distinct principles:

- Participants should be treated as autonomous agents in a manner that accords them the capacity to be treated with respect, by according them the right to hold views, make choices, and take action based on personal values and beliefs. (Bristol, & Hicks, 2014).
- Participants with diminished autonomy should be entitled to additional protections (Judkins-Cohn et al., 2014).

Research ethics applications are expected to address key factors such as informed consent, confidentiality, anonymity, data protection, data storage, and participant/researcher safety (Barnard, 2016). A letter of cooperation (Appendix C) and Letter of Invitation to participants (Appendix D), as listed in the table of contents, were designed to request for permission from participants' organization, and from each of the participants respectively. I first requested consent from the head of the participating organization, who signed the letter of cooperation (Appendix C). Such request was granted before any interview with the participants commenced. Also, I requested each participant to complete and sign the consent form before their participation in the study. All the informed consent forms were signed in two copies so that every participant will keep a copy of the signed consent form.

The informed consent gives each participant autonomous right to voluntarily enroll in the research and voluntarily withdraw at any point in the course of the study (Agu, Obi, Eze, & Okenwa, 2014). As an important requirement for all ethical conduct of

human subjects' research, I made all eligible participants aware, through the consent form, of their right to withdraw from participating in the study before, during or after data collection. If participants declined after or during data collection, the data already collected from such participant were deleted, and the participant duly informed. Three elements of informed consent that are important to this study identified by Belmont Report of 1979 are: information, comprehension, and voluntariness (The Belmont Report, 1979). I gave participants sufficient information to allow them to make an informed decision. As part of obtaining informed consent, I communicated the purpose and objective of the study to each participant before commencing the interviews. As part of the Belmont Report relating to information, comprehension, and voluntariness, participants reserve the right to voluntary participation, and withdrawal at any time in the course of the interviews (Bromley, Mikesell, Jones, & Khodyakov, 2015; Hackett et al., 2014; Wiig, et al., 2014). I reminded the participants of the objective of the study, their confidentiality and voluntary participation, and their rights to skip any or some questions that they do not want to answer or to refuse participation in the study at any point in time or withdraw all or part of the information already given even after the completion of data collection without any prejudice or penalty. This was necessary to prevent participants from discomfort.

I motivated the participants by promising them that they share similar interest and value in this study, and that the final result of this study will be made available to them. This provided enough incentives for the participants to willingly partake in the interview. Distrust and lack of motivation are major barriers to implementing quality and valid

systems rather than lack of incentives (Scholte, Neeleman-van der Steen, van der Wees, Nijhuis-van der Sanden, & Jozé, 2016). Where participants share similar interest and value in a study, they will equally be motivated to optimize the quality of responses they will give (Moore et al., 2016), which will result in reliable performance during data collection (Botje, et al., 2016; Holden, McDougald-Scott, Hoonakker, Hundt, & Carayon, 2014). I did not give the participants any monetary incentives but encouraged them to share in the value of the study.

I assured the participants of confidentiality for all data collected during the study. Where there are numerous assurances of confidentiality and privacy throughout a research process, trust and privacy are reinforced (Marsh, Shawe, Robinson, & Leamon, 2016). I recognized participants' entitlement to privacy with their rights to confidentiality. No participant rejected audio recording, otherwise note taking of the interviews would have been used. Interviews were scheduled at a time and location convenient to the participants, that accorded them full privacy and confidentiality. I assured participants that there would be no mention of their names or organization either in the data collected, transcribed results, analyzed results or in the file and disks where they are stored to ensure anonymity.

To protect the confidentiality of participants, I stored all data in a password protected computer files, and backed up in an external hard drive. Hard copies of the transcribed documents and the downloaded and backed up file in the external hard drive were locked up in a filing cabinet that is strictly under the researcher's custody and accessible only by the researcher. I will retain these data in a secure place for 5 years to

protect the rights of the participants. At the end of the stipulated 5 years, I will delete and shred as applicable, all data collected pertaining to the study.

I protected names of participants or organization through confidentiality. Pseudonyms or numerical codes are often used to preserve anonymity (Beltran-Aroca, Girela-Lopez, Collazo-Chao, Montero-Perez-Barquero, & Munoz-Villanueva, 2016; Lin, 2016; Marsh, et al., 2016). I achieved anonymity by using codes such as “organ” for name of organization, and participant 1, participant 2, participant 3..., participant n, to represent names of the participants. In this way, I ensured that all data, including interview transcriptions, audio files bore only participants’ and organizations’ codes in place of their real names. Any other names of objects or places that may be a pointer to identifying participant’s real names, office or position in the office, I substituted with codes. All participants were given the right to leave the interview at any point during the interview process. I engaged member checking to examine and confirm interview data for corrections, additions or complete deletion if participant decides to back out completely. I informed participants that the results of this study may be published at research conferences, peer review journals, D.I.T thesis and through other public presentations that may arouse possibility of social change among other social needs. I also assured them of anonymity in all future publications resulting from the data collected.

Data Collection

Data collection process for this study comprised the data instruments that was used, the techniques used to collect the data, and the techniques used to name the data files and organize them to facilitate their quick and safe access.

Instruments

Researchers are considered as the primary data collection instrument in a qualitative case study (Gabriel, 2015; Sorsa, et al., 2015; Tracy, Eger, Huffman, Redden, & Scarduzio, 2014), because the data are mediated through the human instrument (researcher), rather than through questionnaires or machines or inventories (Pugh, 2013; Sorsa, et al., 2015). In this case study, I am the primary data collection instrument. Other data collection instruments I used in this study are the semistructured interview guide (Appendix E) and interview protocol (Appendix A) that were used to gather data from the participants. It is also expedient that researchers maintain reflective journals as an instrument for data collection (Spillane, et al., 2017), that keep track of how researchers think in action, take decisions, and their rationale for such decisions and critical thoughts (Dyment & O'Connell, 2014; Ibrahim & Edgley, 2015; Starr-Glass, 2014). Maintaining reflective journals also helps to keep track of researchers' holistic view of their experiences (Rahgozaran & Gholami, 2014; Ryan, 2013), their own research process and challenges (Orange, 2016), their research practice in the light of their study content (Mayes, Dollarhide, Marshall, & Rae, 2016), and qualities in themselves of which they were unaware (Vandermause, Barbosa-Leiker, & Fritz, 2014) that might impact the case study. Researchers also use field notes to capture contextual information about the interview (Lambotte & Meunier, 2013). I engaged reflective journals and field notes as instruments for data collection.

I used semistructured interview questions (Appendix E) and the interview protocol (Appendix A) to gather data from the participants. The hallmark of case study

research has been emphasized by researchers as the use of multiple data sources, a strategy to gain multiple perspectives and validation of data (Carter, et al., 2014; Kaufmann, Stämpfli, Hersberger, & Lampert, 2015; Ledo-Andión, López-Gómez, & Castelló-Mayo, 2017), which also enhances data credibility, and triangulation (Hanney, Greenhalgh, Blatch-Jones, Glover, & Raftery, 2017; Mccardle, & Hadwin, 2015; Patton, 2015). I asked the participants to bring any available documents, historical documents, case organization regulations, policies, and design guidelines documents that is focused on strategies to create easy-to-use banking ATM system interface for people with varying abilities and literacy levels. I worked with non-participant members of other case organizations to collect their policy and design guidelines that focused on strategies to create easy-to-use banking ATM system interface. I reviewed the CBN documentary standard and guidelines on ATM operations in Nigeria and saw how the organization guidelines match with them. Also, I reviewed my field notes and reflective journals that contain some major issues raised during the interviews.

I used member checking to enhance the reliability and validity of the data collection instrument. Researchers have used member checking to establish a back and forth conversation between the researcher and her participants around every stage of the process of data collection (Burda, et al., 2016), including the framing of the research question, vetting of semistructured interview guide (Appendix E), the process of data analysis, interpretation, individual themes, participant themes (Balasubramanian, 2017; Martinus & Hedgcock, 2015; Simpson & Quigley, 2016), presentation of findings, to check if their interviews matched what they actually meant (Ghiga & Stalsby, 2016;

Taylor & Thomas-Gregory, 2014), and ensuring that accurate findings had been extracted from the interviews (Ang, Embi, & Yunus, 2016; Birt, Scott, Cavers, Campbell, & Walter, 2016). Researchers also recommended member checking as the most crucial technique for establishing validity and credibility of instruments used in a qualitative case study (Caretta, 2015; Grieb, Eder, Smith, & Calhoun, 2015; Hoque, et al., 2013; O'Donnell, et al., 2016; Thomas, 2016). I iteratively conducted interviews and follow up interviews with participants until participants' responses led to no new data (member checking).

I used methodological triangulation to enhance the reliability and validity of the data collection instrument. I also adopted the use of multiple data sources, such as available documents, multimedia sources, or historical documents, case organization regulations, policies, and design guidelines documents that is focused on strategies to create easy-to-use banking ATM system interface to engage methodological triangulation. Case study researchers have recommended the use of multiple data resources to gain multiple perspectives and engage methodological triangulation that will maximize reliability and validation of data (Carter, et al., 2014; Yüzbaşıoğlu & Babadoğan, 2016), and build coherent justification of data interpretation (Hoque, et al., 2013). I also engaged methodological triangulation using the study databases, case organization regulations, policies, and design guidelines documents, transcribed data to maximize validity and reliability of data collection instrument.

Data Collection Technique

Multiple sources of data collection identified earlier in this qualitative case study are: in-depth interview with participants, using open ended semistructured questions (Appendix E) and interview protocol (Appendix A), case organization regulations, policies, and design guidelines documents that are focused on strategies to create easy-to-use banking ATM system interface for people with varying abilities and literacy levels, other case organizations design guidelines that focused on strategies to create easy-to-use banking ATM system interface.

The data collection process for this study included semistructured, in-depth face-to-face interviews with nine banking ATM system interface developers, and a review of eleven documents that focused on strategies to create easy-to-use banking ATM system interface. The use of multiple data sources has been recommended researches for a qualitative case study (Bendassolli, 2013; Carter, et al., 2014). These eleven documents comprised of five documents from participant case organization and six documents from non-participant organization that focused on strategies to create easy-to-use banking ATM system interface. Five documents from participant organization included documents on: regulations and ATM technology and specification, user interface design guidelines for creating easy to use interfaces, user requirements analysis procedures, proactive and reactive (feedback) guidelines, and system development and simulation procedures. Six documents that came from non-participant case organizations were Standards and Guidelines on ATM Operations in Nigeria, and Guidelines on Operations of Electronic Payment Channels in Nigeria from CBN, eighty ATM system interface

screen shots, Systems Development Life-Cycle Phases, Field notes, and Reflective journals. This is shown in Table 3.

Interview data collection technique chosen for this qualitative case study, was explored through face-to-face, and member checking. Some researchers have criticized interviews with the claims that interviews have potential for subconscious bias and inconsistencies (Alshenqeeti, 2014), are never 100% anonymous (Alshenqeeti, 2014), time-consuming (Martinus & Hedgcock, 2015), and very subjective and can change over time according to circumstance (Alshenqeeti, 2014; Oates, 2015). Researchers also claimed that responses from interviews might be at a considerable distance from reality (Littig & Pochhacker, 2014), because interviews alone are insufficient form of data to make an in-depth study in a qualitative case study as both the researcher and participant may have incomplete knowledge or even faulty memory (Alshenqeeti, 2014; Littig & Pochhacker, 2014).

Interviews in a qualitative case study are worthwhile because it offers researchers the opportunity to uncover in-depth information that might probably not be accessible using techniques such as questionnaires and observations (Alshenqeeti, 2014). Aside being a data collection tool, interviewing can ensure a mutual understanding between the researcher and the participants, thereby providing appropriate answers and, subsequently, more accurate data. With interviews, there is high response rate with little or no chances of having incomplete answers. This is because data can be explored reviewed and recorded several times as required by the study to ensure accuracy of interview data

(Oates, 2015). Interviewing can involve reality, with the researcher in full control of questioning and answering sequence. Therefore, the interview method was selected.

Researchers have claimed that face-to-face interviews can deliver biased responses (Qiu & McDougall, 2013; Vogl, 2013), can be costly and time consuming in terms of the required significant amount of time to identify, recruit, and schedule the interview, as well as the travel time and costs to meet the respondent in person (Mason & Ide, 2014; Quartiroli, Knight, Etzel, & Monaghan, 2017). However, face-to-face is considered very effective and has been supported by many empirical studies (Vogl, 2013), allows for more in-depth data collection and more clearly identified and understood body language and facial expressions (Min, 2017). Missing face-to-face contacts can make a conversation appear less personal and more anonymous but it can deny the researcher access to the right participant, which is the most important aspect of in-depth interviewing (Min, 2017). Face-to-face has been recommended as the most common method for conducting qualitative interviews (Mealer & Jones, 2014).

For participant interviews, I used face-to face interviews. Face-to-face interviewing is the most widely used form of data collection technique in qualitative research (Janghorban, Roudsari, & Taghipour, 2014, p.1; Reid & Mash, 2014; Stahl, 2014). With IRB approval and case organizational consent to participate, I established the eligible participant's names and contacts information through the organization's information system. I met the participants with a letter of cooperation from the organization (Appendix C), to seek for their consent to participate. On showing interest to participate, I got the participant to sign the participant consent form, thereafter I arranged

for time and location of the semistructured face-to-face interview at the participant's comfort, convenience, confidence, and privacy. I adopted face-to face interviews approach while administering the semistructured questions using the interview protocols, at a time and location preferred by the participant. With the interview protocol (Appendix A), I ensured that the same questions, in the same order, are asked to all participants to eliminated or minimized bias and inconsistencies that may adversely influence the reliability or validity of the interview data. I audio recorded, transcribed and evaluated the interview data. For case organization design guidelines documents, I collaborated with senior officials of the participant case organization, and other case organizations, including CBN, and collected their respective organizational documents that are focused on strategies to create easy-to-use banking ATM system interface.

Member checking establishes a back and forth conversation between the researcher and her participants around every stage of the process of data collection as a means achieving saturation (Burda, et al., 2016; Simpson & Quigley, 2016), and a means to give participants the ability to read the researcher's interpretations and provide any corrections or additional information (Baillie, 2015; Caretta, 2015; Grieb, et al., 2015; Hoque, et al., 2013; O'Donnell, et al., 2016; Thomas, 2016). After the interviews, I established a follow-up interviews and conversations for member checking. During member checking, I made available the interview transcriptions, the updates and reviews from organizational and CBN design guidelines documents to each of the participants for an opportunity to review, correct, modify, confirm, or add as occasion demands. I also

submitted the summaries from my field notes and reflective formal to each of the participants to review, correct, modify, confirm as necessary.

