Implementing Change in a Public Organisation: An Action Research Inquiry of Information Technology Implementation and Adoption

Thesis submitted in accordance with the requirements of the
University of Liverpool for the degree of
Doctor of Business Administration

By

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DECLARATION

I certify that the work presented here is mine alone and no portion has been submitted previously to qualify for any other academic award. The thesis is the result of work, which I carried out since the official commencement date of my DBA journey.

All sources referred to have been documented and acknowledged. Ethical clearance was duly granted.

Liverpool, July 2020

Iniobong L. Usoro

ACKNOWLEDGMENTS

When taking off on my DBA journey towards the end of 2014 (November to be precise), I did not realise what an adventurous and exciting but demanding trip I had in front of me. Now that I have finished, I am glad about the knowledge and experience I have gained and for the difficulties I have been able to overcome along the way. These have made me realise that the journey of completing a thesis is unique and cannot be achieved by one's own might alone. I am therefore grateful to all those who contributed and supported me along the way. Without your help, I would never have accomplished this feat.

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Finally, I would like to express my gratitude to my family for their love, understanding and support. Particularly, I would like to thank my husband Stanley Usoro for his patience and financial support. His belief in my abilities was unwavering and this gave me the needed strength and conviction to complete the journey.

DEDICATION

To my husband,

AVM. Stanley J. Usoro (rtd.) and

Daughters,

Udeme, Seno and Sifon;

Whose support made this endeavour possible.

ABSTRACT

There have been several studies that focused on the efficacy of an information system and its acceptance. A key reason for problems during the implementation of information systems has been the fact that little consideration was given to how the future users would understand and interpret the new technology. The Federal Roads Maintenance Agency (FERMA) introduced the Geographic Information System (GIS) in 2012 to support the monitoring of the entire network of federal roads in Nigeria. It became pertinent because the management of the road network was hindered, and the needed information was not readily available. Six years after implementation, the initiative was not ready for use as a management tool to aid decision-making. The purpose of this study was to explore the lack of adoption of the GIS in FERMA. An adapted technology acceptance model provided an initial understanding of the GIS phenomenon. It offered a path of tracing the impact of the external factors of leadership characteristics and management practices on attitudes and intentions.

Action research (AR) was used to conduct a qualitative inquiry, where semi-structured interviews and observations were embedded appropriately in the cycles of action research. The data gathered was arranged and managed using ATLAS.ti version 8.4, while a form of template analysis was the thematic approach used for the analysis. From AR cycle 1, the overarching themes for dominant discourse were leadership, strategy and staff capabilities. It emerged that the GIS was more than a stand-alone product as was earlier assumed. It was found to be part of a much wider system where everything was connected to something else, and one part could not be removed without consequences to the other. This led to the emergence of the GIS ecosystem adoption model, where the GIS problem had to be tackled holistically with a definite change to managerial practices. The managerial interventions of developing a GIS adoption strategy, conducting hands-on training and enforcing mandatory usage were applied and monitored in AR cycle 2. These critical factors generated the desired change, as important discoveries were made about the organisation and our ways of working. The criticality of leadership in technology-enabled change became apparent because the message transmitted, and its response was highly dependent on the messenger.

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1.1 Research Background

As an engineer working with the Federal Roads Maintenance Agency (FERMA) since 2007, I have been involved with the various operations carried out to deliver on our mandate of monitoring and maintaining all federal roads in Nigeria. FERMA is a government organisation that operates through a three-tier structure: the corporate headquarters, twelve zonal offices, and thirty-eight state field offices. The zonal directorate structure is for effective field operations with each zonal office overseeing three state field offices. The flow of authority and responsibilities percolate from the headquarters through the zonal offices to the state field offices. The headquarters is made up of ten departments namely: Administrative and Human Resources, Legal, Finance and Account, Procurement, Direct Labour, Monitoring and Special Duties, West Operations, East Operations, Engineering Services and the Road Maintenance Management Services (RMMS).

I spent five years in one of the field offices as a Federal Roads Maintenance Engineer overseeing all activities within the state and later moved to the Procurement Department where I spent eight years rising to head the department. In 2017, as a result of my development as a scholar-practitioner, I was posted to head the Roads Maintenance Management Services Department (RMMS) where the Management Information Systems division is domiciled. It was there that I had first-hand experience of investment in information technology because it formed part of my job description. This study required the involvement of all the departments, but was driven from the RMMS department. Also, at the time of this research, I was a member of the top management and was tasked with the implementation and adoption of the Geographic Information System (GIS). It became imperative because the management of the road network was hindered, and the needed information was not readily available. This study explores the lack of adoption of the GIS in FERMA, where I was a key actor in driving the change process.

In the course of identifying the problem, a full systems check was carried out on the GIS, and it was found to be satisfactory. However, the platform lacked the needed data and uploads to enhance full usage. There appeared to be a lack of ownership of the system. It was time for us to take responsibility, thus the decision to focus on the individuals (users) involved with the GIS

through qualitative data so that one could understand their hindrances. My intuition was that for this organisational change I had to focus on the people. The sense making of the actions and interactions of the users through the adopted strategy of action research would provide learning for the organisation. To achieve this, an adapted technology acceptance model (TAM) was found most appropriate as the conceptual framework for the research because its narrow focus on information system acceptance reduced attention on the role of technology and design.

As an insider, I was aware of the benefits of the GIS to our job. It was apparent from training and demonstrations that a functional GIS was critical to improved performance of FERMA operations. The ability to gather and share information from a database readily accessible would improve our efficiency and set FERMA apart as a leading voice within the road sector. Furthermore, introduction of the GIS brought about new knowledge to the organisation with additional skill sets. In the institutional context, this was brought about through improved organisational routines and procedures. For example, the offered hands-on training promoted learning and helped the users to overcome knowledge barriers.

1.2 The Problem

The introduction of new technology in an organisation is typically prompted by a performance gap (Batt-Rawden *et al.,* 2017; Mirvis *et al.,* 1991), where actual performance is below the desired performance. In FERMA, the turnaround rate in processing contract files in the headquarters was slow as information on projects was not readily available. In addition, the inventory of road assets, though updated, was not accessible. Information sharing and management among stakeholders was greatly hampered. The organisation required more information for effective road management. Data in digital form was absent. According to Nath and colleagues (2013), GIS technology is not very useful without adequate data in digital form. Therefore, there was a need to customise the data entry process in FERMA to ensure uniform and adequate analysis. As a means of effectively dealing with the situation, the top management introduced the Geographic Information System (GIS) in 2012 to support the monitoring of the entire road network. The assets to be monitored were road maintenance projects, bridges, street lightings, and office buildings, to mention a few. Atenucci and colleagues (1991) acknowledged the importance of the GIS technology as a valuable decision support tool. Conversely, six years

after installation, the intervention was still not ready for use as a management tool to aid decision-making. There was much blame-shifting. Thus, my initial query was 'why the resistance of the GIS in FERMA?'

Introducing technological change in an organisation presents a different set of challenges to management (Leonard-Barton and Kraus, 1985). The successful implementation of information systems in any organisation depends on a multitude of important and interrelated factors. Its implementation and subsequent use is a process of interrelated steps. A successful IT implementation requires careful planning and coordination where factors such as infrastructure, bureaucracy, employee attitudes and requisite skills need to be considered. Planned change involves a deliberate, purposeful, and explicit decision to engage in a program of change (Levy and Murray, 1986). A key reason for problems during the implementation of information systems is the fact that little consideration is given to how the future users would understand and interpret the new technology (Avgerou, 2000; Lee and Xia, 2011). This indicates the importance of capabilities, views and expectations of the users when embarking on any IT implementation. Consequently, this thesis is an action research inquiry into the implementation and adoption of a Geographic Information System (GIS) in a public organisation with a focus on the perception of the users.

1.3 Research Purpose, Objectives and Question

The purpose of this study was to explore the lack of adoption of the GIS in FERMA with focus on the perceptions of the users.

The objectives of the study were to:

- gain a deeper understanding of the roles of the users and management in the adoption of the GIS,
- positively transform the GIS, to a fully operational state with accurate data and seamless interdepartmental relations,
- use the GIS as a management tool to aid decision-making in the management of the road assets.

I began this study with my initial preunderstanding of the GIS issue as an insider and the key question, 'Why the resistance of the GIS in FERMA?' My focus was on the users as I prefigured that they were key actors in the lack of adoption. I began the literature search with keywords within the problem domain such as information technology, change management, technology implementation and technology adoption. Much understanding was gained. Literature stated that for technological change to be sustained employees must learn new skills and change the way they do things. It went further to note that leadership at all levels could influence the adoption of a new system, emphasising that management actions and practices needed to support the desired change. A detailed review of literature is captured in chapter three. It shows my thought process throughout the review and justifies why I decided to use the technology acceptance model (TAM) as the foundation on which I began the exploration of the lack of adoption of the GIS in FERMA. A key purpose of TAM was to provide a basis for tracing the impact of the external factors on attitudes and intentions. Several studies had considered the extension of TAM, broadening the scope to consider factors such as demographics of users, access barriers, organisational facilitators and influence of leadership styles to mention a few. In this case, an adapted TAM (Figure 4) with the external factors of leadership characteristics and management practices provided the initial understanding of the GIS phenomenon. These two external factors were identified as likely to impact user perception based on my insider knowledge and extant literature.

1.4 Significance of the Research

The fundamental aim of action research is to improve practice rather than to generate theory (Titchen and Binnie, 1994; Coghlan and Brannick, 2014). The concept of action research involves extensive collaboration between the researcher and the participants in data gathering, data discussion and planning throughout the change process. This study consists of two action research (AR) cycles.

This research was not commissioned, so why do it? People and their varying interpretations or responses to events have always been intriguing, so I chose to research the GIS phenomenon in this manner. This study was significant as it provided an empirical discourse on the human perceptions of IT implementation and adoption rather than the system itself. It offered a

discussion of the GIS situation in FERMA with qualitative data revealing the perceptions of the actors directly involved with the system. From AR cycle 1, the overarching themes identified for dominant discourse within the GIS problem were leadership, strategy and staff capabilities. The interactions were integral to developing a comprehensive understanding of the problems associated with the lack of GIS adoption. It emerged that the GIS was more than a stand-alone product, as was earlier assumed.