Data Organization Techniques

In this qualitative case study, I established a means to promote critical thinking and to facilitate the exploration of study process and sections facilitated through several complementary forms within the study. An effective means to facilitate this process is through a reflective journal (Herrington, Parker, & Boase-Jelinek, 2014). Reflective journal is all about how researchers or professionals think in action (Dyment & O'Connell, 2014; Ibrahim & Edgley, 2015). According to Ryan (2013), and Rahgozaran and Gholami (2014), a reflective journal extends beyond the narrower focus in that it encourages the researchers to take a holistic view of their experiences. A reflective journal provides researchers an effective means to promote critical thinking (Starr-Glass, 2014), accomplish them to understand their own research process (Orange, 2016), reflect on their research practice in the light of their study content (Mayes, et al., 2016), and to discover qualities in themselves of which they were unaware (Vandermause, et al., 2014). I kept record of my thoughts, notes, and my reflection about the study process, reviews and feedback. I also kept record of questions about the study topic and some issues or activities related to this study. I specified them by the sections of this study where applicable. Therefore, I kept reflective thoughts that span through the sections of this study: prospectus, proposals, to result generation.

Deploying an efficient and effective system for tracking, processing and managing interview data is the key to a successful data organization and timely

completion of a research study (Dumbill, 2014). First, I created a database to make the raw data collected available for independent inspection. I achieved this by creating a table of data file identification comprising of the following fields for recording participant's responses

- Participant identification number comprising of the identifier “participant” and a serial number e.g. Participant#2 (second interviewed participant),
- Date data was collected,
- Type of interview (first interview or follow up (2nd interview or 3rd). For example, data from participant#2 in a 2nd and 3rd interview was named participant #22 and participant#23 respectively.

One major advantage of developing a formal presentable case study database is that it increases the entire reliability of the entire case study as it enables, in principles, the researcher and other researchers to review the evidence directly and not limited to the written case reports (Patton, 2015; Goldberg, & Allen, 2015). It also provides ready and easy access to the data sources, thereby making it easy to present accurate findings. I recorded the interviews with the participant case study database identifications embedded in the interview recordings, to link the data to the source in the event of clarifications or callbacks or cross-referencing so that responses can be efficiently recalled for sorting and examination over the course of the study. All data were stored anonymously. Third, I got the recorded interviews transcribed (interview summary) and shared the interpretation of the interview with the participants for their review and approval as a form of member checking or validation. This was necessary to make sure that the data I was about to

analyze, correctly represented what was collected from the participants. Forth, realizing that case study research is flexible, I systematically documented any observable changes, and stored all data in all formats that can be analyzed by ATLAS.ti7 - Windows software for qualitative analysis and can be referenced, sorted so that converging lines of inquiry and patterns can be uncovered.

Researchers have suggested specific established protocols for creating quality file naming and data tracking system that included, but not limited to, the following fields: file recipient's name, project name, agency name, date, initials of person who collated the data, and for documenting details regarding the data frame, such as the inclusion of a brief description, code meaning where applicable (Dehart & Shapiro, 2017; Piña & Sanford, 2017). File naming is an essential part of good data management. I created a system for labeling and storing interviews that ensured unique name or case identifier for each file that communicated crucial information about the participant or interviews. I adopted consistency in the file naming and printed the file name on the footer of all study documents for easy identification and quick retrieval. All data collected, transcribed results, analysis results were systematically named also, for easy identification and retrieval. File names depicted date of data collection, type, place, when and who it was collected from, using codes, with no mention of participant's real name, position or office, either in the file or on the disks where they are stored. This made sure I have a way to identify the source of all data, for possible review or follow-up questions even after data collection. This also ensured anonymity and confidentiality as contained in participants' consent forms.

Data collected such as interview transcript were structured and organized in an MS Word™ document file format while audio recordings were in Mp3 format to encourage secured upload into ATLAS.ti7 - Windows qualitative analysis software, for easy cross-comparison of data within transcripts. ATLAS.ti7 - Windows software is appropriate for analyzing textual data (Dehoff, 2015; Hall & Beatty, 2014; Talanquer, 2014). This minimized all forms of delay in the data analysis process, and the amount of information that could be processed, retrieved, and remembered. I made a copy of all the data collected, original, reviewed or transcribed with proper identification code to each, and proper system of ordering. For each file, I also kept one copy to work from and another as backup for safekeeping. Backups were updated as data preparation and analysis proceed. All data were stored in a password protected computer files, and also backed up in an external hard drive. I downloaded all electronic data collected into a USB flash drive and an external hard disk drive. I secured these interview data and data from other sources under lock and key in a filing cabinet that was strictly under my custody, preferably in my study room. This will be maintained in a secure place for 5 years to protect the rights of the participants. At the end of the stipulated 5 years, all data collected, electronic or hard copy, will be deleted and shred as applicable.

Data Analysis

Data collected in this study were mediated through participants' interviews, case organization regulations, policies, and design guidelines documents, other case organizations design guidelines that focused on strategies to create easy-to-use banking ATM system interface, guidelines for ATM software designs in Nigeria from CNB, and

field notes and reflective journals that contain some major issues raised during the interview. Researchers in qualitative case study should bring together all the data sources: interviews, observations, archival documents, images and text (the patches) to quilt together both broad and varied sources (Lambotte & Meunier, 2013). According to Stewart and Gapp (2017), all data sources that related to the case should be transcribed. I transcribed all audio-recordings, all design guidelines documents from the participant organization and non-participant organizations that focused on strategies to create easy-to-use banking ATM system interface.

With these sources, I generated significant amount of multi-faceted data to explore the case. Also, these data sources were employed to implement methodological triangulation, and further secure data saturation as noted by Ray (2017). Some qualitative single case researchers have recommended methodological triangulation that incorporated one-on-one interviews as well as a review of secondary data such as documentaries, web searches, annual reports, board observations and board workshops applicable as useful in confirming, complementing or disconfirming perspectives obtained from study (Booth, 2016; Visser, et al., 2016). Researchers have defined triangulation as a qualitative research design guideline or strategy used to enhance trustworthiness, test validity, develop more comprehensive understanding of phenomena through the convergence of information from different sources, or from multiple methods or data sources (Annansingh & Howell, 2016; Padgett, Gossett, Mayer, Chien, & Turner, 2017; Kaufmann et al., 2015). Triangulation empowers each of these multiple sources or methods to inform, and be informed by each other, and to integrate data into one overall

performance (Deng & Benckendorff, 2017; Ford, Jones, Wong, Clark, & Porter, 2015).

Four types of triangulation for case study are: method triangulation, theory triangulation, investigator triangulation, and data source triangulation (Bidit, Binsardi, Prendergast, & Saren, 2013; Hoque et al., 2013; Johnson, et al., 2017; Kaufmann et al., 2015).

In investigator triangulation, two or more researchers participate in the same study to provide multiple observations and conclusions which can bring both confirmations of findings and different perspectives, adding breadth to the phenomenon of interest (Annansingh & Howell, 2016; Kaufmann et al., 2015). This was not applicable for my study because I am the only researcher to my study. Theory triangulation uses different theories to analyze and interpret data (Hoque et al., 2013). With this type of triangulation, different theories or conceptual frameworks can assist the researcher in reasonably supporting or refuting findings (Carter et al., 2014; Kaufmann et al., 2015). Also, theory triangulation was not appropriate for my study because I used only one conceptual framework in my study. Data source triangulation involves the use of a variety of data sources to determine whether the case being studied remains the same at all times with an additional value of contextual validation (Annansingh & Howell, 2016).

My study was not intended to determine whether the case being studied remains the same at all times or for contextual validation, because my case study was dynamic; strategies are not expected to remain the same at all times. Methodological triangulation involves the use of multiple data sources and multiple methods to analyze and correlate data collected from multiple sources (Deng & Benckendorff, 2017; Johnson, et al., 2017), to study a single phenomenon or case (Annansingh & Howell, 2016). Case study

research has been emphasized by researchers as the use of multiple data sources, a strategy which also enhances data credibility (Goldberg, & Allen, 2015; Mccardle, & Hadwin, 2015; Patton, 2015). Potential data sources in a qualitative case study may include, but are not limited to: documentary, physical artifacts, archival records, direct observations, interviews, and participant-observation (Booth, 2016). Methodological triangulation is designed to complement the multiple sources of data from in case study by the application of multiple methods data analyzes, data storage methods, transcription of audio sources and verifying same. Therefore, I adopted methodological triangulation for my study.

Adopting method triangulation, I started by transcribing all interviews verbatim, and replaced the names of participants with codes during each interview transcription. I also transcribed the design guidelines and documents from my case organization and those from other case organizations that focused on strategies to create easy-to-use banking ATM system interface. I transcribed my field notes and reflective journals to serve as preliminary analysis of the data, because they contain some major issues raised during the interviews. I analyzed the data using thematic analysis. Thematic analysis is a flexible tool to analyze qualitative data in a rich and detailed way (Pfeiler-W, Buffington, Rao, & Sutters, 2017) by identifying important patterns in the data, and making sense of them through the process of systematic reading and re-reading of the data (Connell, Schweitzer, & King, 2015; Yukhymenko, Brown, Lawless, Brodowinska, & Mullin, 2014), or through deriving coding categories (Ahmed, et al., 2016; Brailas, et al., 2017).

Analysis of data was facilitated using ATLAS.ti7. Some available software for qualitative data analysis (QDA) exists. They include (but not limited to) ATLAS.ti7, NVivo, N6, HyperResearch, MAXqda, Qualrus, NUD*IST, Qualrus and the Ethnograph (Ang et al., 2016; Cope, 2014). ATLAS.ti7 has been used by most researchers to analyze and evaluate their qualitative data (Budzise-Weaver, Goodwin, & Maciel, 2015; De Gregorio, 2014). According to Humble (2015), Rodik and Primorac (2015), the most frequently used qualitative analysis software were ATLAS.ti7, MAXQDA and NVivo. Although ATLAS.ti7 is a program that works on counting quotations and the codes associated with them, the counting must result from a cognitive and interpretative work of the researcher. This is because QDA programs do not do the analysis for anyone but do facilitate the process. ATLAS.ti7 has good platform for managing large, complex data sets, and for coding a lot of text or images, videos, etc. with ease. It can conduct searches, visualize qualitative data, and discover, test and describe patterns and themes in the data (Ang et al., 2016).

ATLAS.ti7 attends well to QDA to coded interview transcripts and encourages interactions and conversions with most file types such as Word to, Rich Text (.rtf) files, to PDFs, GIF and JPEG images. It also encourages interactions and conversions from Windows Media Format Files (.wma) and QuickTime (.mov), to many other text, image, audio and video formats. I adopted ATLAS.ti7 (version 7) software for the analysis of data collected in this study because of its good features. During data collection and analysis, I loaded the transcribed data into ATLAS.ti7, with one document for each participant. I created separate documents for each log and each participant to allow for

the possibility of comparing data among participants. Also, decisions for assigning codes, such as phrase, sentence, or paragraph were made. In ATLAS.ti7, one can select a complete sentence and apply codes to it (Olson, McAllister, Grinnell, Walters, & Appunn, 2016).

A logical and sequential process for thematic analysis of data in this study was carried out. I transcribed interviews verbatim and familiarized myself with all the data sources. I also transcribed other data sources such as design guidelines documents from participant and nonparticipant case organizational guidelines for ATM software designs in Nigeria from CNB, field notes and reflective journals. I used member checking to establish a back and forth conversation with the participants on the transcribed data for interpretations, corrections, or addition of new information, to enhance data reliability, validity, and saturation. I generated initial codes for the transcribed data. When codes emerged, I conducted a co-occurrence analysis to identify more frequently used codes to further examine their occurrence. Where applicable, Microsoft Excel was used to create histogram for clearer views based on data exported from ATLAS.ti7. I searched matching codes or themes. I presented quotations, together with the corresponding participant codes to illustrate how each theme was derived from the data.

I also identified major themes and their related subthemes with precise illustrations. Themes represent patterns across data sets (Ghosh, Kim, Kim, & L-Callahan, 2014; Mador, Kornas, Simard, & Haroun, 2016), or clusters of data units grouped together as important categories or subcategories about the data set (Houghton, Murphy, Shaw, & Casey, 2015), or some level of patterned response or meaning within

the data set (Fukawa & Erevelles, 2014; Hurt, Lynham, & McLean, 2014), that are important to the description of the case study in relation to the research question. I reviewed themes, defined, and named them. I compiled report of the analysis and reviewed report with participants through member checking. I updated all possible corrections from reviewed reports, and finally presented them as my final results. Finally, I selected these themes and aligned or tied them to the research question and literature, in order to produce a scholarly report from the analysis. The major research question for this qualitative case study was “What are strategies used by software developers of banking ATM systems in Nigeria to create easy-to-use ATM system interfaces”? Interview questions that addressed my research question were shown in Appendix E. I also presented any discordant findings or those that ran contrary to generated themes,

Reliability and Validity

A measure is reliable when it is consistent, without bias, and measures the concepts it is supposed to measure (Dikko, 2016). Where the same test questions administered to the same participants at different times result in the same data, reliability is established. (Dikko, 2016). Validity is a characteristic that the instruments of measurement used adequately represent items that operationalize the study concept (Zamanzadeh, et al., 2015). According to Trochim and Donnelly (2008), measures, samples, and design don't have validity, but it can be said that measures or samples, or design lead to valid conclusions. The essence of qualitative research is to recognize patterns and themes among words that make sense without compromising its richness and dimensionality (Leung, 2015; Vaismoradi, Jones, Turunen, & Snelgrove, 2016).

To address validity and generalizability issues in a qualitative research case study, a holistic approach is required in the analysis (Khan, 2014). According to Macduff, Stephen, and Taylor (2016) four elements that comprised the original trustworthiness framework or criteria have been substituted as techniques for measuring validity and reliability in a qualitative study. They are:

- dependability
- credibility
- transferability and
- confirmability.

Dependability

Dependability aimed at finding out if the research findings will be stable and consistent over time and across similar conditions (Kanavaki, Rushton, Klocke, Abhishek, & Duda, 2016). Dependability estimates the importance or usefulness of the quality of the processes of data collection, data analysis, and result generation (Watson & Downe, 2017). In brief dependability deals with the issue of replicability of a study enhanced by logical and appropriate reporting of data sampling, data collection and analysis procedures within the adopted methodology (Clarke, Swinburn, & Sacks, 2016). It attempts to answer the question: Would the same data collection methods within the same context, same methods and with same participants yield the same or similar results? This question can be answered by engaging external audits or inquiry audits that can constitute important strategy for feedback, to assess dependability (Miles, Huberman, &

Saldana, 2014). Billups (2014) recommended some options for external auditing that can yield dependability:

- engaging institutional research colleagues at other institutions to review all of your research procedures and findings,
- engaging a faculty member or team of faculty to collaborate, building partnerships to ensure subsequent acceptance of the findings, or
- engaging fellow professional experts or participants with research experience to serve as the external auditors.

In this study, I adopted the second and third options to generate alternate perspectives to ascertain ‘truthfulness’ and also developed partnerships. The second option above was implied as I already have faculty and other committee members whose intentions are to enforce dependability. In addition, I engage extensively the third option above. The target population frame comprised only experts and experienced banking ATM software developers. ALL participants for this study were chosen from among experts from ATM system interface organization. I used one or two of experts who were not among the study participants to serve as external auditors.

Credibility

Credibility employs the techniques to show that the results are believable, appear truthful, and captured a holistic representation of the phenomenon under exploration (Amukugo, Jooste, & Van, 2015). Credibility is a technique employed to evaluate whether or not the findings in the study represent a believable interpretation of the data

collected from the participants (Savage & McIntosh, 2016; West & Moore, 2015). I achieved this through member-checking as discussed earlier in this section.

I adopted member checking with a continuous follow-up interview with the participants to discuss the transcribed data and interpretation of the interviews and the research findings. I had the participants review the interpretation from the interview to ensure the transcription is what they meant and provide necessary changes and clarifications before I proceeded with analysis of the contents. This feedback served as a way to gather additional data that might add to the credibility of this study. I also presented recorded interviews and the interview transcripts to the participants for confirmation. I collected their response, checked insights from one participant with another and also determined the accuracy of the research findings. This I did by taking the final report or specific descriptions or themes back to the research participants and synthesizing the opinion of the participants about the accuracy of the findings. I achieved credibility by requesting the participant feedback, on the interpretations from the interview transcripts.

Transferability

Transferability in a qualitative case study can be confirmed by ‘rich’ and detailed description, and comprehensive reporting of the study process (Bokaie, Simbar, & Ardekani, 2015). Transferability intends to answer the question: Are these findings comparable? Qualitative research aims at producing findings that can be interpreted by other researchers for similar settings, or within their own research design and purposes. According to Henry and Foss (2015), transferability is achieved when a study is

described with sufficient detail such that other researchers can begin to evaluate the extent to which the conclusions drawn from such studies are transferable to other times, settings, and situations. In other words, transferability is the degree to which the findings can apply or be relevant beyond the current study or in another context (Hjelm, Holst, Willman, Bohman, & Kristensson, 2015). I achieved transferability through extensive detail and explicit descriptions during interviews, conversations, observations, and during data collection. This practice allowed me to evaluate comparable transferability of the same circumstance of this study under similar conditions, with similar participants. Efficiency and expediency must not supersede comprehensiveness (Billups, 2014; Lewis, 2015). That is, careful construction and use of qualitative instrumentation, supported by efficient interviews, is essential to ensuring transferability. The more detailed and nuanced information I generated from the study, the greater the likelihood that the findings can be applied to a similar setting, population, or case. The concept of generalizability is not applicable in this study because it is not a quantitative study. However, the relevance of transferability is of paramount importance.

Confirmability

Confirmability refers to the idea that the research findings and interpretations are linked to data in ways easily understood by others (Grieb, et al., 2015). Confirmability measures how well the data supports the findings (Hjelm et al., 2015). Fujiura (2015) viewed confirmability as the degree to which the findings are shaped by participants' responses rather than the researcher's bias, interest or motivation. Confirmability intends to answer the question: To what extent has the researcher worked to neutralize his or her

own bias, motivation or interest as findings are reported? Can one find other ways to corroborate this study results? Two of the most commonly applied strategies to ensure confirmability in a qualitative study include audit trails and reflexivity (Willgens et al., 2016). Triangulation in addition to audit trails and reflexivity are included in the plans to ensure confirmability (Ergene, Yazici, & Delice, 2016).

According to Auger (2016), audit trails are likened to a research study blueprint that outlines detailed procedural records maintained by the researcher. Therefore, confirmability can be achieved by making one's study blueprint accessible to an external researcher so that s/he can attempt replication. If a study can be replicated with similar results, confirmability is strengthened (Billups, 2014). I achieved confirmability through reflexivity. Reflexivity demands that I continuously keep records of what I know about myself and the participants in relation to this study, in such a way that I offset preconceived notions about the research which might interfere with data analysis and interpretation, thereby implementing confirmability or neutrality.

Transition and Summary

Section 2 of this study began with the restatement of the project purpose. It presented a detailed description of researcher's role, the participants, the target population of study and the relationship that existed between the researcher and the participants. The methodology for this qualitative research study adopted a case study design that provided rich, in-depth study of the participants' experiences, and the adoption of context-based multiple in-depth data collection from multiple sources, and primarily inductive analysis and reporting. This study is exploratory in nature, and

therefore adopted a qualitative research that offers best opportunity to explore multiple, in-depth data collection that explored the case, generate the expected reports, codes and themes. The study research design was a qualitative single case non-experiment design. The sampling techniques employed a purposive sampling. Three major ethical principles of respect for persons, beneficence, and justice, adopted as key ethical concerns for human subject protection in clinical research as identified in the Belmont Report was considered the basic ethical principles for the protection of human subjects in this research. Also, Walden IRB guidelines and application of ethical principles were considered in several activities performed during the execution of the study. The research instrument was designed to collect data using a semistructured interview guide (Appendix E) after an extensive literature review and consultation with experts in software interface development.

The data organization technique for this study supported well secured data and information. Data analysis employed open coding approach that examined the text and also analyze it by topics through data reduction and applying constant comparison techniques to obtain a holistic impression of the content. Trustworthiness framework or criteria substituted as techniques for measuring validity and reliability in a qualitative study: dependability, credibility, transferability and confirmability were adopted.

Section 3 will present the findings from my research study, describe applications for professional practice, implications for social change, recommendations for future actions and further study, and offer reflections from the study conducted, with strong concluding statement.

Section 3: Application to Professional Practice and Implications for Change

In this study, I explored strategies to create easy-to-use banking ATM system interfaces for people with varying abilities and literacy levels. In this section, I provide the research findings addressed by the analysis of the evidence collected, and how these findings may be applicable to the society to bring social change expressed in terms of tangible improvements to individuals, communities, institutions, and professional bodies. This section also includes recommendations for actions and further study and a final reflection with strong concluding statement.

Overview of Study

The purpose of this qualitative case study was to identify strategies software developers of banking ATM systems in Nigeria use to create easy-to-use ATM system interfaces for people with varying abilities and literacy levels. The data for this research study came from semistructured interviews conducted with one ATM system interface developer organization in Enugu, Nigeria, and from documentation from participant case organizations and other nonparticipant case organizations. Data also came from my field notes and reflective journals. Findings showed strategies that software developers of the banking ATM system interface in Nigeria use to create easy-to-use ATM system interfaces for people with varying abilities and literacy levels.

Presentation of the Findings

The research question at the beginning of this study was as follows: What are strategies used by software developers of banking ATM systems in Nigeria to create easy-to-use ATM system interfaces? Four major themes emerged from the data analysis

from this study: (a) importance of user-centered design strategies, (b) importance of user feedback as essential interface design, (c) value of pictorial images and voice prompts, and (d) importance of well-defined interface development process. These four major themes illustrate potential strategies software developers of banking ATM systems in Nigeria use to create easy-to-use ATM system interfaces for people with varying abilities and literacy levels. A frequency table is presented under each theme's discussion to illustrate the findings. Each table consists of subjective columns that indicate the frequency of participants who made significant contributions to the theme, and the number of documents that contained important components of the user-centered design strategy (the theme).

All participants in this study were qualified and experienced banking ATM system interface developers who had strategies to create easy-to-use ATM system interfaces for people with people with varying abilities and literacy levels. Participants lived in Enugu and had worked in the participant case organization for the last 3 years. My targeted number of participants for this study was 12. One participant declined, and another travelled out of town (Enugu), leaving a total of 10 participants who could be interviewed. As a strategy towards conducting credible research and to ensure data saturation, I interviewed all participants who consented and were available until there was no new information being provided and no new major emerging codes and categories. Data saturation from the interview data was reached with the ninth participant. There were altogether two women and seven men who were interviewed. The proportion

of male to female participants did not pose any bias because the research question or the interview questions were nongender sensitive.

I used methodological triangulation to analyze the two major sources of data, which were semistructured interviews and 11 documents that focused on strategies to create an easy-to-use banking ATM system interface. These documents comprised of five documents provided for use by the participant case organization that centered on regulations and ATM technology and specification, user interface design guidelines for creating easy to use interfaces, user requirements analysis procedures, proactive and reactive (feedback) guidelines, and system development and simulation procedures. I was also provided with six documents from nonparticipant case organizations, two of which came from Central Bank of Nigeria: Standards and Guidelines on ATM Operations in Nigeria and Guidelines on Operations of Electronic Payment Channels in Nigeria. One other document specifically contained 80 ATM system interface screen shots. Other documents included my field notes and reflective journals that contained some major issues raised during the interviews. The distribution of these 11 documents is shown in Table 3. I used member checking to enhance methodological triangulation, ensure accurate and complete interpretation of the data, and secure data saturation.

Theme 1: User-Centered Design Strategies Are Important

One emergent theme from the data analysis was the importance of user-centered design strategies. User-centered design strategies are important for the success of creating easy-to-use ATM system interfaces. Findings showed that this theme encompassed the following important elements:

- User-centered design process,
- Consideration of cultural backgrounds and literacy levels of users,
- Knowledge and understanding of users' needs, and
- Simple, user friendly, and easy to use design.

These components are needed for ATM system interface developers to create interface design strategies. Table 2 shows five important components of the user-centered design strategy as evident from this study and the frequency (number) of participants who noted they engaged in these important components of user-centered design strategy. Table 2 also shows the number of supporting documents that contained one or more of these important components of the user-centered design strategy.

Table 2

Frequency of First Major Theme

Source of data collection	Important components of user-centered design strategy				
	Centers design process around the user (f)	Understands the cultural backgrounds and literacy levels of users (f)	Design based on knowledge and understanding of users' needs (f)	Understands who the target users are (f)	Makes design simple, user friendly, and easy to use (f)
Participants	9	9	8	8	7
Documents	5	2	2	1	1

Note. f = frequency

All the participants considered people with varied abilities, cultural backgrounds, and literacy levels, literate, semiliterate, and illiterate users, as multiple target user groups who require a user-centered design strategy. While considering multiple target user groups (i.e., users with differing abilities and literacy levels), as applicable in this study, all the nine participants considered interfaces that center the design process around the user and understanding of the cultural backgrounds and literacy levels of users as important components of the user-centered design strategy. To develop design strategies that are user-centered, participants considered strategies that incorporate the users' varying abilities and capabilities. Additionally, eight of the nine participants noted that developers should equip themselves with personalized user information, based on knowledge and understanding of users' needs and who they are. Based on these

observations, developers monitor user behavior and develop proactive assessments required to create an ATM system interface that is easy to use by intended users. Table 2 also shows that seven out of nine participants considered making the design simple, user friendly, and easy to use as ways of achieving the user-centered design strategy.

All the nine interviewed participants indicated that understanding the needs of users, which culminates in a User-Centered design, was an important design strategy. They also reported that creating awareness and conducting short seminars to convince intended users that ATMs are good and easy to use, was a way of achieving user-centered interface design. All participants responded with varied contributions that emphasized the importance of user-centered design strategy. Participant # 2 stated, “We apply the following strategies: we incorporate the user, monitor user's behavior and compromise their varying abilities and literacy levels to enable us adopt user-centered design approach”. Participant # 3 pointed out that designing ATM system interface for all literacy levels, “involves using the low literate people as the ‘skeleton’ of the design input because it provided insight into how user-centered design techniques should be applied to this multiple target user groups”. According to participant # 7, “user-centered design is subjective; subject to who the users are”. Participant #5 emphasized that, to promote adoption of services among illiterate and semi-literate users, who are often among low digitally skilled users, developers should focus on the innovation of the interface design by understanding users’ needs. All the nine participants considered having interfaces that all users will perceive as useful and easy to use as one of the major features for the adoption of user-centered design strategies.

These interview findings emphasized the importance of user-centered design strategies and support the theme. Findings are consistent with TAM in that user centered design strategy guarantees the effectiveness, efficiency and the satisfaction with which users achieve their goals while using the system. Also, the findings support TAM's assertion that user centeredness of design makes the product easy-to-use and influences the extent to which users believe that using the system interface will enhance their productivity. With user centered design, system interfaces are easy-to-use by users because they perceive the interface is enhancing their productivity (PU) and being free of effort (PEOU). PU and PEOU of the TAM theory are the main determinants of the attitudes toward a new technology (Gangwar, et al., 2015). Again, PU and PEOU are the two primary predictors for the potential adopter of new technology and two major determinants of TAM (Tsai, 2015), that clearly define usability or user centeredness (Conti, et al., 2014).

The considerations by participants of the study aimed at developing easy-to-use banking ATM interfaces that will meet the needs of people with varying abilities and literacy levels align with TAM's two major determinants: perceive useful and perceived ease of use, and therefore support the conceptual framework for this study. This is consistent with the literature in that TAM can help evaluate and predict user centered design strategies and how users will respond to a system interface product before starting, during and after the development of the interface (Punchoojit and Hongwarittorn, 2017). TAM strongly supports that incorporating user centered design strategies is essential

facilitating easy-to-use system interfaces that will cater for a variety of people with varying abilities and literacy levels (Tsai, Chang, Chen, and Chang 2017).

Methodological triangulation was achieved, as eleven collected documents also supported this theme. They included two case organizations' regulations, policies, and design guidelines documents that are focused on strategies to create easy-to-use banking ATM system interface. These documents comprised of five centered on regulations and ATM technology and specification, user interface design guidelines for creating easy to use interfaces, user requirements analysis procedures, proactive and reactive (feedback) guidelines, and system development and simulation procedures. The document on user requirements gathering and analysis procedure illustrated, as a method of realizing user-centered design, the usefulness of critically gathering and analyzing the users' requirements: types of users, frequency of use, task experience and computing skill of users that give the developers access to users' information required to make some proactive assessment of all the information gathered about the user groups before making usability evaluation and design. I also reviewed the interface evaluation document that included, among others, the usability criteria such as learnability, memorability, throughput, and flexibility; the CBN standards and guidelines on ATM operations in Nigeria that specified one important quality factor of an ATM system interface, and that is, "ease of use" among others.