More specifically, the GIS was found to be part of a much wider system where everything was connected to something else, and one part could not be removed without consequences to the other. This led to the consideration of the GIS problem, metaphorically speaking, as a technology ecosystem where I needed to think carefully of all actions from leadership to strategy to staff capabilities or user characteristics. FERMA had to rethink its approach to implementing and getting individuals to use the GIS. There had to be a synergy of the three elements of leadership, strategy, and the user to achieve GIS adoption. It led to the emergence of the GIS ecosystem adoption model (Figure 12), where the GIS problem was tackled holistically with a definite change to existing managerial practices.

The actionable knowledge for the adoption of the GIS was threefold. The first was to rethink our mental model and get out of the silo mentality, bearing in mind that in the adoption of the GIS one had to consider the interactions and interdependencies between managers, adoption strategy and the users. The second was to ensure that all involved were engaged with the processes. This was accomplished through working in teams where the overall picture or goal was known. Finally, the managerial interventions of – development of a GIS adoption strategy, conducting hands-on training and enforcing mandatory usage – were applied and monitored diligently. These critical factors generated the desired change. As a result, we made important discoveries about ourselves, and our ways of working, such as the criticality of leadership in technology-enabled change, where the message transmitted and its response was highly dependent on the messenger. The problems associated with slow Internet speed and erratic power supply was found to cut across all the stages of GIS use. The prolonged buffering time delayed tasks and made use of the system both cumbersome and tiresome. In addition, mandatory usage also uncovered the need for more skilled personnel capable of efficiently managing the GIS portal and also the need for more computers, GPS devices and other relevant hardware.

The research was an exciting and enlightening experience. The GIS use improved, and the organisation is working much more effectively. These provisions have laid the foundation for future IT implementation and an adoption framework within FERMA.

1.5 Structure of the Thesis

The thesis is organised into six chapters.

Chapter 1 describes the organisational problem and the purpose of the research indicating its significance and what has been achieved. It sets the stage for the study in a specific context and provides the overview.

Chapter 2 discusses the philosophical assumptions that underpin the research. It also specifically discusses the action research strategy, the action research cycles, data collection method, data analysis techniques and processes. This includes identification of interviewees, preparation of interview questions, interview schedule design, and participant consent form to mention a few.

Chapter 3 presents the literature relevant to the successful implementation and adoption of new technology in organisations. It is an extensive review of literature, and it ends with the conceptual framework for the research adapted from Davis *et al. (*1989) technology acceptance model. The adapted model is specific to this GIS problem and provides a foundation for determining the impact of the new technology based on the researcher's inside knowledge.

Chapter 4 is action research cycle 1, it shows the interpretive understanding of all participants identified as either an influencer or a user. The chapter begins with the construction of the problem, followed by interviews to explore the constructed problem. The rationale for the interviews was to explore and assess my initial construction of the problem with the adapted TAM model (Figure 4), by seeking the participant's perspective and experiences. After analysis, the findings and interpretations caused the development of a GIS ecosystem model for adoption (Figure 12) as a tool for addressing the GIS problem in FERMA. It identified the positive factors that aid adoption as well as the constraints that caused non-usage. The overarching themes identified for consideration were leadership, strategy and staff capabilities.

Chapter 5 is action research cycle 2, it is an action chapter where the developed GIS ecosystem adoption model is tested, and three out of the five managerial interventions were applied. The action learning set (ALS) agreed that the three interventions would be: 1) developing a GIS adoption strategy, 2) conducting hands-on training, and 3) enforcing mandatory usage. The data collection phase spanned six months. The users of the GIS were observed across five major processes of the organisation. They were the procurement process, the contract validation process, fieldwork progress updates, project completion and project sign-off and payment. The chapter then goes further to discuss the key outcomes of the intervention.

Finally, chapter 6 is the evaluation chapter. It discusses the findings and the value of the outcomes after the managerial interventions in the form of first, second and third person learning. It highlights where the organisation was at the beginning, identifies the key things that caused the change or improvement and answers the framed research questions explicitly. The chapter also discusses how the organisation would ensure that the learning is sustained.

1.6 Summary

The ultimate goal of this research was the development of actionable knowledge, which explained the lack of adoption of the GIS in FERMA and through action research improved practice as the emerging factors were addressed. The next chapter discusses the methodology used to conduct the research in a manner that engaged the scholar-practitioner, allowed for collaborative activities and offered actionable knowledge for the practitioner and academic communities.

2. RESEARCH METHODOLOGY

2.1 Introduction

There is no laid down best path as to how one carries out a study. It all depends on the problem at hand and the appropriate approach for investigation (Holloway and Wheeler, 1996). The issue here was to identify the factors that are hindering adoption of the Geographic Information System (GIS) in my organisation, FERMA. In this case, the focus was on sense making of the perceptions, actions and interactions of the actors in a manner that provides learning for FERMA.

The epistemological and methodological assumptions of a researcher are factors that guide him or her in the choice of research methodology. In describing my philosophical approach, I agree with a comment made by Alvesson and Sköldberg (2000, p. 4), '…. it is not methods, but ontology and epistemology which are the determinants of good social science.' From the various courses covered as I developed as a scholar-practitioner, I learned that the study of organisations could be carried out from a multiple of paradigms (Hassard, 1991). This resonates with the thinking of Potter and Wetherell (1987), where they stated that it is as important for one to develop an appropriate theoretical understanding as it is to perfect one's methodology. My position as a researcher throughout all the critical action learning projects was such that helped me produce knowledge that aided understanding and improved my workplace-based issues. Thus, this chapter will discuss the philosophical assumptions that underpin this research. It would also discuss my choice of methodology, research design and step-by-step process of the study so as to answer the research questions.

2.2 Overview of Research Methodology

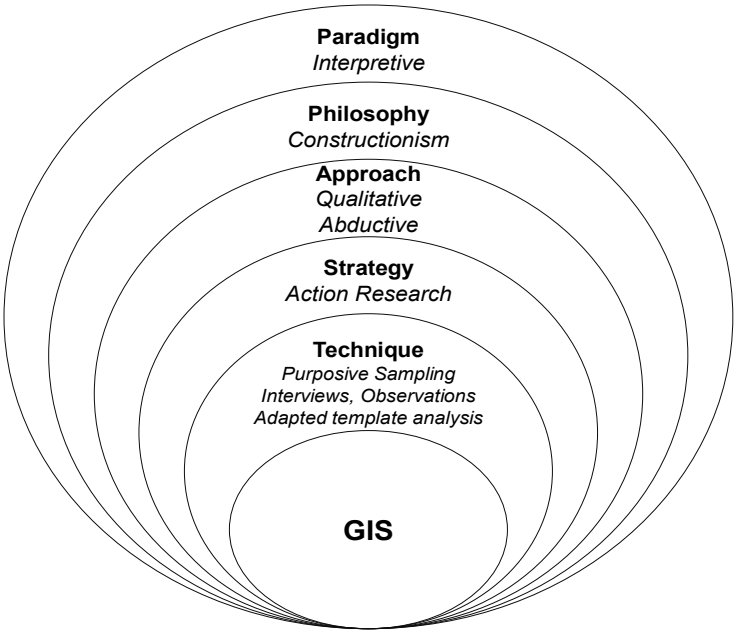

Figure 1: Overview of Research Methodology (adapted from Easterby-Smith *et al.*, 2012 and Saunders *et al.*, 2017)

Figure 1 reflects the thesis research methodology at a glance. It is an artificial construction to be viewed as a map. It depicts the GIS phenomenon and the various layers that had to be peeled off to uncover the reasons for its lack of adoption. It shows the choice of action research to conduct a qualitative inquiry within the interpretive research paradigm. The focus of the study is the GIS in FERMA. The techniques adopted to collect data were semi-structured interviews and observations embedded appropriately in the cycles of action research while a form of template analysis was the thematic approach used for analysis (Braun and Clarke, 2006; King and Brooks, 2017). The participants through social interactions constructed knowledge. Thus, the underlying philosophy through which I examined the GIS situation was constructionism (Creswell, 2013; Young and Collin, 2004).

2.3 Research Paradigm

In this study, the interpretivist paradigm is used. The interpretive approach considers the methodical exploration of rational action by watching people as they are, without manipulation to the environment. The goal being to learn and gain insight to how they construct and preserve their world created through social interactions (Neuman, 1993).

2.3.1 Rationale for Choice of Interpretivist Research Paradigm

Using Burrell and Morgan's (1979) matrix of four paradigms in Figure 2, there are two axes:

- The objective and subjective axis - at the objective end of the spectrum, the researcher sees reality as something waiting to be discovered while in the subjective realm reality is something in our heads defined by our subjective experience. This is described further in the section on research philosophy.
- The radical change and regulation axis - at the side of radical change, the world is viewed as a place to be changed for varying reasons. It is concerned with how organisational activities are conducted and propounds methods through which radical changes could occur. An example is to strive for the status of equality. At the opposite end is regulation, where the world is seen as a fairly stable place where one can study a current situation. Regulation refers to courses of action that could enhance organisational activities within its existing structure.

From my assessment of the needs of this research specific to my organisation, FERMA, it is mainly about the actors and their perceptions of the GIS. The degree of change expected remains cohesive and orderly for the individual, and it should transform into adoption or full usage of the GIS. A fully functional GIS translates to an improvement in the efficiency and productivity of FERMA because all information on the federal road network would be centralised and easy to access and share. This positioned me in the interpretive quadrant, which states that organisations were to be understood from the participant's perspective in order to comprehend how shared versions of reality emerged and were sustained. It was this approach that generated the kind of data and knowledge that I sought. My position was not entirely at the regulation end. On the change dimension, I would position myself in the middle of the bottom half, leaning more

towards the subjective axis, believing that truths are based solely on one's mental choices or subjective processing.