All the documents are grouped according to how their contents relate to the information that contained important components of User-Centered design strategy. Table 2 shows the frequency (number) of documents that contained important

components of User-Centered design strategy (the theme). For instance, five of the eleven documents reviewed contained information that can be tied to centering design process around the user, while two of the eleven documents reviewed contained information that can be tied to understanding the cultural backgrounds and literacy levels of users.

Therefore, all the eleven documents contained one or more information relating to the impotent components of User-Centered design strategy, and also supported the findings from participants as shown in Table 2. Table 3 shows each of the eleven documents I used, as mentioned above.

Table 3

Documents Reviewed by Sources

Participant case organization	Sources of Documents Reviewed				
	Nonparticipant case organization				
	CBN	80 ATM system interface screen shots	Systems Development Life-Cycle Phases	Field notes	Reflective journals
n=5	n=2	n=1	n=1	n=1	n=1
Regulations and ATM technology and specification	Standards and guidelines on ATM operations in Nigeria	80 ATM system interface screen shots	Systems Development Life-Cycle Phases	Field notes	Reflective journals
User interface design guidelines for creating easy to use interfaces	Guidelines on Operations of Electronic Payment Channels in Nigeria				
User requirements analysis (proactive) procedures					
Reactive (feedback) guidelines					
System development and simulation procedures					

Note. *n* = number of documents

I was also provided with one document that specifically contained eighty ATM system interface screen shots that portrayed the existing interfaces in some banking ATM systems that appears not easy-to-use by this study's participants: people with varying abilities and literacy levels. These eighty ATM system interface screen shots align with

what participant # 7 said “user-centered design is subjective; subject to who the users are”, and support recent research that emphasized that end-user feedback is always subjective, and important in analyzing user requirements, in order to make developers become aware of the potential users and of their requirements on the intended design of user-centered interface (Lotta, Väinämö, & Torvinen, 2017). These eighty ATM system interface screen shots further supports this study’s specific IT problem that claimed that some software developers of banking ATM systems in Nigeria lack strategies to create easy-to-use ATM system interfaces for a variety of people with varying abilities and literacy levels. These ATM system interface screen shots, nevertheless, supported this theme because I understand why the interface was not suitable for my case study even though it was user-centered, subject to who the intended users were. Other documents reviewed are my field notes and reflective journals that contained some major issues raised during the interviews.

Considering multiple target user groups in the design of ATM system interface calls for new ideas and innovations from developers that aim at making the interface easy to use. Tsai, et al. (2017) emphasizing on the importance of user-centered design strategies, asserted that users interact with a system through a user interface and sees the user interface as constituting the totality of the system. Lapao, daSilva, and Joao (2017) hold that user-centered design strategies, that incorporates the users’ multiple characteristics by way of reinforcing users’ ownership of the system, is paramount, because it leads to higher compliance and ease of use of the system by intended users. Contributing to this, Sheffer, et al. (2017) indicated that iterative cycle that involves

continual reviews with end users, provides the communication of the user-centered design methodology. Sheffer, et al. (2017) maintained that the core of good user-centered design is potent application of human factors methodology because it impacts ease of use and easy-to-use of the interface.

The recent research of Sheffer et al (2017) supports the major theme of engaging User-Centered design strategies as important for the success of the ATM interface. This recent literature is consistent with literature found since the onset of my study, and the two major determinants of TAM: PU and PEOU because, according to Sheffer, et al. (2017), good user-centered design impacts users' PU and PEOU of the interface. The user centered design strategy is a critical issue in both the product design and service sector (Lin & Cheng, 2015). This is because user centered design does not only ensure that the product is easy-to-use, it also ensures and influences the extent to which users perceive the product as useful or ease of use. According to Taherdoost (2018), three main factors influence the acceptance of technology product: satisfaction, security and quality. This theme supports this literature in that user centered design strategy also improves satisfaction, effectiveness, and, efficiency with which users achieve their goals while using the system.

These factors as identified by Taherdoost (2018) are the major determinants of users' attitudes toward a new technology (Gangwar, et al., 2015). These factor: satisfaction, effectiveness, and, efficiency are also the factors that define TAM's PU and PEOU, the two primary predictors for the potential adopter of new technology (Joo, et al., 2014). This theme is consistent with TAM, the conceptual framework for this study, in

that what defines user centered design strategies, is reasonably or logically harmonious with what defines TAM. Findings from this study show that user centered design strategies encourage developers to create system interfaces that are easy-to-use, and influence users perceive usefulness and perceived ease of use of the product. User-centered design standards evaluate and improve the effectiveness, efficiency and satisfaction of the system interface, in that user-centered design impacts users' PU and PEOU of the interface (Punchoojit & Hongwarittorn, 2017; KuÈbler, et al., 2014). Findings from this theme are also consistent with this recent literature because participants and case organization documents attest to the engagement of user-centered design strategies to actualize easy-to-use ATM system interface.

Challenges are bound to arise in the design of ATM system interfaces for people with varying abilities and literacy levels. These challenges are usually handled through study, evaluation, and implementation geared toward establishing user-centered design (Pinegger, Hiebel, Wriessnegger, & Müller-Putz, 2017). According to KuÈbler, et al. (2014) a system for communication and control, developed by user-centered design standards, is evaluated and improved by three main factors: effectiveness, efficiency and satisfaction guidelines. Recent research by Punchoojit and Hongwarittorn (2017) supported the claim by KuÈbler, et al. (2014). However, Punchoojit and Hongwarittorn (2017) added some other factors such as safety (error tolerance), utility, learnability (easy to learn), memorability, and engaging, to validate and improve user-centered design standards. The implication here is that if an interface is user-centered, it will be effective, efficient and satisfactory because according to Punchoojit and Hongwarittorn (2017),

and KuÈbler, et al. (2014), user-centered design standards evaluate and improve the effectiveness, efficiency and satisfaction of the system interface.

This theme, provides one of the answers to the research question of this study. These three major factors: effectiveness, efficiency and satisfaction that evaluates user-centered design standards, are confirmed indicators of whether the users find the system easy-to-use or perceived as usable, which are two important determinants of TAM: This is evident in my findings because all the nine participants agree that user-centered design strategy will lead to achieving system interfaces that are perceived as useful and easy-to-use by users. These findings support the conceptual framework for this study on this ground of PU and PEOU that are the two major determinants of TAM conceptual framework, regarded as the most suitable conceptual framework for this study. This theme is consistent with the TAM conceptual framework, the purpose of this study, and it answers the research question for this study.

Participants agree that strategies that incorporate proper knowledge and understanding of users' needs and their varying abilities and capabilities, will lead to user-centered design strategies. Pribeanu (2017) similarly noted that designing for usability requires a user-centered attitude: knowing the users, the tasks they perform, and developing a product iteratively in a design. To achieve easy to use interface design, some researchers noted that systems must be designed from the onset through user-centered design by bringing in the users' need at the forefront of development (Kellogg, Fairbanks, & Ratwani, 2017). This idea was confirmed by Choi, Rhiu, Lee, Yun, and Nam (2017), who also noted that system developers should consider having intended

system users involved from the system design stages to the implementation stage in order to address the issue of PU and PEOU. Further, Paul, Bhuimali, and Chatterjee (2017) asserted that user-centered design incorporates activities that are concerned and focused on understanding of users' case characteristics, that are fundamentally responsible for design and development of system interfaces that are easy-to-use by all within the users' case characteristics. This literature is supported by theme # 1 of this research and previous researchers as cited in the review of professional and academic literature of this study. Making a concluding note in this section, user-centered design strategy is paramount for the success of creating easy-to-use banking ATM system interfaces that will cater for people with varying abilities and literacy levels in Nigeria.

Theme 2: Importance of User Feedback as Essential Interface Design

Another emergent theme from data analysis was importance of user feedback as essential interface design. The role user feedback plays in the development process of creating easy-to-use ATM interfaces was prevalent in my findings from the interviews with the participants and consistent with literature prior to my data collection. Table 4 shows four important techniques for obtaining user feedback from ATM system users as evident from this study and the frequency (number) of participants who indicated these techniques for engaging user feedback were essential to interface design. Table 4 also shows the number of supporting documents that contained these important components of user feedback as essential interface design. These frequencies are not mutually exclusive, meaning that two or more of these components may appear in one document.

Table 4

Frequency of Second Major Theme

Source of data collection	Important components of user feedback as essential interface design			
	Through audio and video records at ATM service point (f)	Through help desk services, emails and phone calls (f)	Through administration of questionnaires (f)	Through evaluation of system traffic (f)
Participants	9	9	4	4
Documents	5	7	6	4

Note. f = frequency

All the participants noted that user-feedback was usually obtained through audio and video records at ATM service point and through the help desk services, emails and phone calls. Eight of the participants added that user-feedback can also be mediated through administration of questionnaires and through evaluation of system traffic.

Participants noted that a user-centered design process should incorporate a consistent and iterative elicitation of end-user feedback necessary to ensure that the system design supports users' tasks by providing developers the right information to work with.

Participants indicated that ability to identify and understand feedback received from users is important to developers to create easy-to-use system interfaces for people with varying abilities and literacy levels. This is because the feedback received will incorporate data that will be used to design the required system that meets overall users' needs. This ties my study findings with findings from a similar study by German (2017) who found that it is only through empathy, end-user feedback, and resultant data analysis that system

developers can design services that meet user needs. This finding also supports the works of Kim et al. (2014) and Mi, et al. (2014) in the literature review that proposed the need for developers of user interfaces to analyze user requirements and device accessibility, extracted from existing standards and guidelines, so as to facilitate design services that meet user needs to close the challenging gaps.

Effective implementing of an interface platform that will cater for both the literate, semi-literate and the illiterate begins with the understanding that the illiterate group forms the ‘skeleton’ of the design input because this understanding provides insight into how user-centered and user-friendly interface design techniques can be applied to this multiple target user groups: literate, semi-literate and the illiterate users. For all users with varying literacy levels to use the same banking ATM system interface and find them useful and easy to use, the ATM interface must provide effective communication platform that is understood and usable by all user groups. The theme, importance of user feedback as essential interface design, supports that effective communication platform must be understood and usable by all user groups.

Participants # 2, 4, and 7 noted that receiving feedback as to whether their design is easy to use and acceptable is important because user acceptance of a technology is often considered more important than usability and convenience. Moreover, participants # 1 and 9 noted that it is difficult to know how innovative technologies are evaluated from the point of view of user acceptance without end-user feedback. Participants provided varying feedback procedures that align with the organizational feedback template. Nine participants noted that they obtain feedback on system acceptability

primarily through audio and video records from ATM users at the ATM service point as part of security surveillance. At ATM service points, users talk, and in some cases, express their honest opinion, possibly in their own language. These comments are usually honest since ATM users are unaware that their comments are being recorded. They also claimed they collect feedback on system acceptability through one on one interaction with users, through help desk services and through emails and phone calls. Four participants receive feedback through administration of questionnaires on users to get immediate responses and through evaluation of system traffic, knowing whether it is on the increase or decrease from the point of implementation. Participants # 8 and # 6 noted their feedback from users can be obtained through the ATM system, especially when there is a transmission problem, such as use of wrong ATM code, trying to overdraw the account, exceeding the daily allowance or using expired ATM card. Participants # 3 and # 5 talked about monthly ATM feedback survey forms handed out or emailed to ATM customers, and during campaign and short seminar presentations. Participant #9 suggested the incorporation of a feedback bottom in the ATM system interface to give users the opportunity to rate the system interface whether it is easy to use and acceptable.

Although there were several avenues to get feedback from users, despite the varied feedbacks, developers do not look for consensus but welcome all forms of feedbacks to enable consideration of all potential difficulties from all the user groups. Participants emphasized that creating system interface for both literate, semi-literate, and the illiterate is a difficult one for user-interface developers; hence interaction with the target user groups is essential. In addition, developers conducted follow-up interviews

after these changes to ensure all were attended to, and that there were no new major errors or problems created. One important comment received from all the nine participants was the need to consider all variety of users while analyzing the feedback data. Participants maintained that analysis of feedback data is done in two levels: first the system is tested and evaluated with the feedback from the literate group and improved according to the suggestions of this user group. Second, the system is evaluated with the feedback from the illiterate group and evaluated according to the suggestions of this user group. This two-step method allows developers to solve any usability errors and put the system easy-to-use with these two levels before making the system available to the end users. Participants claimed they adopted this method to avoid the illiterate group being demotivated by the literate group. This ensures that the system interface is user-centered and easy-to-use for users with varying abilities and literacy levels. This finding is consistent with a recent study by Pinegger, et al. (2017) who explored and evaluated feedback gathered from different groups into combined steps and strategies to further develop and improve the product. This finding also supports the work of Hoehle et al. (2015) as noted in the review of literature, that suggested user interface design strategies motivated by feedbacks gathered from a combined consideration of varied endogenous and exogenous inputs from the end users. This finding therefore provided an answer to the research question for this study because end-user feedback and resultant data analysis form part of strategies banking ATM system interfaces use to create easy-to-use interfaces that will cater for people with varying abilities and literacy levels. Another recent study that supported this study findings was from Steen and van Bueren (2017),

who also added that feedback and evaluation gathered from different user groups at different steps are used to develop easy-to-use system interfaces.

Methodological triangulation was achieved with the documents that supported the four important techniques for obtaining user feedback from ATM system users as shown in Table 4. Two documents, user requirements analysis (proactive) procedures and Reactive (feedback) guidelines, revealed templates used by this study's case organization for transiting from proactive and reactive (feedback) stages. The proactive template stores the developers' "feed-in", gathered from prior research, knowledge or intuition. guidelines, and system development and simulation procedures. This is evaluated and implemented at its first stage to be reactively assessed by the intended users to produce a possible first end-user feedback. This is often referred to as template version 1, test 1.

User requirements analysis uses the template to the proactive assessment for the developers to make adjustment or add new features, ready to go for another reactive assessment that will yield another end-user feedback. This is template 2 test 2. With the help of a user requirements analysis, developers become aware of potential users and of their requirements on the intended interface to be developed. This forms part of the strategies used by developers to create easy-to-use system interface. These documents support the theme. This iterative end-user feedback evaluation continues until the system usefulness, credibility, and desirability is achieved.

Interviews from participants support the findings from these documents. Participant # 2, #3 and #6 who categorically stated that there is no ending to proactive assessment by developers and reactive assessment (end-user feedback), as long as the

product is in demand. Two other participants, participants #8 and 9 made it clear that, even after a system is designed, future users might not often have clear understanding of the implications new interface technologies will have on their lives so there is limit to the input they can give into the design decisions. According to participant #8, “we as developers do not only study the end users’ abilities and literacy levels, we also collect inputs from these end users that strive to understand the contexts, challenges, relationships, environments, culture, and emotions, especially where a design problem is situated”. Recent research by Ienca, Kressig, Jotterand, and Elger (2017) supported these findings. Ienca et al. (2017) noted that using end-user feedback from the user testing to make changes to the template continues with a follow-up interviews after these changes are made to ensure there were no new major changes observed or old ones left unattended to. This approach ensures that developed interfaces are user-centered and easy-to-use.

Recent literature supported the theme: importance of user feedback as essential interface design process. German (2017) asserted that end-user feedback is an important component of user-centered design strategy, adding that it is only through empathy, end-user feedback, and resultant data analysis that system developers can design services that meet user needs. This addresses one major concern of ATM system interface developers in Nigeria, and that is regular evaluation of ATM interface challenges and situations which initiates a redesign process that goes beyond system and terminal interfaces. These efforts serve as feedback to the ATM builders to ensure that ATM system interfaces are perceived as useful and easy to use by all users. The theme also supports previous researchers, Betab and Sandhu (2014), Kassem et al. (2014), and Kumar, et al. (2014),

cited in the review of professional and academic literature of this study and is consistent with the conceptual framework for this study. Betab and Sandhu (2014), Kassem et al. (2014), and Kumar, et al. (2014), emphasized the importance of user feedback as essential interface design or redesigned process because developers must have the user in mind, in order to incorporate into the ATM interface design process a secured authentication interfaces that are effortless, and easier for users. Contributions by Ilyas et al. (2013), as cited in the review of professional and academic literature of this study, also recognized the importance of user feedback as essential interface design process because interface usability answers to users' peculiarity to a locality or country: the literacy levels, culture and behavior. Also, a recent study by German (2017) supported findings from this study that put developers' ability to identify with, and understand users' feelings or difficulties, received as feedback, as an important requirement for the design of user-centered interface system that can meet the needs of user groups. German also noted that design process does not only begins and ends with the end user but also includes consistent and repeated elicitation of end-users' feedback which is essential to ensure that the system design supports the developers' tasks and decision-making processes by providing the right information at the right time, and in an intuitive manner

Another recent study also supported the findings that link design rethinking to end-user feedback. Petersen and Hempler (2017) noted that design rethinking focuses on rapid prototyping by turning ideas into actual products that are then tested, iterated, and refined, based on end-user feedback. According to Petersen and Hempler, the co-creation inherent in the design rethinking processes during system interface development and

testing were vital to creating easy to use system interface, and value for users. In another development, Boronow, et al. (2017) indicated that during usability tests, developers often want to know and validate that they are interpreting their results correctly by incorporating interactive activities that provide immediate end-user feedback. According to Boronow, et al. (2017), end-user feedback is an essential strategy employed by developers to create easy-to-use interfaces because prototypes are iteratively revised based on end-user feedback, and results from the feedback provides help to developers, which shows how users understood the system.

Silva, Jimenez, Blomberg, and Luis (2017) asserted that one important usefulness of end-user feedback is that it helps in the design process to ensure easy-to-use system interfaces by generating the development and distribution processes that creates new features, and involving end-users, resulting in subsequent collection of much feedback as possible and creation of effective solutions during the development process. The results of this study support the work of Chin-Feng, et al. (2014), who reported that use of user feedback is an essential and important design process to create good user interfaces that are customized, intuitive, interactive, tailor-made and easy-to-use. Silva, et al. (2017) further stated that new features are developed according to end-user feedback and implemented in a development branch, passing through several analyses, tests and end-user feedback stages. The literature aligns with the theme and ties back to my study's findings. Five of the interviewed participants stated that the design of the developers' codebook is always refined in response to end-user feedback and subsequently reevaluated.

User feedback is regarded as a technology acceptance enabler and an important design strategy to actualize easy-to-use system interface product. This is because user feedback serves as a complementary approach to understanding users' perceptions and formation that may lead to system interface product acceptance. In other words, user feedback represents design strategies to impact users perceived ease of use and usefulness of the interface product. Participant # 5 and #1 affirmed that end-user feedback is as good as the user-centered interface, because without the end-user feedback it is not likely for the developers to have user-centered interface that users will perceive as useful or ease of use. This findings from participants are consistent with TAM's two major determinants: PU and PEOU, in that users' feedback design process is evaluated when users perceived the product as useful and ease of use.

User feedback therefore serves as the pivot for user centered and easy-to-use design strategies because all designs strategies to create user centered and easy-to-use interfaces work around the analysis and reanalysis of user feedback data to ensure alignment and consistency with the two major determinants of TAM: PU and PEOU. The implication here is that, for a user-centered interface design to be most beneficial as to influence user's PU and PEOU, appropriate end-user feedback must be in place. This was possibly why participants # 4 and #7 noted that users feedback evaluation must include features in the intended or new system, otherwise it might result in a fake evaluation of the new system interface product or technology acceptance. Findings from the participants is supported by the theme and aligns with the result of the studies by Abu-Dalbouh (2016). Findings from Abu-Dalbouh's study reported that effective feedback

evaluation is necessary to ensure the intended system interface adequately meets users' requirements and scope of the of the system. Abu-Dalbouh also stated that TAM is one of the most popular and effective models for evaluation of user feedback process. This theme supports this literature and also aligns well with TAM's conceptual framework for this study in that the major determinants of TAM: PU and PEOU are also the major result from good user feedback evaluation process.

According to Pribeanu (2017), end-user feedback is developers' guidance and strategy on the path to user-centered interface design. Thus, Theme # 2 provides answers to this study's research question. Ienca, et al. (2017) added that ideal end-user feedback loop between interface developers and users should be pursued in the design strategies to create easy-to-use system interfaces for varied user groups and is exemplified by their peculiar iterative process of needs assessment and product adjustment in line with the theoretical and conceptual framework. This study's conceptual framework is founded on TAM's major determinants: PU and PEOU, to support strategies for developing user interface for banking ATM and user-centered design that will cater for a variety of users with varying literacy levels and culture. Previous studies by Martinsa et al. (2014), cited in the academic literature of this study, show that it is only through the study and analysis of user's feedback within the design process that understanding of what constitutes the three external variables that are determinants of TAM's PEOU and PU: perceived risk, social influence, and facilitating conditions, can be evaluated. In other words, TAM is validated by the study and analysis of user's feedback within the design process.

Oh and Moon (2013) noted that for ATM system interfaces to be perceived as useful or easy to use by the user, such interface design process must adequately adopt end-user feedback as an essential design strategy. Oh and Moon's work is supported by this theme. Discussing design strategies to create interfaces that support TAM's PEOU and PU; Bhattacharya and Laha (2013) stated that any interface design process should consider user feedback in terms of knowing the users and tasks, who they are, and what goals they try to achieve. Such interface design process, according to Kwan, et al. (2014) can only deploy easy-to-use interface through the end-user feedback approach for design and evaluation process. This study's finding therefore supports previous studies and TAM conceptual framework for this study.

Developers of banking ATM system interfaces should take advantage of user feedback to promote continued updates of their systems. In a user-centered design aimed to identify strategies software developers of banking ATM systems in Nigeria use to create easy-to-use ATM system interfaces for a variety of people with varying abilities and literacy levels, opening the possibility of perfecting the design based on the feedback from end-users is very essential. Easy-to-use is an important criterion to assess the quality of banking ATM systems, and one of the success indicators of a system that is suitable with the users' needs. However, this process is perfected during the engagement of end-user.

Theme 3: Value of Pictorial Images and Voice Prompts

Another emergent theme from data analysis was the value of pictorial images and voice prompts. Pictorial images and voice prompts are important strategies developers of

banking ATM system use to create easy-to-use system interfaces for a variety of people with varying abilities and literacy levels. An interface that will cater for both the literate, semi-literate and the illiterate begins with the understanding that the illiterate user forms the 'skeleton' of the design input. This understanding provides insight into how pictorial images and voice prompts strategies can be applied to create easy-to-use system interfaces for this user groups. Findings from participants show that pictorial images and voice prompts provide effective communication platform that is understood by all literacy levels.

For all users with varying literacy levels to use the same banking ATM system interface and find them useful and easy to use, the ATM interface must provide effective interaction platform that is understood by all users. The theme, value of pictorial images and voice prompts, is important in providing effective interaction between the ATM system interface and users, as strategies to create easy-to-use interfaces. This study's finding shows that developers use pictorial images and voice prompts as strategies to create easy-to-use system interfaces for a variety of people with varying abilities and literacy levels. This finding also provides answer to this study's research question.

Table 5

Frequency of Third Major Theme

Source of data collection	Important components of value of pictorial images and voice prompts			
	Pictorial images, and enhanced voice prompts with short transaction cycle (f)	voice feedback in users' own language (f)	a text-free user interface and extensive use of hand-drawn (f)	graphics /imagery and voice as inputs (f)
Participants	8	5	3	2
Documents	2	1	1	1

Note. f = frequency

One major comment from all the nine participants was the need for effective communication that is understood by all multiple target user groups: the literate, semi-literate, and the illiterate. Table 5 shows four important components of the theme, as evident from this study, and the frequency (number) of participants who indicated these components as effective strategy to create easy-to-use interface for all literacy levels. Table 5 also shows the number of supporting documents that contained these important components of pictorial images and voice prompts. These frequencies are not mutually exclusive, meaning that two or more of these components may appear in one document. Eight participants noted that pictorial images and enhanced voice prompts with short transaction cycle can be used to create interaction between the user and the ATM interface. Voice feedback in users' own language was noted by five participants as a strategy to create easy to use ATM system interface. Participants generally emphasized

that user interaction on ATM interface should involve short texts, spoken voice prompts, spoken dialog interface, graphical interface, multimedia user interface, enhanced voice prompt, touch inputs, and language selection that are common to users. Participant # 2, for instance, emphasized the combination of text free or graphics interface with voice prompt, because without the voice feedback, even users who had seen the pictorial images interface may not realize without significant prompting, what they are expected to click on to cause an action or understand what they were clicking on.

Findings from participants indicated that incorporating pictorial and voice prompts emerged as part of strategies they use to create easy to use banking ATM system interfaces for a variety of people with varying abilities and literacy levels. Participant #2 noted that Nigerians, whether literate or illiterate, generally do not have good reading culture. According to participant #5 “Illiterate users of ATM system interface prefer a system with voice prompt, fewer prompts, text free interface with short transaction cycle”. Participant #3 specifically noted that strategies to create easy to use ATM system interface that will cater for the cultural and literacy differences among user should incorporate short text, enhanced voice prompts with short transaction cycle. Participant #3, #7, #8 and #9 emphasized the need to strategize interaction in graphical images and voice prompt. This was better explained in the statement of participant #7 “pictorial images and voice prompts are adopted and strategized by using artefacts within the cultural environment of the people or users; such as: press 1 for English, 2 for Igbo, 3 for Yoruba, and 4 for Hausa. English, Igbo, Yoruba, Hausa are the major spoken languages in Nigeria”. Participant #9 also noted the importance of “using enhanced voice prompt as

input, to encourage users that are weak in vocabularies”. These participants indicated that this strategy has helped to effectively harness cultural and literacy differences in establishing good communication protocol between the ATM system and the users, to create easy-to-use Banking ATM system interfaces for a variety of people with varying abilities and literacy levels. These participants reiterated this strategy of engaging voice feedback in users’ own language, because it excites the users as they could hear the system speak in their native language. This finding is consistent with the conceptual framework for this study, because developers considered value of pictorial images and voice prompts as important strategies that are successful for creating ATM interfaces that are perceived by users as useful and ease of use. This finding also provided answer to the research question for this study because it attests to one of the strategies banking ATM system interfaces use to create easy-to-use interfaces that will cater for people with varying abilities and literacy levels in Nigeria.

In the review of professional and academic literature, Kajiyama and Satoh (2014) proposed interface models that focus more on how users and systems can inspire one another’s internal elements. Kajiyama and Satoh (2014) defined “interaction” to mean the inspiring of the internal elements of both users and systems rather than the conventional superficial interactions between users and systems and proposed a system that explores users’ interface needs by using required images and voice prompts that will synchronize with users’ varied abilities. According to SathishKumar and Kamalraj (2014), a combination of text and graphical metaphor may be the best user interface for a variety of people with varying abilities and literacy levels. Therefore, this study’s finding supports

the findings in the review of professional and academic literature. Recent research by Bhadani, Shankar, and Rao (2016) also supports this strategy of using artefacts within the cultural environment of the users. Bhadani, et al. (2016) noted that supporting interface services in local dialect can act as a catalyst in positioning the system as a socio-economic empowerment instrument that can enhance strategies to create easy-to-use system interface, promote adoption of multiple services to these multiple user groups. This research is consistent with the findings from participants and supports previous literature cited in this study.

Five documents were used in achieving methodological triangulation to enhance the reliability and validity of this theme. They include documents on regulations and ATM technology and specification, user interface design guidelines for creating easy to use interfaces, system development and simulation procedures, field notes, and reflective journals as shown in Table 3 above. The user interface design guidelines for creating easy to use interfaces provided by participants indicated three basic cognitive challenges that serve as platforms to be considered as the development of voice and graphical interface progresses. All the five documents used in achieving methodological triangulation revealed strategies developers used in ensuring that voice interface created reduced users' memory load, or encouraged short-term memory loading by users, and discouraged users learning complex set of commands too quickly. These strategies make the interface easy to use.

These documents also contain policies that guides developers on how well the demands of the new mental structures of the intended interface match the concepts and

procedures that users are already familiar with. The documents also guide developers on how much information the users should hold in their short-term memory for effective use of pictorial interface and voice prompts, to avoid being momentarily distracted. By this, developers ensured that interfaces created are perceived by users as useful and ease of use. These documents support the theme, and in agreement with the conceptual framework for this study.

Participants #1 explained that a strategy that help developers understand the adequacy of this issue of conceptual complexity, memory load and attention on users, is easily achievable through usability testing at several stages of the interface development process. In support of this, participant #6 proposed that the development process that places value on pictorial images and voice prompt must involve both the ability to ensure good voice prompt and good engagement of images. This is supported by participant # 5 and #3 who categorically stated that designing ATM interface that will be easy-to-use by illiterate users should be text free, with extensive use of hand-drawn with familiar terms and images. These indicate support for the theme and provide answer to the research question of this study, as they add another strategy used to create easy-to-use system interface.