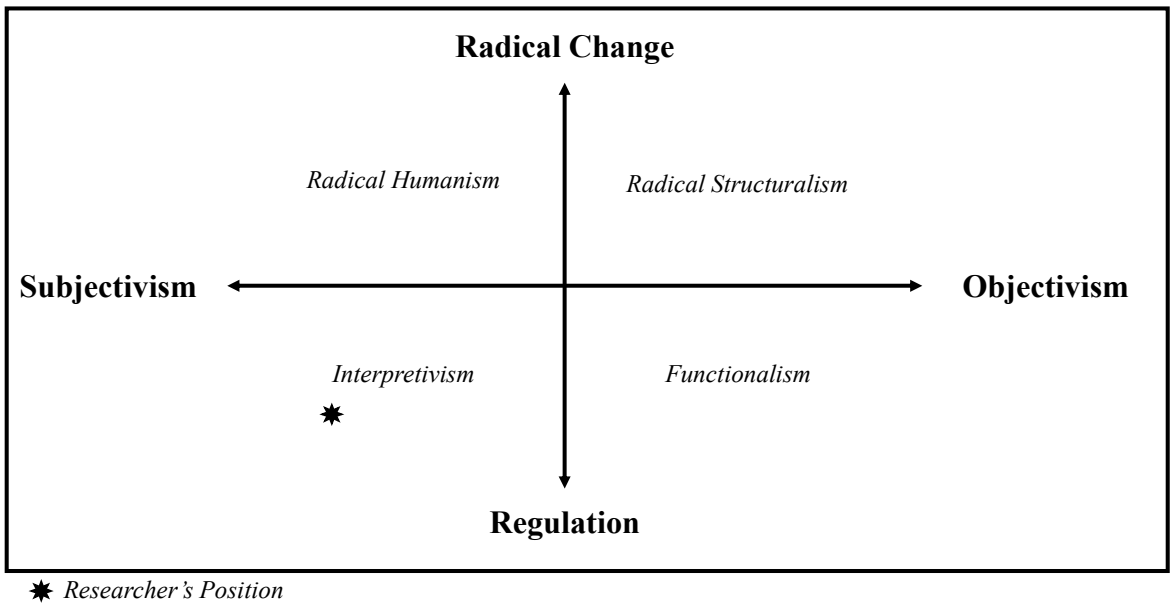

Figure 2*:* Burrell and Morgan's Four Paradigms (1979)

2.4 Research Philosophy

According to Creswell (2003), ontology is a researcher's perception of reality, while epistemology is the role taken by the researcher. Ontology informs epistemology, how an individual views the world influences his or her knowledge of it. An objectivist view of ontology assumes that psychological phenomena are real with definite properties. In contrast, subjectivist view of ontology assumes that psychological phenomena are socially constructed (Johnson and Duberley, 2000). Thus, there is no worldwide understanding of an occurrence. The world is viewed as '…where meanings, sense making and knowledge are relative to the time, place and way they are constructed – in the everyday interactions of people' (Cunliffe, 2011, p. 656). This research is based on the relativist ontology where truth is contextual and depends on the viewpoint of the researcher (Easterby-Smith *et al.*, 2012). There are multiple realities, which are created. The goal is to understand the meaning and grasp the actor's definition of the situation.

2.4.1 Constructionist Epistemology

Scholars engaged with Information Systems (IS) argue that the philosophical assumptions on which a study is based should be clearly stated when investigating issues within the field (Orlikowski and Baroudi, 1991; Walsham, 1995). According to Bryman (2016, p. 27), 'an epistemological issue concerns the question of what is (or should be) regarded as acceptable knowledge in a discipline'. Positivism and social constructionism are two of many contrasting epistemologies that advocate different methods in the study of social reality. Constructionist epistemology is an interpretive approach. It maintains that knowledge is a social construction so the interpretations of occurrences depend on the perception of the researcher (Lincoln and Guba, 2000; Orlikowski and Baroudi, 1991; Walsham, 1993). Consequently, through interpretations and actions new insights are gained. In this research, focus is on the knowledge created through social interaction with the participants.

There was also consideration of what would be done with the knowledge gained and to what purpose. The guide was Burrell and Morgan's grid (1979) in Figure 2. It indicates that for a regulated approach to change there must be a better understanding of the organisation to enable better and more effective actions. The introduction of the GIS was a regulation approach to change. In line with this, my epistemological stance was social constructionism because knowledge was co-constructed with the participants. The emphasis was on the collective generation of meaning, which allowed me to uncover the minute details of the GIS phenomenon, which were unknown.

2.5 Research Approach

In the IS field, there are both quantitative and qualitative research approaches. The quantitative approach within the IS field relies on the use of numbers, and is familiar to most information system researchers (Lee and Hubona, 2009). The quantitative approach focuses on numbers and assumes a cause and effect relationship between social reality and humans. However, as organisational reality does not go along with statistical inferences, the qualitative approach is favoured because it records accurately in words the organisational reality of IS related phenomena (Eryilmaz *et al.,* 2015; Ferguson *et al.,* 2018; Walsham, 1993). In this study, my

preference is for qualitative research because human behaviour is contextual and does not follow linear models.

The overall research approach in this study is qualitative. Qualitative research methods provide valuable perception and realisation of the varying individual encounters related to new technology. It examines the data gathered in the form of participants' voices and also considers their actions (Creswell, 2003; Merriam, 1998). A qualitative approach flows from my stance as an interpretivist, dealing with in-depth analysis of a small sample. The rationale is that it is a good fit as this descriptive information will reveal and provide a general understanding of the GIS situation in FERMA.

Creswell (2013) discusses several reasons for employing a qualitative approach. Among them are:

- The research question starts with why or what,
- The topic needs to be investigated in detail,
- The writer brings him/herself to the study,
- The researcher's role is that of an active learner rather than an expert passing judgment on participants.

It can be demonstrated that this study meets all the above criteria as the primary question of this research, 'Why is there a lack of adoption of the Geographic Information System in FERMA?' is a why question typically answered by qualitative research. The primary purpose of this research is to explore the GIS situation in the organisation through my active participation, which requires a detailed description in order to understand the dynamics at play. It is a qualitative study using the action research strategy with abductive reasoning (Alvesson and Sköldberg, 2002; Gyöngyi Kovács, 2005), I had to move back and forth using both induction and deduction to link theory and data. As an insider researcher, there was some level of preunderstanding through personal reflexivity of the GIS issue. However, it was impossible to be either purely deductive or inductive because the research design involved both making informed decisions based on data obtained such as the participants' voices describing their GIS experience and making assumptions or deductions based on existing theories found in extant literature to arrive at a new understanding.

2.6 Research Strategy and Techniques

The reason for an action research (AR) type of design was to encourage organisational learning in order to generate practical end results. Recognising issues, setting out a plan of action, acting and evaluating the action were the steps taken to produce practical outcomes. AR involves a varied protocol that embraces the comparison of research and action, theory and practice (Mckay and Marshall, 2001). It is a collaborative effort in which all individuals involved in the study are knowledgeable and contributing participants (Kuhne and Quigley, 1997). Dick (2004) defined action research as an adaptable spiral practice that permits the simultaneous attainment of research and action. In this case, the action is about improvement and the research about my understanding and gaining greater knowledge of the organisational dynamics. AR is used when the researcher is concerned with actions and interpretive understandings (McNabb, 2013). It is designed to allow changes in action plans as people learn from their personal experiences. Lewin's three-stage change model (1947) was an intentional interrelation of action and reflection. Within the problem context, the measures taken to tackle an identified phenomenon should be seen to arise from the plans for developing, assessing and updating theories (Susman and Evered, 1978). The methodology used for a strictly academic-focused research differs from the type used in a theory-practice focused research and as such, I deem the choice of methodology in any research to be critical.

Action research is conducted in the present. It's intent is to help integrate research and practice in one's self, the organisation and the wider practice community, which form the three voices and audiences: first-, second- and third-person (Reason and Bradbury, 2008). The first-person addresses the researcher's inward inquiry and reflection. Second-person inquiry involves inquiry with others through face-to-face dialogue. This is primary in terms of change in practice because the collaborative processes engaged in applying the iterative cycles of construct, plan, act and evaluate provide the needed learning, which translates to the actionable knowledge for a third-person audience (Coghlan and Brannick, 2014).

Gummesson (2000) listed the distinct properties of action research. From a managerial perspective, the properties entail tackling twin objectives of solving an organisational challenge and contributing to the existing body of knowledge. A conceptual framework is necessary as a guide for the action researcher and it should be related to the particular context where the

problem is situated (Checkland, 1991). AR bridges theory with practice and requires prior understanding of the organisational environment and its dynamics to a certain extent. Its methodology enhances the skills and competencies of the researcher and participants as they learn through action (Hult and Lennung, 1980). As an insider researcher, one has 'preunderstanding' knowledge of the organisation's everyday life and is part of the GIS phenomenon. Due to this knowledge, the GIS issue was identified as a critical event that was affecting the overall achievement of the organisation's strategic goals. Merely acquiring the technology was not enough to obtain the anticipated benefits. Consequently, I was able to carry out research that produced actionable knowledge through my acquired skills as a scholar-practitioner. The research started with reflection on my preunderstanding rather than the conventional collection and analysis of data. The action of implementation of the GIS had been concluded and my task was to explore the situation in detail. This meant that I had to methodically consider each step of the GIS technology where the participants were involved to understand the lack of adoption. According to Ramsey (2014, p. 18), scholar-practitioners 'need to develop skills of finding, recognising and evaluating evidence'. In developing these skills, I took the following steps: 1) description of the research problem, 2) review of the literature, 3) formulation of research questions, 4) design of the research, 5) sampling and data collection, 6) data analysis, and 7) evaluation of the data. The research strategy as depicted in Figure 1, was limited to two robust action research cycles performed within the time available for the DBA thesis. Figure 3 (section 2.6.3) is a detailed illustration of this component. AR cycle 1 was the traditional research construction from the literature. The outcome was a conceptual framework to assess and explore the GIS phenomenon. This resulted in several findings that led to applied interventions in AR cycle 2. The details of the construct, plan, act and evaluate stages are discussed in section 2.6.3 under action research cycles. This section outlines the issues of being an insider researcher, sampling, data collection and analysis of data. This thought out process ensured that evidence obtained enabled unambiguous answers to the research questions.