Existing literature was consistent with my study's findings regarding the use of pictorial images and voice prompts for effective strategy to create easy to use ATM system interfaces for literate and illiterate users. Recent research shows that visually attractive pictures or icons in an interface that spur individuals' emotions can provide greater satisfaction, excitement, effectiveness, efficiency and enjoyment than text-based

interfaces that offer only functional value (Lee, Chen, & Hess, 2017). As mentioned earlier in this section, participant #3, #7, #8 and #9 emphasized that the use of pictorial images and voice prompts design strategies are based on a framework that considers the users' tasks, their peculiarity and what goals they try to achieve. According to these participants, such considerations help to achieve easy-to-use interface product whose contexts agree with or influence users PU and PEOU of the interface product. The theme therefore supports the findings, what was discussed in the literature, and is consistent with the TAM conceptual framework for this study, in that pictorial images and voice prompts design strategy is founded on framework that considers TAM's major determinants: PU and PEOU.

Another recent information system research on affective cues suggests that using such cues as voice prompts in system interface designs can influence a user's perceived usefulness and ease of use of the system during an interaction with the interface (Zhang, 2013). Lee, et al. (2017) and Glaser and Schwan (2015) found that the pictorial appeal of a technology influenced users' perceived enjoyment of using the technology. The wait time literature, according to Lee, et al. (2017), suggests that affective cues such as voice prompts, can improve users' mood and perceptions as they wait their turn to use the system.

Recent studies on interface design, have reported that the main strategy to address motor impairments is to create an interface that will minimize movement and physical effort required for input (Dim & Ren, 2014). This can be achieved, using voice prompts, switch control devices, and eye-tracking. A similar recent study by Ernst and Girouard

(2016) highlighted that for blind users, the gestures designed should be logical and easy to learn and remember, as blind users rely much on their memories. For users with upper extremity disabilities and Down's syndrome, who face difficulties in precisely controlling their hands, researchers have suggested that developers should consider selecting simple and flexible gestures such as tapping (Choi & Chan, 2015). Findings from other researchers that studied users with learning or intellectual disabilities on social websites and other interfaces have strategized by creating interface that will minimize the user deficiencies or efforts required for input (Holmes, & O'Loughlin, 2014; Shpigelman, & Gill, 2014a; Shpigelman, & Gill, 2014b). Theme # 3 supports these findings that valued pictorial images and voice prompts to minimize and close the gap that could result in understanding some technical and long words of phrases. Also, the theme supports the findings from Davies, et al. (2015) who reported that the main strategy to create easy-to-use interface for illiterate and semi-literate users is to address literacy deficiency or intellectual disability by minimizing the use of technical texts or long text vocabulary required for input.

Value of pictorial images and voice prompt are important strategies to create easy-to-use banking ATM system interfaces that are culture sensitive. Usability design should reflect culture in practice in order to improve user experience in the aspect of human interface design (Hoehle et al., 2015). Previous work by Davis (1989) indicated that culture does indeed influence interface acceptance, especially interface issues like colors, graphics, signs and placement of voice prompts which are elements that may have different connotations for people with different cultural backgrounds. Theme # 3

supports the literature, the findings from participants, and is consistent with TAM in that value of pictorial images and voice prompt design strategies reflect culture in practice, that influences system interface acceptance.

Findings from participants showed that pictorial images and voice prompts provide effective communication platform that is understood by all literacy levels, better perception of learnability, self-efficacy, enjoyment and excitement than text-based interfaces, especially among illiterate and semi-literate users. Perceived learnability, self-efficacy, enjoyment and excitement were found in literature to be significant drivers of TAM (Teoh, et al., 2013). According to Alalwan et al. (2015) and Kelly (2014), self-efficacy appears to be the most powerful factor influencing users' behavioral intention and trust because users who believe in their ability to effectively use technological services, are more likely to trust using such technology, as well as being more motivated to use the product. The theme supports this literature and consistent with TAM in that pictorial images and voice prompts design strategies provide effective communication platform for learnability, self-efficacy, enjoyment and excitement that culminates in users' PU and PEOU of the systems interface product. Also, pictorial images and voice prompt encourage users that are weak in vocabularies with contexts that agree with the two primary determinants of TAM: PEOU and PU.

Kanjwani and Singh (2014) explored some external variables of TAM and found that perceived enjoyment, excitement and satisfaction are determinants of TAM. According to Kanjwani and Singh (2014), usability of new technology was not affected by customer satisfaction, but by perceived enjoyment and excitement. Users' perceived

enjoyment and entertainment have been found in literature to be positively related to PU and PEOU (Bedman, 2013; Giri, et al., 2014). These determinants of TAM: perceived enjoyment, excitement and satisfaction are influenced by the theme. Therefore, this theme supports the conceptual framework for this study in that the pictorial images and voice prompt design strategies considered users' perceived enjoyment during design that have significant impact on the acceptance intension of users.

Results from recent literature and previous studies also support this study findings that the text-free designs were strongly preferred over standard text-based interfaces by illiterate and semi-literate user groups. Gabriel, Cunha de Miranda, and Erica (2016) noted that touch screen and voice user interfaces, are being widely used as interaction interfaces because they provide easy-to-use interfaces than onscreen keyboards. The theme in this section, value of pictorial images and voice prompt as strategy for creating easy to use system interfaces, is consistent with the conceptual framework of this study, the purpose of this study, and provided answer to the research question for this study. The value of pictorial images and voice prompt as interface developmental strategy is paramount for the success of creating easy-to-use banking ATM system interfaces that will cater for people with varying abilities and literacy levels in Nigeria.

Theme 4: Importance of Well-Defined Interface Development Process

The fourth theme to emerge from data collection and analysis was the importance of well-defined interface development process. A well-defined software development process ensures good software quality product based on the following software quality factors: efficiency, effectiveness, reliability, usability, functionality, maintainability, and

portability. Among these factors, usability or easy-to-use, was found a significant software quality factor that needs to be considered in a well-defined software development process (Gupta, Ahlawat, & Sagar, 2017). This theme relates to the conceptual framework for this study because in a well-defined interface process., usability factor or easy-to-use is considered as significant drivers of TAM. This is because software development process usually incorporates usability testing (Sharma, & Singh, 2015), and during the usability testing, PU and PEOU, TAM's major determinants, are mostly useful for user acceptance testing (Davis, 1989)

Table 6

Frequency of Forth Major Theme

Source of data collection	Important components of well-defined interface development process		
	Software Development Life Cycle (f)	System design has a well-defined process (f)	Analyze old system and new system requirements to create desired system (f)
Participants	9	6	4
Documents	1	3	2

Note. *f* = frequency

This theme encompasses the process that follows a well-defined standard Software Development Life Cycle (SDLC) which the developers follow when creating easy-to-use ATM system interfaces for a variety of people with varying abilities and

literacy levels. Table 5 shows three important components of well-defined interface development process as evident from this study and the frequency (number) of participants who indicated these components of well-defined interface development process as strategies to create easy-to-use system interface. Table 5 also shows the number of supporting documents that contained these important components of well-defined interface development process. These frequencies are not mutually exclusive because two or more of these components may appear in one document. The content included SDLC processes that start with the definition, gathering and analysis of users' requirements and system boundary (varied cultural and literacy levels); the design, to the deployment of products. All participants stated that while the SDLC provides valuable guidance for developing the system interface processes, developers must not fail to address the continual change for end-users' requirements that demands a continual cycle of implementation support until the requirements of the users are met.

All the participants attested that a well-defined interface development process is important because it enhances developers' resource skills, effective communication and decision-making abilities along the project life cycle, that majorly contributes to the delivery of high quality interface products. It was stated that, while developers come with their skills set, knowledge and expertise in the developmental process, there is the impression that the ability and freedom to clearly articulate what is required and what should be delivered is critical in developing high quality user-centered and easy-to-use system interface. Participant #8 stated, "system design has a process. What is important is developer skill in software development to implement correctly the component or

subsystem assigned to him, and to perform effectively the verification and validation function”. Participant # 5 stated that design process is well-defined, progressing from studying and understanding the current or old system to using the analyzed requirement within the old system, to affect some changes within the current system, thereby producing interfaces that are easy-to-use by intended users.

Furthermore, most of the participants believed that knowledge sharing among project team members is very important especially during the time to bring together all developers’ design strategies in the organization to ensure one coherent, easy-to-use, and acceptable banking ATM system interface. Participants # 1, 2 and 8 noted that, aside the SDLC model providing an important platform for synergy for developers’ resource skills, effective communication and decision-making within and among developers on how well the process is adhered to, is important in creating easy-to-use interfaces. Contributing to the issue of design process, participant #7 noted that the model also provided additional resources to developers by making developers’ research data services discoverable and reusable. This process, according to this participant provides an important advantage of avoiding replication of software that already exists and enabling the reuse of system data services where applicable. According to participant # 7, 8 and 1, following the developmental processes in a manner that makes it possible to trace or reference each of the requirements at any phase of the developmental process, are important strategies in the process of creating user-centered interfaces that users will perceive as useful or ease of use. These findings from participants supports the theme.

Out of the eleven documents reviewed in this study as shown in Table 3, six were used in achieving methodological triangulation to enhance the reliability and validity of this theme. They include documents on regulations and ATM technology and specification, user interface design guidelines for creating easy to use interfaces, user requirements analysis (proactive) procedures, reactive (feedback) guidelines, system development and simulation procedures, and SDLC phases as shown in Table 3. The document on regulations and ATM technology and specification on the design process received from my case organization highlighted some attributes of system requirements: correctness, conciseness, completeness, unambiguous, verifiability, modifiability and traceability. This document details good users' requirements analysis and supports the findings from the participants in this study. Also, provided by my case organization is another document on the system development and simulation procedures, providing developers with information on the foundation and principles to guide practices throughout the systems development life cycle and beyond. A document on SDLC was also reviewed, contains guidelines to follow in tracing some of the case challenges from user requirement analysis (varied cultural and literacy levels) to implementation or the other way around. Also, SDLC models other than the conventional Waterfall Model were also reviewed that showed practical evidence of differences between the models and potential inconsistencies. These apparent differences and potential inconsistencies between the models encourage developers to work independently without requiring a continuous reconciliation of their models and views for some periods of time. This also promotes skills and talents within and among interface developers required to strategize

for the creation of easy-to-use system interfaces. Findings from document reviewed support the finding from participants. These findings are consistent with the theme, and with the conceptual framework for this study.

It is evident from the review of professional and academic literature of this study that many researchers and developers of ATM system interfaces have worked with well-defined interface development processes for creating easy-to-use, and acceptable system interface. Studies by Hoehle et al. (2015), have noted that a well-defined interface development process is important for improving usability values required for creating easy-to-use, and acceptable system interfaces. The quality of a system interface is significantly dependent on its usability (Gupta, et al., 2017). According to Gupta, et al. (2017), good software products are measured by different quality factors such as efficiency, effectiveness, reliability, usability, functionality, maintainability, and portability. Among these software quality factors, usability or user friendly or ease of use or easy-to-use, is found to be a significant software quality factor that needs to be considered in a well-defined software development process. The theme supports the literature and is consistent with TAM conceptual framework for this study in that usability or easy-to-use, efficiency, and effectiveness, considered in a well-defined software development process as significant software quality factors, are also significant drivers of TAM

Well-defined software development process is important design strategy software developers use to create easy-to-use ATM system interfaces because among all good software quality factors, usability or easy-to-use is significantly considered in a well-defined interface process. Usability has been noted in literature to be validated by users'

effectiveness, efficiency and satisfaction in using the system interface product (Sharma & Singh, 2015; Gupta, et al., 2017). These factors that validate usability: effectiveness, efficiency, self-efficacy, enjoyment, and satisfaction also validate TAM's two major determinants: PU and PEOU and found in literature to be significant drivers of TAM (Teoh, et al., 2013). This theme supports the literature and the conceptual frame work for this study. Easy-to-use interface actions are realized based well-defined interface development process that incorporates usability testing mostly useful for early user acceptance testing. According to Hoffman et al. (2015) value for adaptability and reusability of services are realizable for useful and easy-to-use interface actions based on a well-defined interface development process. Existing research is consistent with the findings from previous studies and from the participants in my study regarding the use of well-defined interface development processes for creating easy-to-use, and acceptable banking ATM system interface.

Many researchers who attested to the benefits of adopting the SDLC model, noted that it is a good technique, easy to comprehend and well-defined, with facilities that can help developers to create user-centered and easy-to-use interfaces (Oluwaseun, Muyiwa, Olanrewaju, Omolaran, & Iyabo, 2017). According to Sinha and Jain (2013), developers that have value for adaptability and reusability of services as their top priorities, must see the need to synergize their skills and talents with a well-defined SDLC guidelines. Machado, Rita, Santos (2017) supported these findings by Sinha and Jain, with the claim that benefits of well-defined interface development process include, among others, reduced required skills due to impacted service reuse. These findings are in line with Jain,

Rothenberger, and Sugumaran's (2017) reported that the benefits of a well-defined interface development process include shortened developers' development lifecycle time. A well-defined interface development process is the key strategy to improved valuable guidance for developing user-centered system (Bird, 2017), and prioritized accurate requirements and how users perceived its usefulness and ease of use (Stuckey, Sarkani, & Mazzuchi, 2017). The findings from these studies support this literature. Recent research studies reported that it takes a well-defined interface development processes to actualize improved interface products that are reliable, easy-to-use, and acceptable (Liou, Hsu, & Chih, 2017), with increased developer productivity (Branco, Xiong, Czarnecki, Küster, & Völzer, 2014). The success of designing a system interface that is easy-to-use and perceived as useful and ease of use is tied to the adoption of a well-defined interface development process.

According to Sun, Ha, Teh, and Huang (2017), a well-defined interface development process has numerous benefits that included, among many others, users' perceived usefulness, ease of use, and improved software quality. The findings from this study support their research. Chevers and Grant (2017) noted that a well-defined interface development process improves customer perceived ease of use and satisfaction and reduces developmental costs. The theme supports this literature and is relevant in providing answer to the research question for this study, because the theme: well-defined interface development process, is considered as strategy by software developers of banking ATM systems in Nigeria to create easy-to-use ATM system interfaces for a variety of people with varying abilities and literacy levels.