2.6.1 Insider Research

Action research calls for the insider researcher to explicitly state the theoretical underpinnings of 'preunderstanding' knowledge (Coghlan and Brannick, 2014). For this study, I am against

objective reality observed from afar, which can be replicated across organisations. I favour subjective reality that considers the ideas or 'truths' of each individual. It necessitates understanding the different experiences of individuals instead of looking for external causes to explain behaviour (Easterby-Smith *et al.,* 2012). From my experience as a manager within the organisation, I gathered that the GIS technology was appropriate. However, there was a missing link with the individuals involved. Knowing that people are different, it was logically derived that everyone would have different perceptions and experiences of the GIS. This translated to the fact that modes of motivation towards actual usage could be different and would need to be considered.

Insider research is a basic application of action research. The actions carried out by organisational members to improve a workplace issue enables further understanding of required managerial roles (Coghlan and Brannick, 2014). There are four significant challenges when considering insider research, and they are access, preunderstanding, role duality and organisational politics. In this study, as an insider researcher, the key people relevant to the research were readily accessible. My status as a member of top management also increased the networks I could access downwards through the hierarchy. I was attentive to the strengths and limits of my preunderstanding by reflecting on my actions at every step of the research process. As a result, I was able to reframe my understanding of the GIS issue. I was also conscious of my dual role and its demands while negotiating organisational politics and its impact during the process of inquiry (Coghlan and Brannick, 2014). The characteristic of asking searching and provocative questions that cause others to look at themselves differently has become an acquired skill. Critical thinking and critical reflection in management research and practice are underpinned by the notion that problems do not have fixed diagnoses and cures (Anderson *et al.,* 2015). Thus, one needs to work with an open mind and a questioning approach. With the acquired skill, I now have a strong sense of self with values of care and practicability.

2.6.2 Purposive Sampling

Sampling sets out to obtain a true appreciation of the study population (Easterby-Smith *et al.*, 2012). It involves two steps: 1) setting boundaries that describe the study within the limits of

available time, and 2) creating a framework that helps uncover the constructs surrounding the study.

Oppong (2013) identified convenience, theoretical and purposeful sampling as sampling methods in qualitative research. According to his study, the least reliable approach was the convenience sampling method due to the fact that it is based primarily on the convenience of the researcher with respect to effort, time and financial implications. In the theoretical sampling method, the researcher chooses samples so as to formulate or try out a theory. Purposeful sampling method was the generally accepted method because it is a non-random technique where the researcher chooses individuals who are involved and knowledgeable about the issues being researched. The purposive sampling method was the adopted technique for this study.

2.6.2.1 Rationale for selecting the participants

Sampling is essential for further investigations as it has the power to steer the analysis based on whom, why, where, what and how. It places a restriction on the conclusion as well as determines the degree of confidence that could be placed on the outcome of the analysis (Miles and Huberman, 1994). Purposive sampling is chosen to adequately address questions posed in a study by choosing specific individuals who are skilled and experienced about the issue of interest (Hesse-Biber, 2010; Palinkas *et al.*, 2015). Purposive sampling could be classified further as criterion sampling (Patton, 2015). In this study, the participants were selected on the reason of each person being involved with the GIS.

The research was made up of two groups - influencers and users. All the participants were chosen based on their involvement with the GIS technology. They were either users or those individuals who could influence the actions and perceptions of the users [influencers]. Six senior managers out of twelve were selected because they could influence the desired change. They were heads of departments actively involved in collecting the needed data such as operations, procurement and engineering services to mention a few. The six senior managers formed the action learning set (ALS) that collaborated with me, the facilitator, in identifying the needed managerial intervention after the initial interviews. Similarly, nine users of the system were chosen across varying grade levels. Six were progress officers from the various departments in the headquarters on grade levels eight to ten, while the other three were FRMEs (middle

managers) on grade levels twelve to fourteen in charge of operations in their state field offices. They were chosen within the GIS system to test out managerial actions, which were located at their workstations. All the selected individuals were informed of the study and what it entailed. Participation was voluntary and no one refused, rather they showed enthusiasm at being part of the study. This is discussed further in section 2.8 under ethical issues.

2.6.3 Action Research Cycles

The act of constructing and selecting this action research project is a learning cycle in itself. Zuber-Skerrit and Perry (2002) identify writing a thesis as an action research cycle with inquiry-in-action and reflection on how the core action research project was designed implemented and evaluated. Hibbert *et al.* (2010, p. 48) argued that 'when we experience reflection, we become observers of our practice.' They regarded reflexivity as a 'process of exposing or questioning our ways of doing' (p. 48). This fits with Alvesson and Sköldberg's (2000) premise that reflexive research involves interpretation and research. In reflection, one considers the assumptions made and the observations.

The cycles of action and reflection support a robust action research (AR). It is a repeated cycle of operations starting with problem identification, followed by planning on how action would be taken and then once action is taken the outcomes are examined and evaluated (Coghlan and Brannick, 2014; Coghlan and Holian, 2015; Greenwood and Levin, 2007). To Steier (1991), reflexivity consists of how a researcher makes sense of the objective world and at the same time examines his or her actions and assumptions. Clegg and Hardy (1996, p. 769) viewed reflexivity as 'ways of seeing that turns back upon and takes account of itself.' Knowledge creation requires reflexivity. The outcome of this AR project is practical and usable knowledge for the organisation.

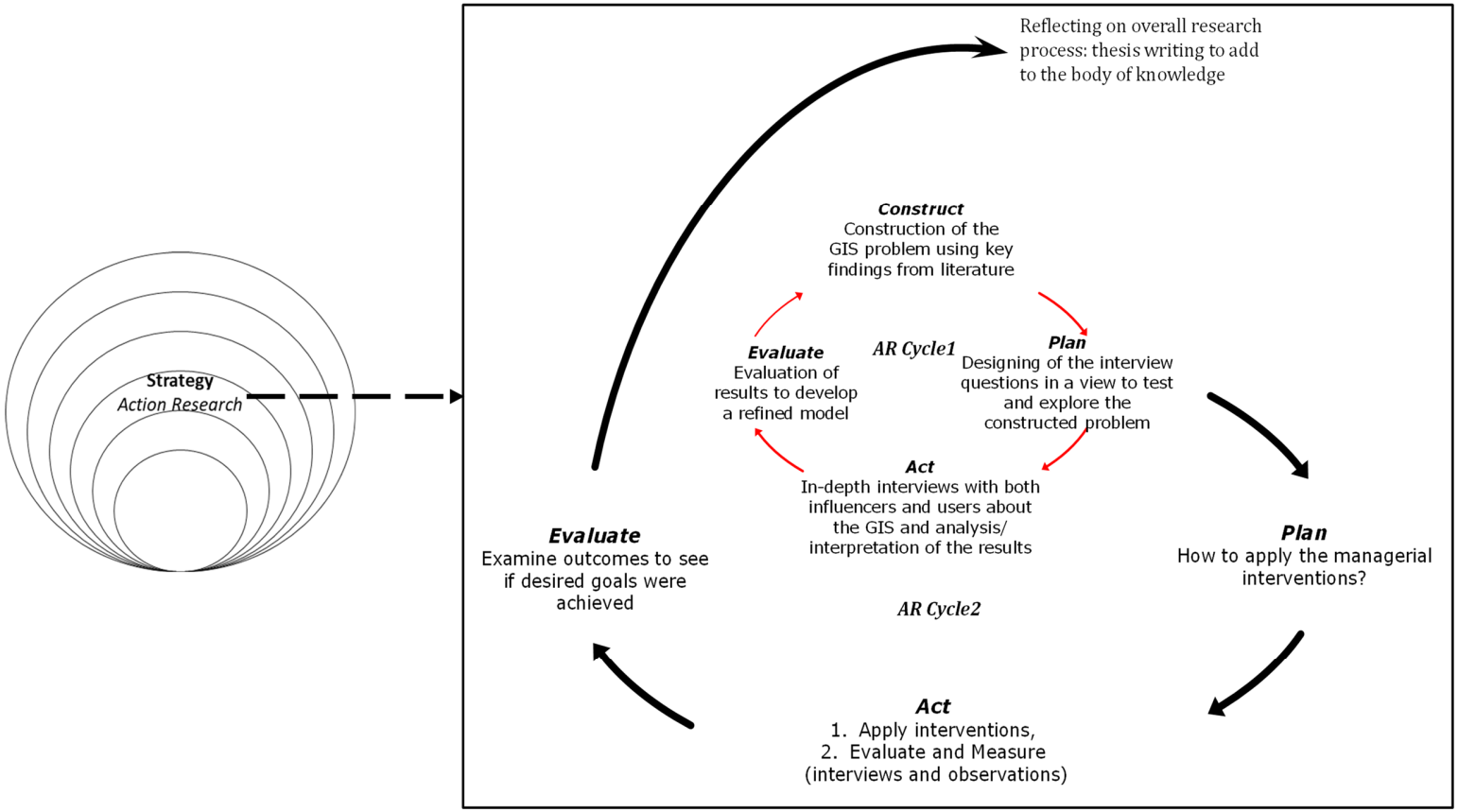

Figure 3: Overview of Action Research Project – (The Research Strategy)

2.6.3.1 Action research cycle 1

It comprised of the following:

a. Constructing – The process of gaining an initial understanding of the problem and the development of a conceptual framework from the extensive review of literature. The problem under study was located within the scope of the Technology Acceptance Model (TAM). This is fully documented in chapter three.
b. Planning Action – The preparation of interview protocol and questions. My central focus was the human perspective, the users of the technology and their perceptions, thus my choice of semi-structured interviews to explore the model. The interview guide (see Appendix B) was divided into three sections: the introduction, the TAM (Davis, 1989) and exploring factors around the adoption of the GIS. The goal was to explore the critical areas reflected in the conceptual model in a manner that leaves one open to new perspectives. The rationale for each section was clearly documented to ensure proper flow in relation to the initial literature diagnosis that resulted in the adapted TAM model. The interview questions were centred on the factors identified in the conceptual framework and posed in a manner that enabled participants to open up about their own experiences and perceptions of the GIS. I was careful not to refer to assumptions suggested by literature in my questions to avoid the risk of bias on the part of the interviewee. The interviews started with a preamble to the topic, followed by warm-up questions to put the interviewee at ease. A pilot interview was conducted to assess the understanding of the interview questions and its potential to yield useful results. Consequently, some questions were reworded, and others further clarified.
c. Taking Action – This was to explore the TAM model through in-depth interviews with both influencers and users. An aggregate of fifteen semi-structured interviews of approximately 45 minutes each were conducted in line with the developed interview guide. With the prior consent of the participants, the interviews were audio-recorded for transparency. The conversion from audiotapes to transcribed text began the data analysis process. The transcripts were read multiple times before commencing the initial coding. Passages with similar meanings were grouped together under one code for ease of analysis (Braun and Clarke, 2006; Gibbs, 2007; Gibson and Brown, 2011). The transcribed notes were coded to create a focus for critical reflection and interpretation.

The a priori themes (King and Brooks, 2017) of leadership, staff capabilities, strategy, structure, intention to use, perceived ease of use and perceived usefulness were established from the interpretation and understanding of the perspective of the adapted TAM model. As a novice researcher, the coding progress was slow because I was trying to inculcate the habit of memo writing.

d. Evaluating Action – In line with the abductive research approach (Alvesson and Sköldberg, 2002; Gyöngyi Kovács, 2005), the results were evaluated using the literature to gain an initial understanding. Then the understanding was further explored and tested for plausibility with the Action Learning Set (ALS) in a bid to ensure that the initial construction of the problem as a basis for action was as robust as possible. Joyce (2012) indicated that change approaches are strengthened and organisational problems tackled through the use of action learning sets. They stimulate reasoned actions and acquisition of new knowledge through collaboration and insightful queries (Revans, 2011). In this study, the ALS was more collaborative in nature. The goal was to assess my interpretations with them and seek their perspectives and objections. It was also an extra assessment of my ability to field questions and discover whether my analysis rang true to other members of the organisation. Each step of the way I was experiencing, understanding, judging and taking action. From the initial data gathered, there was a need to interpret the GIS phenomenon further using the technology ecosystem as a metaphor. This is described fully in chapter four where new understanding forms part of the findings.

2.6.3.2 Action research cycle 2

The second AR cycle represents the process of identifying interventions and applying them. All managerial interventions were grounded on existing theories and ideas for credibility, with a focus on the problem. It comprised of:

a. Constructing – The mini-cycle (AR cycle 1) was the construction phase of the second cycle (AR cycle 2).
b. Planning Action – Planning on how to apply the managerial interventions of developing a GIS adoption strategy, conducting hands-on training and enforcing mandatory usage of the GIS as identified by the ALS. A detailed description can be found in section 5.3.

Also, in this phase, follow up questions (Appendix C) were prepared for use after the intervention to determine the status of GIS adoption.

c. Taking Action – There were two separate actions at this stage: 1) The application of the interventions which signified the stage of the research within the cycle, and 2) Evaluating this action through interviews and observations to acknowledge what was being done and its implication. Further interviews were conducted as users were observed twice a week at their workstation for the duration of the AR cycle 2. Over 30 hours of user observations were carried out. As stated by Barratt and his colleagues (2011) who used semi-structured interviews and user observations, the level of care and attention to detail during the data gathering process is critical so as to ensure its thoroughness and reliability. This is detailed fully in section 5.4 and section 5.5. My primary concerns, as a scholar-practitioner were to observe and document those occurrences related to the GIS issue within the organisation. This entailed recording actions carried out as well as keeping a reflective journal, bearing in mind at all times the actual data being sought.
d. Evaluating Action – Analyse new data and reflect on the outcomes with the ALS.

A detailed explanation of this second cycle is given in chapter five.

2.7 Validity and Reliability

In a research process the words validity and reliability are commonly used to give account of the measurement tools and methods applied. However, they are related to quantitative research. Johnson and Duberley (2000) point out that research is not satisfactory or of high scholastic rigour unless it attains a high degree of reliability and validity.

2.7.1 Trustworthiness of Data

In action research, the results are extremely contextualised due to the fact that the researcher is part of the topic being researched. Consequently, there must be another method to demonstrate that the results are trustworthy and valid. Lincoln and Guba (1989) discuss four standards for the assessment of trustworthiness of an action research. They are dependability, credibility, transferability and confirmability.

Dependability is the quality of the integrated processes of visualising the study, collating the data, explaining the findings and documenting the results. Dependability is ensured through transparent processes and judgements that are logical and coherent (Lincoln and Guba, 1989; McKay and Marshall, 2000). In documenting this study, I made sure that there were adequate examples and quotations from the interviews to substantiate the findings in a manner that could easily be assessed by a reader.

The purpose of credibility is to attain trust and confidence for the outcomes realised (Gibbs, 2007). Qualitative validity is described by the credibility standard used, which entails being sure that from the perspective of the participants the results are admissible. In order to preserve the verity-value of the participant's story and achieve credibility, the audio-recorded data were replayed. Also, literal extracts of participant's feedback were included in this thesis to allow for judgement that is independent as regards the analysis and its outcomes. A few of the measures taken to attain credibility include: 1) the participants were allowed to speak freely based on the structure of the interview questions, 2) as an insider researcher with a conscious knowledge of my position, there was constant reflection on the interpretations made to avoid taken-for-granted assumptions or unconscious misrepresentation of the data, 3) the participants used in the research were only those who were interested voluntarily and who had a desire to help in solving the problem by providing answers to queries with the full understanding that there were no wrong answers, and 4) in order to authenticate the interpretations and seek different views, if any, collaborative sessions were held with the action learning set (ALS).

Transferability in action research is about being able to apply the knowledge gained from the study in other scenarios. The specific nature of action research suggests that the burden of transferability lies with the person who deems to transfer and not the original researcher (McKay and Marshall, 2000). The knowledge generated within this study has been highly educative to organisational members as new ways of thinking about new technology adoption emerged. There was learning about how to develop appropriate actions in relation to technology implementation and user acceptance, which translated into improved GIS usage. The actionable knowledge may work elsewhere with proper consideration of that particular context if deemed appropriate. A detailed description of the GIS phenomenon, the research setting, processes and outcomes are

provided to enable readers have a proper understanding of it and where possible compare it with similar situations.

Confirmability is established through reflexivity. Harvey (2014) advocated a continuous process of checking interpretations with the participants. It was imperative to ensure that the interpretations used were not the result of the ideas or dispositions of the researcher but that of the participants. The transcriptions were made available to all participants for review and confirmation of captured words. Transcribing is an interpretive act that involves the researcher making judgments. It could be considered as the first step in analysing the data (Bailey, 2008). Action research is a continuous loop of constructing, planning, taking action and evaluation. The interpretations made were discussed during the weekly meetings with the users over the six months period of applied interventions. It helped me immensely when reflecting on the results of the action as it guided the next steps to follow.

2.8 Ethical Issues

In all research, there could be issues of ethics that affect the participants as well as the organisation. For this study, the principle on research ethics incorporating human participation by the University of Liverpool was utilised. It stated that it was imperative that the participants be given an affirmation that participation is voluntary without any adverse ramification as well as a declaration about confidentiality.

At every point of this study, from the beginning to the end, precautions were put in place to ensure that the safety and comfort of the participants were a priority and the participants were also made to understand that they had the liberty to withdraw from the research at any given time. They were educated about the research and their part. Also, how the data to be collected would be handled and secured was discussed. Specific reference was made to the anonymity of their contributions (British Sociological Association, 1992, Wiles *et al.*, 2006).

All selected individuals agreed to take part in the study. Prior to the interview, the participant information sheet was given to each participant. In addition, consent forms were submitted in advance and signed copies later collected. There was no risk above the everyday activities that one is exposed to in a typical business day within the organisation. Action research is a

cooperative manner used to introduce change within organisations (Coghlan and Brydon-Miller, 2014). My ability to reflect on the GIS situation and select a suitable mode of engagement is my learning as a scholar-practitioner with emphasis on my epistemological commitments. My stance was that of an interpretive researcher because I was fully involved with the research problem in an attempt to understand, give interpretations and cause improvement (Creswell, 2013).

The qualitative method of research made it easier for me as a manager to understand the human perceptions of the GIS issue. My preunderstanding was an advantage. The key challenge was how to be close to the data through prior knowledge but simultaneously create some distance. Action research allowed me to watch persons at their workstation and gather data. My role was complicated because I had to maintain a neutral perspective eliminating or reducing personal and professional biases. I found myself continually juggling the two roles, scholar and practitioner. I wore the hats separately on different occasions but also had to wear both hats interchangeably in a single occasion. Organisational politics was not ruled out. I had to be politically astute in deciding the topic and when to engage (Coghlan and Shani, 2005; Brydon-Miller, 2008; Coghlan and Brannick, 2014). These scenarios are explained further in section 6.2 as challenges encountered notwithstanding the benefits of insider research.

2.9 Study Design Limitations

Brydon-Miller *et al.* (2003) mentioned that a weakness of action research is its localism. Actions were indeed specific to the GIS situation. However, the learning gained could be considered by other organisations concerning the introduction of new technology and user acceptance. It is worth noting that transferability is the responsibility of the interested individual, and there could be a need to adapt it to fit the new context. Thus, the factors selected for this study are context specific. Nevertheless, chapter six (section 6.4) provides a detailed consideration of third-person inquiry, which looks to the dissemination of findings to a wider audience.

2.10 Summary

The goal of this study was to identify the problems in adopting a geographic information system based on the perception of the actors to improve the usage. The interpretivist paradigm was considered most appropriate to explore and understand the GIS phenomenon from the participants' perspective. The research was further based on the epistemological stance of social constructionism, as knowledge was co-constructed between the researcher and participants. It was a qualitative study using the action research strategy as it allows learning through experiences towards solving local practice problems. It helped to resolve a problem jointly through the use of iterative processes of construct, plan, act and evaluate. The study consists of two action research cycles, and through abductive reasoning, I was able to gain new insights on the lack of adoption of the GIS in FERMA. The chapter further discussed the choice of purposive sampling with the inclusive criteria of persons involved with the GIS. It also indicated that semi-structured interviews and observations were the chosen methods of data collection, while a form of template analysis was the thematic approach used for analysis. The next chapter is an extensive review of extant literature used to understand the GIS problem and develop a conceptual framework. It is the construction phase of AR cycle 1, captured as the construction of the GIS problem using key findings from literature as depicted in Figure 3.