Recent literature also supports the findings from this study regarding the adoption of one of the primary, very common, and the oldest software development architecture: the waterfall method with a five-step developmental series of phases that are simply and well-defined, with the output of one phase providing the input to the next phase (Nugroho, Hadi, & Hakim, 2017; Mitri, Cole, & Atkins, 2017). Also, supported by this theme is the claim by researchers that system developers chose the right software development model or a hybrid that is well-defined to allows developers to set developmental strategies that will yield the desired product within the time limit, while maintaining the quality of software products as per the standards (Awwad, 2017). While making a good choice of SDLC, it is important, according to Díaz, Pérez, and Garbajosa (2014), to maintain traceability that defines and maintains relationships between artifacts involved in the software life cycle in both forward and backward directions, that is, from requirements to code and from code to requirements, respectively.

The choice or combination of appropriate model(s) on a well-defined process and guidelines helps to shape strategies interface developers use to create easy-to-use system interfaces for intended users. The findings in this section is consistent with the conceptual framework of this study, the purpose of this study, and provided answer to the research question for this study. Well-defined interface development process is important for the success of creating easy-to-use banking ATM system interfaces that will cater for people with varying abilities and literacy levels.

Applications to Professional Practice

The IT problem that this study researched was that the existing banking ATMs in Nigeria do not adequately cater for a variety of people with varying abilities and literacy levels. About 40.33% Nigerians aged 15 years and older are illiterate or semiliterate (Worldometers, 2017; United Nations World Population Prospects, 2015). This large population of illiterate or semiliterate Nigerians are not served because some software developers of banking ATM systems in Nigeria lack strategies to create easy-to-use ATM system interfaces for a variety of people with varying abilities and literacy levels. Easy-to-use ATM system interfaces that cater for a variety of people with varying abilities and literacy levels in Nigeria is increasingly important and presents new challenges that must be addressed by software developer organizations through prioritizing strategies to create easy-to-use banking ATM system interfaces. ATM system interface developers should take advantage of the new technological innovations designed on high level usability platform to close the existing usability gaps often observed in the ATM systems in Nigeria (Ilyas et al., 2013).

The study's findings were significant and supported current literature on interface development strategies as well as documents supplied by the organization that provided clear demonstrations and guidelines. Findings from this study revealed successful strategies that are currently used by an organization to create easy-to-use ATM system interface for a variety of people with varying abilities and literacy levels. Such strategies impact users' satisfaction and acceptance of product. By providing successful strategies

other developer organizations and individual developers can adopt similar strategies to improve their interface development.

The developers' strategies illustrated by the findings may be the culminating point where the relationship among the IT professionals, interface developer organizations, developer experts, and aspiring developers can help improve the user friendliness of interfaces which may increase the use of ATMs by bank customers in Nigeria. Findings from this study may become the bedrock on which developer experts and aspiring developers build their professional identity. Developers' strategies illustrated by the findings may serve as a consultancy, advisory or reference point to IT professionals, not just on ATM user interfaces but also other customer-facing user interfaces. IT professionals may adopt a reflective use of the findings as a validation of design methods in practice, or as knowledge for assessing current strategies or guidelines to be adopted toward creating easy-to-use customer interfaces.

Findings from this study may also provide an empirical basis for user-centered design, planning, training, adoption and execution. It also may shed light on the usefulness and usability of user-centered design methods which may lead to practical guidelines and evaluative criteria. When a developer or IT professional understands why strategies to create easy-to-use interfaces are important, they will be encouraged and motivated to adopt these strategies to, not only design in isolation from the users, but have it integrated among the developers or professionals to improve the overall interface design. This may enhance and optimize their processes that may result in significant time savings and may translate to cost savings as well. It may also speed up developers' content

development timeframes, thus increasing their overall output at the same workforce scale. The process for designing a user-centered interface is similar to designing a front-end website in that the steps you take are linear and iterative. Therefore, strategies illustrated by the findings from this study may motivate and encourage best practices among website developers as they adopt strategies.

Strategies illustrated by the findings of this study are good practices for all customer-facing user interfaces and can be applicable to professional practices in many fields such as eHealth, e-Education, complex adaptive system, to mention but a few. Professional practices in these fields can take advantage of this study's findings. Strategies illustrated by the findings of this study hold the most value by impacting IT professional practices in creating customer-facing user interfaces, especially among IT practitioners that have little control over user-centered designs. For instance, in eHealth services where user centered designs are needed to provide specialized care management system for patients with chronic diseases at the comfort of their homes, this study's finding may offer strategies to create better user centered and easy-to-use design interfaces. It has been noted that in the eHealth sector, professional practices require patient-centered system involving complex adaptive system (Flieger, 2017), whose implementation require user centered design strategies to create easy-to-use interfaces because patients with chronic diseases require specialized services or self-care management systems in the comfort of their homes (Frykholm, Flink, Lindblad, & Ekstedt, 2016). This is because patients, living with chronic illnesses, symptoms, and disabilities require complex medical regimens at home, and adoption of a user-centered system or the role of self-manager is important. This study's finding may be

applicable to professional practices in eHealth as it may offer guidance on better strategies to implement such eHealth user-centered systems

Professional practices in education, especially in modeling of language for improving the controllability of learning design quality may find this study's findings useful because modeling of language for improving the controllability of learning design quality engages user-centered design strategy. User-centered design strategies have been used in the modeling of language for improving the controllability of learning design quality (Zendi, Bouhadada, & Bousbia, 2016), toward improving usability and accessibility (Juárez-Ramírez, 2016), and evaluation of text analysis tools in a digital history project (Heuwing, Mandl, & Womser-Hacker, 2016). Findings from this study may help professionals in these fields seeking successful strategies to create user-centered design and adaptive systems. By adopting strategies illustrated by the findings of this study, organizations may enhance their strategies, skills and talents to create better software products that are reliable and acceptable.

Strategies illustrated by the findings from this study may also improve professional IT practice and establish better communication of technological ideas and best practices among developers because of the increased understanding and effects of better strategies for creating easy-to-use and successful banking system interfaces in Nigeria. Better communication of technological ideas and best practices among developers may cause a growing number of user interface technologies to emerge. This may lead to new innovational trends in banking that may emerge into potential advancement in the IT practice. Successful adoption of strategies illustrated by the

findings from this study results may also impact new IT practitioners on strategies to create successful and easy-to-use interfaces that may impact other applications that are user interface technology dependent such as electronics voters machine, automobile maintenance devices, point of sales etc.

Implications for Social Change

This study's findings add to the existing knowledge of literature by providing information and knowledge on strategies software developers of banking ATM systems in Nigeria use to create easy-to-use system interfaces for a variety of people with varying abilities and literacy levels. The study's findings may encourage social change as more software developers in Nigeria understand strategies to create easy-to-use interfaces that may improve user morale, preference, attraction, and productivity, and also increase the use of technology by underrepresented groups in Nigeria. Strategies illustrated by the findings from this study may allow users to perform their tasks with minimal delays thereby reducing the long queue by users at banking ATM points. This study's findings may greatly enrich knowledge in electronic banking and ATM usage in Nigeria and may provide banks and organizations that use bank products with insights on how to improve customer satisfaction as many developers learn successful strategies to create easy-to-use interfaces that cater to variety of people with varying abilities and literacy levels. With easy-to-use interfaces for a variety of people with varying abilities and literacy levels, many more clients will be able to use technology without mediation.

Findings from the review of the professional and academic literature, as well as documents supplied by the organizations, found that Nigerians are likely to be among the

top countries that store money in their houses, rather than aligning to the ongoing cashless move (EFInA, 2014, p.12). Emengini and Alio (2014, p.1), Ezeamama, et al. (2014, p.85), and Itah and Ene (2014, p.363), found that the estimated proportion of cash circulating outside of the banking system in relation to the total cash in circulation in the Nigerian economy was given as 65%. One of the major reasons for this may be banking customers' inability to use ATMs due to varying levels of literacy. Strategies illustrated by the findings may leverage economic development and social change in this area, as many people in the country may begin to understand, trust, and use the banks and the ATMs by themselves because they are easy-to-use by all people with varying abilities and literacy levels. Recent literature claims that technology is increasingly ubiquitous with interconnected and interdependent facilities (Murray, et al., 2014). Strategies illustrated by the findings from this study may encourage banking ATM organizations in Nigeria to improve their strategies to create easy-to-use ATM system interfaces. Findings from this study, may increase the penetration of these technologies into different domains apart from the banking sector.

Strategies illustrated by the findings from this study may serve as a basis for positive social change because it may advance the use of other technology outlets that require easy-to-use system interfaces. When incorporated into Nigerian politics, there may be great social change as interfaces may now accommodate all eligible voters, because strategies illustrated by the findings from this study may encourage direct participation for a variety of people with varying abilities and literacy levels. Also, this

study's findings may encourage more Nigerians to trust and become interested in political affairs, especially voting, and may bring about true democracy in Nigerian politics.

Social changes are associated with transformations in various spheres of human life because successful implementation of a transformation in one area has the potential to inform other related areas. This study's finding may equip interface developers with strategies to make tremendous impact on other related services such as economic restructuring, societal value systems, spread of media technology, and other areas of National interest that are user interface technology dependent.

Recommendations for Action

In Nigeria, the existing banking ATMs do not adequately cater for about 40.33% illiterate or semiliterate adults aged 15 years and older (UNESCO, 2015). As a result, only 7.9% of Nigerians use ATMs and 53% of adults who are bank customers use their ATM cards (EFInA, 2014). Banking ATM system interface developers have to acquire knowledge and effective strategies to improve the use of ATMs for people with varying abilities and literacy levels in Nigeria. This desire for knowledge and effective strategies to create easy-to-use ATM system interfaces is increasingly important and presents new challenges that must be addressed by software developer organizations, especially at this time when technological innovations are becoming increasingly ubiquitous, with interconnected and interdependent facilities. Strategies that have been shown to be effective from this study's findings include:

- importance of user-centered design strategies,
- importance of user feedback as essential interface design,

- value of pictorial images and voice prompts, and
- importance of well-defined interface development process.

These findings were significant and supported current literature on interface development strategies, as well as documents from the study case organization. Findings from this study are important to banking ATM interface developer organizations, Software Developers Association (SDA), ATM Industry Association ATMIA of Nigeria, and independent ATM interface developers

The participants in this study emphasized the importance of user-centered design strategies and the importance of user feedback as part of the essential interface design process. They also emphasized a well-defined interface development process. Developers and developer organizations must consider users' needs in relation to the design strategy are dynamic. Therefore, strategies are not expected to remain the same at all times. Users' needs are influenced by many external factors and hence needs are subject to change.

This is especially the case with creating ATM system interface for a variety of people with varying abilities and literacy levels, which is subject to changes in the social culture. What is trendy at this moment may not be so in the future. Under usability or easy-to-use design strategy, developers should spend time gathering input from users and encourage them to get involved in the design. By the time the product is produced, users' needs may have changed and thus no longer meet the new needs. Therefore, a dynamic study of users' status in relation to intended strategy to create easy-to-use interfaces, must be constantly reviewed to avoid system failure.

The developers' strategies illustrated by the findings was based on recent Nigerian statistics reporting a poor literacy level. This literacy level could improve positively or decrease even further. User feedback was regarded as essential in the interface development process even after a successful interface development because of changes in assumptions. An ATM interface that is easy-to-use in one country or locality may produce a frustrating experience and usability problem in another country, because interface usability answers to the literacy level and cultural background of the user, among others, that are subject to change. Therefore, all developers and stakeholders must understand how the user variables that formed the foundation on which the user-centered design and strategy stands have changed over time to avoid system interface failure.

The user interface cannot be seen independently of its use by the professionals because user interface fully reveals itself to professionals only when in use. Aside my study case organization, other organizations that may benefit from the findings are the banking ATM interface developer organizations, Software Developers Association (SDA), and the ATM Industry Association (ATMIA) of Nigeria. Findings from this study will also be made available to appropriate professional literature and/or professional meetings such as Information Technology Association of Nigeria (ITAN), Institution of Management Information System (IMIS), Nigeria Internet Group (NIG), Nigeria Computer Society (NCS), and Computer Professionals (Registration Council of Nigeria) CPN. Upon completion of the study, my recommendation for reaching these groups includes, banking ATM interface developer organizations, SDA, and the ATMIA of Nigeria, informing them of my study's completion and where they can obtain a copy.

Second, I will send a one to two-page summary of the research results to the participating organization (stakeholder) and to each participant of this study. Third, I will inform all the professional groups mentioned above, the avenues for disseminating this research results to participants, and community stakeholders will be through verbal presentations via seminars and conferences. They will also be communicated of the date, time and venues at the appropriate time.

Recommendations for Further Study

The work presented in this study was motivated by a single goal: to identify strategies software developers of banking ATM systems in Nigeria use to create easy-to-use ATM system interfaces for a variety of people with varying abilities and literacy levels. One of the limitations of this study was that the sample came from relatively small number of software developers of banking ATM system interface, chosen among qualified and experienced interface developers from one case organization. Findings from this study is also limited by the perceptions and experiences of these participants regarding their responses during the interviews which may not be generalizable to all banking ATM system interface developers in Nigeria. Expanding the study to include more interface developer organizations by way of considering or exploring multiple case studies may replicate findings across cases and further add to the knowledge base and professional practice among banking ATM system interface developer organizations. Multiple case studies using a larger population aimed at identifying strategies to create easy-to-use ATM system interfaces is recommended for further study. The eligibility criteria that defines the population of this study limited this study to participants from one

developer organization in a small geographic area. ATM system interface development is a global industry with over 300 ATM system interface developer organizations in Nigeria. Future studies that may bring additional impact may consider expanding the study to include ATM interface developer organizations in other geographical areas in the country.

Furthermore, the fact that the study centered on strategies that address varied culture and literacy disabilities further limits this study findings from researching other disability cases such as vision impaired, hearing-impaired, and intellectually impaired users. Disability is a human rights issue because people with disabilities experience inequalities and are often subject to violations of dignity because they are denied equal access to some basic social pleasantries such as the use of ATM system. Therefore, another related area for additional study could be to conduct studies using developers who have strategies to create easy to use ATM system interfaces that will cater for both the variety of literacy levels, vision impaired, hearing-impaired, and intellectually impaired users. A study with successful developers with this focus may provide additional insight and allow more users to the ATM system especially among the vision impaired, hearing-impaired, and intellectually impaired users. Therefore, the findings from this study mirror recommendations that there exist opportunities for hybrid approaches for developing strategies to create ATM system interface to additionally cater for these family of disabilities: vision impaired, hearing-impaired, and intellectually impaired users.