3. LITERATURE REVIEW

3.1 Introduction

This chapter is centred on the review of extant literature considering relevant factors associated with information technology (IT) adoption and change management. I used my initial preunderstanding of the GIS phenomenon to begin the literature search. Hence the broad keywords that started the literature search were information technology, change management, technology adoption and technology implementation. From the initial readings it started to emerge that the leadership of an organisation and the organisational readiness in terms of those who would be affected by a change were critical. I was also guided by my preunderstanding, to carry out an in-depth search of user perceptions and capabilities of new technology. The literature on change and information technology is extensive. The area reviewed relates to information technology (IT) adoption, its determinants and interventions in the context of user perceptions, interactions and management practices. This is because technology is the consequence of human activity (Crowston *et al.,* 2017; Orlikwoski, 1992). In seeking to understand the lack of adoption of new technology, the focus then narrowed towards how information technology users experience leadership and factors that hinder adoption. The overall goal of this research was to proffer suggestions towards a positive transformation or adoption of the GIS as a decision-making tool in the management of road assets in Nigeria. Several scholars have acknowledged the importance of GIS technology as a valuable decision support tool (D'Amico *et al.,* 2019; Huang, 2018; Schofield *et al.*, 2017). However, in FERMA, there was still the problem of usage. Individuals were still using the manual means of obtaining information.

Organisations are investing heavily in information technology to remain relevant in a complex and competitive surrounding (Nah *et al.*, 2004). The European Commission's 2007 statistic showed that more than 2.5% of GDP was invested on information technology in Europe and the USA. Nigeria was not left out; over $50 billion was targeted for IT in 2018 (NIPC, 2017). Organisations introduce new technology to improve their performance (Batt-Rawden *et al.,* 2017; Mirvis *et al.,* 1991). This was the case in FERMA. A successful IT implementation requires careful planning and coordination where factors such as infrastructure, bureaucracy, employee attitudes and requisite skills need to be considered. In line with this, the Standish

Group Chaos Manifesto (2013) showed that 60%-70% of IT projects were, to a limited degree, unsuccessful. A key reason for difficulties during the implementation of information systems is the fact that little consideration is given to how the future users understand and interpret the new technology (Avgerou, 2000; Lee and Xia, 2011). It indicates the importance of the capabilities, views and expectations of the users when embarking on any IT implementation. According to Wognum and his colleagues (2004), only 10% of the difficulties encountered in implementation are due to technical issues while the human factor accounts for 90% of the problem. In examining failed projects, Myers (1994) confirmed that the context of the interactions of the users must be put in perspective to get the whole picture of an IS implementation process. It was evident that insufficient knowledge of new technology is an inhibitor to its implementation and subsequent use (Globerson *et al.,* 1995; Godoe and Johansen, 2012; Safi *et al.*, 2018).

The theoretical perspectives of change management and technology acceptance form the basis of this research. Change is constant and organisational leaders who anticipate and can manage change provide effective and successful leadership. The study aims to explore in detail the users' perceptions of the new GIS technology as a particular form of change management. Consequently, to place the research in context, the review begins with the definition of the key concepts: - information technology, IT implementation and IT adoption.

3.2 Information Technology

Information technology (IT) is the action of using computers and telecommunication devices to organise data. It is an essential tool in improving the productivity of any organisation and provides an opportunity for businesses to improve their efficiency and effectiveness (Gichoya, 2005; Oliveira and Martins, 2011; Patel and Patel, 2016). IT is a subset of information systems (IS) considered here as interconnected devices for gathering data; processing and saving for later use. Generally, the term IS refers to an arrangement of people, data records and activities that process information in an establishment (Paul, 2010). There are different meanings and different interpretations for the words information technology and information systems, but for this study, IT means the development and use of information systems. In other words, IT and IS are synonymous and representative of the same concept within this context. As a result, the words will be used interchangeably.

3.2.1 IT Implementation

A few studies have mentioned that implementation and adoption of IS are different phenomena (Cresswell and Sheihk, 2013; Iivari, 1986; Mirvis *et al.,* 1991; Sabherwal and Robey, 1993; Takian *et al.*, 2014). It is the standpoint of this research that the term implementation would be used to define the planning and hardware installation of the information system (IS). This contrasts with adoption or acceptance of the IS, which connotes effort to gain full use of the system (Davis *et al.*, 1989), which could be influenced by varying external and internal factors. The changes that occur in introducing IS in public organisations need to be adequately managed by the organisation to make certain that desired implementation goals are accomplished (Krishna and Walsham, 2005; Vatharkar *et al.,* 2018; Wiredu, 2012).

3.2.2 IT Adoption

Davis and his colleagues (1989) described technology adoption to be the use of software programs to improve performance, gain competitive advantage and make information easily accessible. Bharadwaj (2000) discusses the role that IT proficiency can play in improving the performance of organisations. Similarly, Baliamoune-Lutz (2003) emphasises the need to understand the crucial issues that are fundamental to successful IT adoption strategies. It is suggested that once individuals accept technology, it will be used (Amoaka-Gyampah and Salam, 2004). For the purpose of this research, IT adoption is the same as IT acceptance.

The degree of IT adoption in countries was closely linked to the degree of economic and human development in those countries (Shih, Kraemer and Dedrick, 2008). Scholars have indicated that economic development programmes and IT adoption in the developing countries within sub-Saharan Africa are highly connected and should not be trivialised (Adeleye and Eboagu, 2019; Avgerou 2008; Bahrini and Qaffas, 2019). Although the adoption of IT through the whole of sub-Saharan Africa is broad, it is considered to a certain extent to be less advanced than other countries (Alozie *et al.,* 2011). This, in a way, explains the fact that IT infrastructure within Nigeria is still underdeveloped (Achimugu *et al.*, 2009; Ramachandran *et al.,* 2019). According to Osibanjo and Damagum (2011), in their study of organisations in Nigeria, the inability of personnel to adopt IT is due to poor infrastructure, level of technical knowledge and limited training opportunities. One of the contributions of IT adoption in the public sector was in the

area of data gathering, storage, analysis, and retrieval as information for policy-makers. This emphasises the need for accurate data. Widespread acceptance and usage of implemented IT solutions in the public sector can aid decision-making. A country like Nigeria stands to gain so much from the adoption of IT systems, as is evident in the application of IT in the banking industry (Oluwagbemi, Abah and Achimugu, 2011). The matter of contention is that implementation and IT adoption are cost intensive while the failure rate is high making it of vital importance to study further the adoption of IT in a public organisation.

3.3 Organisational Change Management

The introduction of new technology is an internal change aimed to improve organisational efficiency (Cummings and Worley, 2005; D'Agostino and Delaney, 2015; Lippert and Davis, 2006). There are external and internal reasons for change (Lanning, 2001). The decision to implement a new information system in FERMA was an internal one. It was not imposed on the organisation by external forces, it was chosen in line with the strategic vision of top management. Organisations must deal with new technology and with upgrades for existing technology, thus the need for managing the change. Organisational change management for this study can be considered as the course of action towards ascertaining and managing the human element of technological change, most notably the responses to new goals and ways of achieving them.

This review of organisational change management begins with the examination of existing theories so that the study can be placed in its appropriate context. In order to present well thought out strategies, researchers need to reflect on earlier works of scholars on change models (Weick, 1999). Kurt Lewin developed one of the earliest change models in 1947. It was broken down into three steps: unfreezing, changing and refreezing. The model assumed that the change was planned and emphasised that people were always the root of the change. While there are many models for change management most of them align with the work of Lewin. Kotter's eight-step model (1995) focused on leading change. In his model the upper-level management shoulder all responsibility for an effective change. Action research (AR), the method adopted by this study is grounded on Lewin's model (Dickens and Watkins, 1999). It is a process by which fact-finding called diagnosis (unfreezing) precedes the intervention or action (change) and then fact-finding

where evaluation is carried out and if the desired outcome is achieved the change is stabilised (refreezing). There is a commonality in the change models and their transition modes as they all focus on persuading people of the need for change, followed by how to adopt and sustain the new ways of working. The intervention or actionable knowledge arrived at by the action learning set (ALS) was applied to the GIS situation, and the outcomes observed and evaluated accordingly. The introduction of the GIS was planned towards enhancing the data needed in the management of the road assets. This demanded that the employees learn new skills and change the existing mode of road data collection. AR provided the platform for me to reflect on why previous attempts at GIS adoption failed. As a result, the diagnosis arrived at should be noteworthy.

Change encompasses people's actions as well as their thoughts. Much of the difficulties faced in information system projects are not associated with technical issues but rather with the people within the organisation. Therefore to manage humans in change, there must be consideration of their attitudes and responses to the work (Agboola and Salawu, 2010; Kitchen and Daly, 2002; Wognum *et al.*, 2004). It then became crucial that I incorporated the interactions that took place within teams for effective management of the GIS issue. In an organisational change endeavour there are several justifications for focusing on the people. Calder (2013) stated that such a focus could reduce resistance to any introduced change. Lanning (2001) emphasised that a primary factor in successful change management is participation. Participation is two-fold, commitment to the change and achievement of the goal in an efficient manner. This resonates in the technology acceptance model (TAM) that focuses on an individual's perception of new technology (Davis *et al.*, 1989). TAM is discussed in detail in section 3.4, highlighting how users reach an acceptance and use technology. Trying to understand the environment's influence on the dynamics of the Geographic Information System (GIS), justifies the consideration from literature of leadership and management practices as the key external elements that impact the adoption of GIS in FERMA. Leadership at all levels can influence and convince users of the advantages gained from a new system or planned change. In addition, management commitment and responsibility translate to practices, which support a change such as the provision of infrastructure and training to enhance capabilities, that foster acceptance by the users. The key themes of leadership and management practices will be addressed in-depth later in this chapter.

3.3.1 Change Management and Information Technology

The relationship between change in organisations and the introduction of new technology remains to be deeply researched and analysed. Nevertheless, technology imposes change from everyone in accordance with his or her position on the hierarchical ladder due to the many aspects that need to be considered at the same time, such as available knowledge, skills and duties. Change management in the context of IS projects focuses on the organisational features affected in the course of implementation and adoption. It translates to concentration on actions that encourage employee understanding of the new technology (Anderson and Anderson, 2010; Ziemba and Oblak, 2015).

Organisations are progressively expected to develop new ways of improving employees' acceptance for technological change strategies (Wognum *et al.,* 2004; Ziemba and Oblak, 2015). Several scholars have attempted to study this phenomenon through varying perspectives. Some indicated that those responsible for technological change should strive harder to ensure that potential users participate in the planning and implementation process (Chau and Hu, 2004; Delaney and D'Agostino, 2015; Luo *et al.*, 2006; Parsons *et al.,*1991). Robey and Sahay (1996) whose focus was on the understanding or subjective sense that participants made of the new GIS and how it translated to organisational transformation, concluded that where information technologies were counted upon to enable transformations, the acceptance and cooperation of those people who ultimately interacted with the technology enhanced the prospect that transformation would actually occur. They emphasised the need for a firm commitment to the GIS by the management with the reassurance that jobs would be enhanced and not lost. Persuasion of the technology's benefit was captured during the training program with an understanding of the overall vision of the top management. It was on this premise that the identified GIS issue being researched focused on understanding how the users perceived the innovation. Organisational learning with an emphasis on spreading knowledge and empowering technology users was identified as imperative, while acceptance and cooperation by the users were paramount (Delaney and D'Agostino, 2015; Robey and Sahay, 1996). This suggests that effort should be made to provide a coaching environment during IT implementation and adoption.

3.3.2 Change Management and Technology Adoption

From literature, several models have been advocated in relation to technology adoption. The focus of this study is on the individual's perception of a technology and how it impacts the use of that particular technology. Such models include the theory of planned behaviour (TPB) by Ajzen (1991), Theory of Reasoned Action (TRA) by Ajzen and Fishbein (1980) and the various extensions of the Technology Acceptance Model (TAM) namely: TAM2 (Venkatesh and Davis, 2000), TAM3 (Venkatesh and Bala, 2008) and the Unified Theory of Acceptance and Use of Technology (UTAUT) by Venkatesh, and his colleagues (2003). Amongst these, when giving a detailed account of an individual's acceptance of information technology, TAM is usually chosen (Bagozzi, 2007; Chutter, 2009; Oliveira and Martins, 2011). The two studies that put forward the consideration of TAM (Davis, 1989; Davis *et al.,* 1989) have been cited more than 25,000 times, thus it can be concluded that TAM is dominant within IS literature. Results by Yousafzai and his colleagues (2010) also indicated that TAM was a more effective and parsimonious way of indicating the preceding events of technology use. Consequently, for this research, TAM was considered the most appropriate starting point. It was adapted to fit the unique GIS situation in FERMA based on other aspects identified from the literature.

3.4 Technology Acceptance Model

TAM is a dominant theory. It strives to explore the characteristics of an individual as it relates to the perception of new technology (Davis *et al.*, 1989). TAM is a frame of reference for explaining decision-making by individual persons. It is an expansion of the theory of reasoned action (TRA: Ajzen and Fishbein, 1980). According to Venkatesh and his colleagues (2003), individual reactions towards new technology trigger the decisions that result in actual usage. TAM suggests that elements contributing to technology acceptance and use are impacted by individual viewpoints of the technology (Lewis *et al.*, 2003). TAM models how users come to agree to use new technology. It assumes that users' reflections and reasoning determine technology acceptance and usage that in turn governs their preconceptions and attitudes. Focus is on acceptance of IT at the individual level. According to De Vreede, Jones and Mgaya (1998), TAM predicts the acceptance and actual use of a technology through an individual's perception of the technology's ease of use and usefulness. However, even though perceptions are internal

constructs, the external circumstances contributing to the mindset could be regulated through suitable managerial interventions (Agarwal and Prasad, 1999; Venkatesh and Davis, 2000). Thus individual perceptions of usefulness and ease of use that could be impacted by other external factors is reflected by TAM. According to researchers, attitude towards performing behaviour and social pressures to perform behaviour are the determinants of behaviour. As reported by Bagozzi (2007), TAM postulates that attitudes would have a positive effect on the mindset that would develop interest and encourage individual determination towards the use of technology. In addition, the technical attributes of an IS, and methods and means concerning the contributions of perceived usefulness and perceived ease of use are considered in the TAM model (Ouadahi, 2008). TAM has been used to illustrate user behaviour across an array of information technologies. However, Horton and colleagues (2001) insisted that TAM was better at predicting intention than actual use.

The two core elements of TAM are perceived usefulness (PU) and perceived ease of use (PEOU). PU is defined as the extent to which an individual believes that the information system (IS) could boost his or her work performance while PEOU describes the amount of energy that is anticipated while using the system (Ouadahi, 2008). When employees deem that there are advantages gained from a change effort and can adapt to it easily, commitment is more certain (Herold *et al.*, 2008). The survey by Claar, Dias and Shields (2014) indicated that when a technology is perceived to be easy to use, it influences the need to consider and believe in its usefulness. This determines the behavioural intention, which positively translates to actual use. In studying patients' perceptions and behaviours TAM was considered the most appropriate (Ahlan and Ahmad 2015; Abdullah *et al.*, 2016). In another study conducted in Malaysia, it showed that the intention to use mobile learning was mediated by its usefulness and ease of use as depicted by TAM (Tan *et al.,* 2014). TAM predicted the use of a word processing package (Davis *et al.*, 1989), smartphones (Park *et al.,* 2013) and the single platform E-payment (Lai, 2016). Studies were also carried out to see whether TAM explains actual use (Legris *et al*., 2003; Turner *et al.*, 2010). The conclusion was that one must be cautious when applying TAM outside the context in which it is validated.

Hsiao and Yang (2011) went further to identify three directions in the application of the TAM. They were task-related information systems, e-commerce information systems and hedonic

information systems. Task-related systems are devised to improve work performance of users thus resulting in greater effectiveness. The GIS falls within this category. Finally, in line with my justification of using the TAM model, Gagnon *et al.* (2010) carried out a systematic review to investigate factors that impact the adoption of IS by health care experts and identified PU and PEOU as the most dominant factors. From the above, it is evident that PU and PEOU are the two distinct factors of the original TAM. Thus in exploring the lack of adoption of the GIS, the TAM will provide the needed foundation to commence the research.

I am aware of the shortcomings of TAM as regards the methodology for testing the model (Yousafzai *et al.,* 2007), its parsimonious nature neglecting other user behaviours related to IT acceptance and adoption (Benbasat, 2007; Burton-Jones and Hubona, 2006) and the theoretical foundation (Bagozzi, 2007). For example, Horton, Buck, Waterson and Clegg (2001) had varied results in their application of TAM as a tool in understanding intranet usage. Keung *et al.* (2004) also found discrepancies a year later in a TAM prediction on a particular technology that was likely to be adopted. Another limitation is the fact that several studies validating TAM had students as participants within the academic environment where use was voluntary, which is not a reflection of real-life settings (Lee *et al.,* 2003). It is worthy to note that a volitional environment was one of the laid down conditions of TAM (Vanketesh, 2000). However, Brown *et al.* (2002) tested this boundary condition and concluded that there could be additional determinants to explain the acceptance of technology in a mandated environment. All of this emphasises the impact of context and environment in technology adoption. TAM is dependent on the users being questioned with greater accuracy on intention to use rather than actual use. This reaffirms the need to expand TAM to embrace the impact of social factors (Agarwal and Prasad, 1997), as is being considered in this study with the consideration of the external factors of leadership and management practices.

Yurov and Potter (2006) made the first attempt to include leadership in technology use after the technology had been accepted. The study highlighted how the intent of staff and subordinates to give information used for system development could be affected by the persuasive influence of IT leadership. They concluded that a greater degree of cooperation and willingness on the part of employees to maintain their enthusiasm in studying IS technologies and features could be generated by productive leader-follower interrelationships. Yukl (1989) surmised that in the

model of technology usage, inclusion of leadership is based on the perspective of leadership literature that influence in organisations is a collective process shared among members. Coeurderoy, Guilmot and Vas (2014) explored technological change adoption identifying usefulness (PU), ease of use (PEOU) and supervisor influence – a form of leadership – to be the critical factors in IT adoption.

3.5 Leadership in Technological Change

Leadership has been noted as a characteristic that impacts the speed of adoption of a top-down technological change (Chau and Hu, 2004; Coeurderoy, Guilmot and Vas, 2014; Seyal, 2015). It makes it necessary to know what exists in extant literature about leadership in technological change because it will clearly define and provide an understanding of its effect on change management and IT acceptance. Leadership is a complicated term that can be considered in multiple ways and as such, a universal description for it does not exist (Attah *et al.*, 2017). For this study, leadership is viewed in relation to change management and is defined as the process of persuasion by leaders towards realising organisational goals through change (Kurtzman, 2010). The focus is on technology acceptance and sustained usage. Organisational leaders influence IT adoption by their formal authority. The activities of leaders and the response of the users determine the outcome of technology implementation works (Lewis *et al.,* 2003). Leaders are important actors in a change process. They are influential because their subordinates hold them in high esteem within the socially constructed environment (Bligh *et al.,* 2011). Leaders are the ones responsible for painting a future state and making the process as smooth as possible. Leadership for technological change can come from executives, managers or the users themselves. Support and commitment is needed at all levels.

3.5.1 Top Management Influence

Top management influence denotes the role of the executives concerning the introduction of new technology. In FERMA, the decision to introduce the GIS as a means of improving the organisational performance came from top management. A lot had to be taken into consideration because implementing a change initiative requires planning and monitoring with appropriate

milestones. There must be commitment and acceptance of this responsibility by management. A leader's attitude and mannerism are crucial to an employee's perception of an IT innovation (Orlikwoski, 1992; Yurov and Potter, 2006). In an earlier study, Jarvenpaa and Ives (1991) focused on the perceptions and attitudes of the chief executive officer (CEO) with regards to IT, believing that an involved CEO only needs to view IT as contributing to the organisation's success. He does not need to participate personally in IT management, but if the organisation is to be progressive in its use of IT, the CEO must send the right supportive signals. Lewis and his colleagues (2003) suggested that through commitment and innovativeness on an individual level, top management could influence the beliefs about technology use. Other scholars also indicated that user beliefs about the usefulness (PU) and ease of use of a technology (PEOU) is positively impacted by top management's commitment and support for the technology (Al-Haderi, 2014; Al-Mamary and Shamsuddin, 2015; Mirvis *et al.*, 1991). The successful implementation of new information technologies depends on the beliefs and expectations of both managers and workers. Therefore, top managers need to consider the context of any technology implementation as well as the human factor. The focus should go beyond the technicalities of the system (Chau and Hu, 2004; Oreg and Berson, 2011; Coeurderoy, Guilmot and Vas, 2014). Systematically checking in on employees and their progress towards desired change will encourage the development of a positive IT use mindset (Lapointe and Beaudry, 2014). It is necessary that innovation offers a distinct advantage over whatever it replaces, or potential users would hardly be motivated to use it. This could be the case of the GIS because six years after implementation, it was still not ready for use as a decision-making tool. The gains of a new technology are rapidly seen once there is a mechanism in place for positive feedback to users (Leonard-Barton and Kraus, 1985).