Reflections

As I reflect upon this study, I remembered vividly one peculiar event I encountered at Dallas, Texas, USA. This encounter stupendously motivated me with passion to undertake this study. In Dallas, a friend drove me to one of the ATM points. We performed our transaction with the ATM system while sitting in the car. There were just one or two cars in the queue. In Nigeria, my home country, there are always crowds of people waiting for their turn at the ATM points (See Figure 1). The ATM interfaces I used in USA were not complex when compared to the ones in Nigeria. Aside other challenging factors peculiar to Nigeria, one major factor I reflected on that might be responsible for the intimidating crowd at the ATMs in Nigeria, was the literacy levels of users. I knew it was possible to explore ideas from expert ATM interface developers in Nigeria who have strategies to create easy-to-use banking ATM interfaces that may cater for these variety of people with varying abilities and literacy levels.

Coming from a good statistical background, I had some bias, like most statisticians, that quantitative approach is the best or only option. So, I spent some time trying to fit all I was going to do into quantitative method. However, by good mentoring, I realized I might not accomplish the study effectively using that approach, and another one might be more appropriate. One of such ways was through qualitative approach, because I needed to gain in-depth knowledge of strategies and methodologies. This approach turned out better for me because it stripped me of any possible bias except that of interviewer bias, which is always resident but can be minimized. As a statistician, I was conscious of interviewer bias that might come through asking leading questions or

not putting the question in similar sequence to all participants. This was handled using the interview protocol. I have not undertaken a qualitative study of this format or level before. Therefore, I opened myself to be mentored on the processes of doing a qualitative case study and to understand from the participants' strategies to create easy-to-use banking interfaces that for a variety of people with varying abilities and literacy levels I have learned much while doing this study. I learned about the significance of putting in place an appropriate conceptual framework in a qualitative study that will impact the understanding of my study. I now know much more than I knew when I began this study, being persuaded that whatsoever one can imagine and believe, can be realized especially in system interface design and development.

My interaction with the participants resulted in mutual benefits. After the recorded interview session, I engaged the participants in a few minutes' chat, and from their feedback, some appreciated interviewer qualities such as being empathic, listening, having knowledge about the study and being emotionally matured. The participants often conducted interviews with their end user customers, so they appreciated good interview process qualities they observed. It was exciting for some of them to be privileged to express verbally their in-depth knowledge. One, remarkably confessed he was going to be patient with the end user next time he goes for a face-to-face interview. As the researcher, I learned from the participants that even though developers work for the same organization, they have different and unique ideas which they bring into the design process, but they all follow the same organizational design guideline. On graduation, I

would have enough understanding to impact my students and colleagues on qualitative analysis, especially now that Universities in Nigeria are beginning to embrace its use.

Summary and Study Conclusions

In this study, I made efforts to identify strategies software developers of banking ATM systems in Nigeria use to create easy-to-use ATM system interfaces for a variety of people with varying abilities and literacy levels. Strategies used by developers, illustrated by the findings from this study were

- importance of user-centered design strategies,
- importance of user feedback as essential interface design,
- value of pictorial images and voice prompts, and
- importance of well-defined interface development process.

There is an ongoing need in Nigeria for banking ATM systems that can cater for a substantial proportion of the population classified as illiterate, semiliterate, vision impaired and hearing-impaired users. Banking ATM system interface development technology in Nigeria may experience tremendous innovation if all these disability categories are incorporated in developing an easy-to-use ATM system interface. The limitations placed on this study, by engaging some relatively small qualified and experienced banking ATM system interface developers from one organization notwithstanding, findings from this study were significant and supported by organizational documents and current literature on interface development strategies, and consistent with TAM conceptual framework of this study. Therefore, findings from this

study should have greater applicability to other developer organizations as well as other IT organizations that are user interface technology dependent.

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Appendix A: Interview Protocol

What I will do	What I will say—script
<p>Introduce the interviewer and set the stage—often over a meal or coffee</p>	<p>First I will introduce myself, this project, and the participant’s right to participate or not. My name is Felix Aguboshim. I am a doctoral student of Information Technology at Walden University, USA. I am also a teaching staff in the Department of Computer Science, Federal Polytechnic Oko, Anambra State, Nigeria. I live in Enugu, Nigeria. This project is my doctoral study research. This interview will last approximately 60 to 90 minutes. I will ask a series of open-ended questions prompting you to reflect upon strategies to create easy-to-use ATM system interfaces for a variety of people with varying abilities and literacy levels in your organization. You have the right to refuse to answer any question. With your permission, I will record the interview. Your name and any other information that leads to personal identification will be omitted from the interview transcript, including all presented and published data resulting from the study. Your participation is voluntary</p>
<ul style="list-style-type: none"> • Watch for non-verbal queues • Paraphrase as needed 	<p>1. What strategies have you used to create easy-to-use banking ATM system interface for a variety of people with varying abilities and literacy levels?</p>
	<p>2. How does culture of users impact your strategies to create easy-to-use ATM system interfaces?</p>
	<p>3. How does literacy level of users impact your strategies to create easy-to-use ATM system interfaces?</p>

<ul style="list-style-type: none"> Ask follow-up probing questions to get more in-depth 	4. How do you effectively harness cultural and literacy differences to create easy-to-use Banking ATM system interfaces for a variety of people with varying abilities and literacy levels?
	5. What aspects of your design strategies contributed to easy-to-use interface for a variety of people with varying abilities and literacy levels?
	6. What aspects of your design strategies ensured that banking ATM system interfaces you created will be acceptable by variety of people with varying abilities and literacy levels?
	7. What design process do you employ to ensure easy-to-use Banking ATM system interfaces?
	8. How do you work with others in the organization to ensure one coherent, easy-to-use, and acceptable banking ATM system interface?
	9. How do you receive feedback as to whether or not your design is easy-to-use and acceptable by people with varying abilities and literacy levels?
	10. Summarize or identify strategies you use to design easy-to-use banking ATM system interfaces that will cater for the illiterate, semi-literate or literate users.
What I will do	What I will say—script
Wrap up interview thanking participant.	Thank you for participating in this important interview.

Schedule follow-up member checking interview.	I will contact you within 1 to 2 weeks to schedule a follow-up interview and/or meeting, that will take no more than 15 minutes of your time, where I will provide you with a copy of the transcript from your interview and you will have the opportunity to review and to ensure that I have accurately portrayed the meaning of the information you provided me with prior to my proceeding with analysis of the transcript contents.
Follow-up Member Checking Interview	
Introduce follow-up interview and set the stage.	Thank for you taking the time to meet with me. I provided you with a copy of the transcript from your interview for review and comment on the transcript contents prior to my proceeding with analysis of the transcript contents.
Share a copy of the Transcript, interpretations of individual question. Bring in probing questions while adhering to the IRB approval. Walk through each question, read the interpretation and ask: Did I miss anything? Or, What would you like to add?	Please review transcript and sign each page to verify that it accurately reflects the interview

Appendix B: Human Subject Research Certificate of Completion



Appendix C Letter of Cooperation

Felix. C. Aguboshim

Doctoral Candidate at Walden University,

USA

XXX@waldenu.edu

XXX

27th September 2017

To: The Manager

Enugu

Dear Sir or Madam,

My name is Felix Aguboshim. I am currently a doctoral student at Walden University, USA. I am also a teaching staff in the Department of Computer Science, Federal Polytechnic Oko, Anambra State, Nigeria. I live in Enugu, Nigeria. I am working on a doctoral study entitled *User Interface Challenges of Banking ATM Systems in Nigeria*, as a partial fulfillment of the requirements for the degree of Doctor of Information Technology. The purpose of my study is to explore strategies software developers of banking ATM systems in Nigeria use to create easy-to-use ATM system interfaces for a variety of people with varying literacy levels.

Your company was selected as a potential participant in this study based on your organization's professional role and expertise in computer software development in Nigeria. In this study, I will be requesting to meet with some of your employees who have the required English proficiency, are 18 years or older, have strategies to create easy-to-use ATM system interfaces for people with varying literacy levels, within the last three years, and live in Enugu, Nigeria. I will also be requesting to gather nonproprietary information about design processes.

All your answers will be strictly confidential and will not be related to your real name, address or organization. Also, all records pertaining to this study will be kept private, and any report from this study will not include any information that will make it possible to identify you or your organization

Being in this study will involve some minor risks such as those encountered in studies of this type that involves disclosing one's professional expertise to other fellow professionals or risk of minor discomforts that can be encountered in daily life, such as taking time away from your work to attend to an interview. Otherwise, there are no anticipated risks to your participating in this study. Being in this study would not pose risk to your safety or wellbeing. There are global benefits accruing from a study of this kind that has the potential of impacting new innovations and influencing in the banking ATM systems. Successful implementation of this study will surely have a significant impact on the interface design industry, as well as positive outcomes for society, as

strategies to create easy-to-use ATM interfaces for all literacy levels will be understood.

Your participation could lead to benefits such as a published research study which may bring significant social change, as well as positive outcomes for society because it might advance the use of other technology outlets that require easy-to-use system interfaces.

.

Participation in the study is voluntary for all participants chosen. Participants may refuse participation in the study at any point in time or withdraw all or part of the information already given even after the completion of data collection without any prejudice or penalty.

Please consider participating in this study and respond to me via email at XXX@waldenu.edu using the format attached below or simply mail it as your electronic consent.

Thank you very much for your consideration and time!

Sincerely,

Felix C. Aguboshim

Walden University

Doctoral Candidate

9th October, 2017

Dear Felix Aguboshim,

LETTER OF COOPERATION

Based on my review of your research proposal, I give permission for you to conduct the study entitled "*User Interface Challenges of Banking ATM Systems in Nigeria*" within our company. As part of this study, I authorize you to collect data among my consented employee, and perform results dissemination activities for your doctoral dissertation. Employees' participation will be voluntary and at their own discretion.

Your interview may be conducted within the employee's office or any other location, and at a time convenient to the participants. We also understand that such location and time will accord participants full privacy and confidentiality. We reserve the right to withdraw from the study at any time if our circumstances change.

I wish you the best in your Doctoral dissertation.

Best Regards

Sincerely,

Appendix D: Invitation Letter to Participants

Felix Aguboshim

Walden University

USA

XXX@waldenu.edu

Date: _____

Dear Esteemed Participant,

My name is Felix Aguboshim. I am currently a doctoral student at Walden University, USA. I am also a teaching staff in the Department of Computer Science, Federal Polytechnic Oko, Anambra State, Nigeria. I live in Enugu, Nigeria. I wish to request that you participate in my doctoral research study entitled “***User Interface Challenges of Banking ATM Systems in Nigeria***”. The data I will collect from this study will be used to identify strategies software developers of banking ATM systems use to create easy-to-use ATM system interfaces for a variety of people with varying abilities and literacy levels. As the sole researcher for this study, I will be interviewing participants who have knowledge and experience on strategies to create easy-to-use ATM system interfaces for a variety of people with varying abilities and literacy levels. The purpose of this e-mail is to inform you about the details regarding participation in the study as well as your rights so that you may make an informed decision as to whether to participate in this study.

Your participation in this study is completely voluntary. If you agree to participate, you have the right to skip any or some questions that you do not want to answer or refuse participation in the study at any point in time or withdraw all or part of the information already given even after the completion of data collection without any prejudice or penalty. There will be no payment for participation in this study but, I greatly appreciate your time and effort in being a part of this study. Attached here with is a letter of cooperation from the head of your organization.

Best regards,

Felix Aguboshim

XXX@waldenu.edu

Appendix E: Semistructured Interview Guide

Script Prior to the Interview

I would like to thank you once again for being willing to participate in the interview aspect of my study. My name is Felix Aguboshim, a Doctoral Candidate from the School of Information Systems and Technology, Walden University USA. I am studying “User Interface Challenges of Banking ATM Systems in Nigeria”, with a focus on strategies software developers of banking ATM systems in Nigeria use to create easy-to-use ATM system interfaces for a variety of people with varying abilities and literacy level.

Based on my recent studies at Walden University, coupled with a vast review of the professional and academic literature that formed the specific IT problem of this study, I now know more about ATM system interfaces. I believe my contact with you will add to this qualitative case study, aimed at identifying strategies software developers of banking ATM systems use to create easy-to-use ATM system interfaces.

This study seeks to identify strategies software developers of banking ATM systems use to create easy-to-use ATM system interfaces for a variety of people with varying abilities and literacy level. The aim of this research is to document the possible strategies software developers use to create easy-to-use ATM system interfaces in order to encourage social change among software developers of banking ATM systems in Nigeria, and software developers in general, as more developers will learn from this study, how to create easy-to-use interfaces that may improve users’ morale, preference,

attraction, and productivity, and also increase the use of ATM banking in Nigeria. Our interview today will last approximately one hour during which I will ask you questions that will elicit from your abundant professional expertise, strategies software developers use to create easy-to-use system interfaces, and ideas that you may have about ATM system usability.

You had earlier completed a consent form indicating that I have your permission to audio record our conversation. Thank you! This interview is for my Doctoral research purposes only. All your answers will be strictly confidential, and our results or publications will not be related to your real name, address or organization. As such, please make every effort to be open and honest when responding to the questions. Please let me know if at any point, you want me to turn off the recorder or keep something you said off the record. It is completely up to you whether to participate. You may withdraw at any time. You may also skip questions you would prefer not to answer.

If you do not consent to audio recording, I will only take notes of our conversation. Before we begin the interview, do you have any questions? If any questions (or other questions) arise at any point in this study, you can feel free to ask them at any time. I would be more than happy to answer your questions. Thank you.

So, can we move on to the interview?

Semistructured Interview Questions.

The following Interview questions are intended to address my research question.

1. What strategies have you used to create easy-to-use banking ATM system interface for a variety of people with varying abilities and literacy levels?

2. How does culture of users impact your strategies to create easy-to-use ATM system interfaces?
3. How does literacy level of users impact your strategies to create easy-to-use ATM system interfaces?
4. How do you effectively harness cultural and literacy differences to create easy-to-use Banking ATM system interfaces for a variety of people with varying abilities and literacy levels?
5. What aspects of your design strategies contributed to easy-to-use interface for a variety of people with varying abilities and literacy levels?
6. What aspects of your design strategies ensured that banking ATM system interfaces you created will be acceptable by variety of people with varying abilities and literacy levels?
7. What design process do you employ to ensure easy-to-use Banking ATM system interfaces?
8. How do you work with others in the organization to ensure one coherent, easy-to-use, and acceptable banking ATM system interface?
9. How do you receive feedback as to whether or not your design is easy-to-use and acceptable by people with varying abilities and literacy levels?
10. Summarize or identify strategies you use to design easy-to-use banking ATM system interfaces that will cater for the illiterate, semi-literate or literate users.