In line with this, Oladapo (2007) found the attitude of the CEO and senior managers to the benefits of IT to be highly significant to the use of IT in an organisation. The reason was their proximity to the decision-making process. As top management they were knowledgeable to why a particular technology was chosen. In the case of a successful GIS project (Somers, 1998), the leadership was a project champion who provided executive-level support and influence. In addition, he was high enough in the organisation to guarantee continuity in the political and financial support. The continued sustenance of the financial and human resources dedicated to IT was fundamental for implementation success. This information was worth further exploration within FERMA as the present CEO was a proponent of developing IT within the organisation.

The 2013 Standish Group Chaos Report on IT success factors identified executive support, user involvement and competent staff as the top three factors. Other scholars found top-management support, user readiness and capacity of the managers to manage technology change to be the critical factors in the implementation and adoption of new technology (Al-Haderi, 2014; Al-Mamary and Shamsuddin, 2015; Brown *et al.*, 2007; Marvis *et al.,* 1991). Leadership influence does not rest only with top management; it has a trickle-down effect. The primary assessment of new technology by users is influenced by what their superiors and peers think of the technology (Lewis *et al.,* 2003; Venkatesh *et al.,* 2003). Next is a consideration of what literature has to say about the supervisor and peer influence concerning the user perceptions or attitudes formed towards technological change.

3.5.2 Supervisor Influence

Balogun (2003) urged that senior managers should acknowledge the strategic input that middle managers provide to the process of change. Middle managers as the intermediary have to go through their own individual change as well as assist members of their team and their juniors to go through the same process. Depending on the nature of the IT system, the organisational and political framework of its deployment and its effects on skills, jobs and working environment the implications of change in IT for managers are inclined to alter (Harley *et al.,* 2006). Researchers need to know the manner in which change is interpreted by middle managers and how their interpretive framework or schematics develop and evolve (Balogun and Johnson, 2004). Middle managers have been identified as key actors of change who impact employee behaviours and attitudes the most (Stone, 1994; Currie and Proctor, 2005; Rezvani *et al.*, 2017). Farahnak and colleagues (2019) emphasised the role of the immediate supervisors in determining the attitude of the users. It is most important that their influence required for the implementation of the new technology be sustained. This is an important point to consider as FERMA being a bureaucratic organisation with top-down communication and formalised rules could have been a hindrance to middle manager influence in the GIS adoption. Middle manager understanding of individual differences in perception of new technology is vital in order to develop suitable mechanisms for interventions that could lead to effective implementation (Delaney and D'Agostino, 2015).

3.5.3 Peer Influence

Worker participation in the early stages of planning for technological innovations is important as it instils faith in management, which could help employees sustain positive attitudes (Orlikwoski, 1996; Vadapalli and Mone, 2000). It has been argued that change emanates from the daily activities of members of the organisation as opposed to beginning at the top (Chau and Hu, 2004; Tsoukas and Chia, 2002). Thus, peer influence can be regarded as a dominant factor. Davis, Bagozzi and Warshaw (1989) on the other hand, insisted that the critical limitation to acceptance by users was the fact that the systems were not user-friendly. They believed that perceived usefulness (PU) strongly influences peoples' intentions. As Tenkasi and Chesmore (2003) noted for implementation of any change to succeed, learning needs to happen. Therefore, to make certain that individuals would utilise a new IT, novel assimilations and awareness need to be developed through local learning processes and engagements. The study on social information processing submits that individuals are more inclined to share expectations, knowledge and assumptions with people they are acquainted closely to in a working environment (Isabella 1990). It reaffirms Burt's (1987) findings that the advice of co-workers can influence the adoption behaviour of change recipients. The prior experiences, which a user has with technology, shape their perception of a new technology (Agarwal and Prasad, 1999). There are those who are enthusiastic about new things, they have high personal innovativeness and can encourage others towards acceptance (Agarwal and Prasad, 1998). If the individuals who get to utilise the technology first are compelling role models, their demonstration has a greater meaning for a wider audience.

3.5.4 Leadership Style

In the domain of leadership styles, a qualitative study by Beatty and Lee (1992) suggested that a transformational approach to leadership was better in reducing hindrances to technological change than a transactional leadership approach, which concentrated on technical problem solving to the neglect of people and organisational issues. Schepers *et al.* (2005) examined the influence of transformational leadership and transactional leadership methods in the acceptance of technology within the frame of reference of service organisations. Their studies indicated that leadership using transformational methods efficiently impacts the anticipated usefulness of a new

technology whereas leadership using transactional methods did not exhibit any noteworthy outcomes.

Yurov and Potter (2006) examined the role of transformational leadership in technology acceptance and concluded that it engenders and sustains the intention to use the technology. Similarly, Cho, Park and Michel (2011) showed that IS success could be improved if leaders' adopt the transformational leadership style. Transformational leaders act in ways that engender the perception of organisational support, which helps the employee in operating any new information system. Transformational leaders impact the values, behaviours, beliefs and attitudes of their followers (Howell and Higgins, 1990). It improves employee commitment to the cause. Employees' dedication to change was positively correlated to transformational leadership (Ford *et al.*, 2003; Herscovitch and Meyer, 2002). The success or failure of any organisational change could thus be said to be largely contingent on the leaders' ability to make the employees committed to the change process. Commitment to technological change is most important throughout the duration of the change (Brown *et al.*, 2007).

Employee burnout caused by the demand to work harder for improved performance was a negative element to transformational leadership suggested by some scholars (Arnold and Connelly, 2013; Lee, 2014; Stevens *et al.,* 1995). As transformational leadership models assume the decision making process is the prerogative of those at the top, Tourish (2013) indicated the need to make the leadership versus followership divide less distinct. In a situation where distributed leadership is required, leadercentric focus at the top could pose a problem (Tourish, 2014). In addition, followers could over rely on the competencies of their transformational leaders, and as a result impact their job performance negatively (Zhu *et al.*, 2013). Thus, Ortekiil and Ertesvag (2014) advocated that a balanced approach between transformational and transactional leadership style provided greater impact in a technological change.

Ouadahi (2008) focused on employees' attitudes with regards to the acceptance of Information Systems (IS) and found it to be notable. He observed that employees respect and faith in the reliability of their leaders is pivotal in the process of influence. The participatory leadership style was favoured for influencing and gaining employee assistance when putting a new information system in place (Edmonds, 2011; Ouadahi, 2008). This is at variance to the bureaucratic leadership style dominant in FERMA where employees are made to follow specific rules and

lines of authority. Furthermore, literature also indicates that once there is management backing and encouragement towards change-related activities, employees' commitment to change is bound to increase. If employees feel support and commitment from management, they will exhibit high productivity (Cummings and Worley, 2005; Wanberg and Banas, 2000). This leads us to communication because it was deduced that the way and manner in which a leader communicates the change initiative is fundamental.

3.5.5 Communication in Leadership

Leadership communication refers to those messages from a leader that is of significant importance to the employees as they convey the vision or mission of transformation of the organisation. Rogers (2003), in his studies on innovation, indicated that reaction to change is determined by one's perception of the level of unfamiliarity linked to the change. How and when the change is accepted depends greatly on the mode of communication adopted and its reception by the individual. According to Brown *et al.* (2007), communication is fundamental in IS implementation and more critical in the adoption phase. Communication is crucial in change management because it is the tool used in executing the change as well as highlighting the challenges (Delaney and D'Agostino, 2015; Kitchen and Daly, 2002).

Lanning (2001) indicated that communication has to be effective. Thus, many different means could be used. Open communication allows end-users to have a rapport with management (Croft and Cochrane, 2005; Edmonds, 2011; Ouadahi, 2008). Wanberg and Banas (2000) and Ertürk (2008) explored how open communication impacts an individual's attitude toward organisational change. They found that when a person is knowledgeable about his or her responsibilities with regard to an innovation and has a sense of inclusiveness, they presumably are open to the change. It is assumed that the understandings and meanings, which the managers ascribe to information technology, affect the technology's deployment, use and consequences (Robey and Sahay, 1996). Specifically, participation in decision-making related to change in actual change projects, or in training is positively related to openness or commitment to change (Ertürk, 2008; Wanberg and Banas, 2000). The success of organisational change implementation is highly dependent on the ability of the manager to motivate and communicate appropriately (Gilley *et al.,* 2009). Amoako-Gyampah (2004) emphasised that communication impacts the perceptions about the usefulness of technology (PU) and ease of use (PEOU). It also translates to user acceptance and

user satisfaction. According to Globerson and his colleagues (1995), to overcome resistance to an innovation there must be clear directions on the use of the technology and its interpretations to real-life occurrences. Organisational members must trust, commit to the system and have the capability to adapt to the change to ensure success (Jones *et al.,* 2005; Lewis and Seibold, 1996). There is a need to have a formal communication plan that includes multiple types of communication that appeal to all (Golson, 1977).

3.6 Management Practices and its Impact on Technological Change

Management practices as it relates to technological innovation, demands a relationship between strategy, organisational structure and staff capability (Golson, 1977; Sherer *et al.*, 2003; Rosacker and Rosacker, 2010). The goal of the organisation with the new technology must be clearly defined and where necessary changes made in terms of task allocation, coordination and supervision. This is because the ways people are organised and the understanding and proficiencies, which, they bring to their work, does not always keep up with the implementation of new technologies. Managers must exhibit some form of experience and enthusiasm regarding new technology and how to achieve technological change (Coeurderoy, Guilmot and Vas, 2014; Mirvis *et al.*, 1991; Wognum *et al.,* 2004).

3.6.1 Strategy

An organisation's strategy for managing technological innovation is crucial as it gives a detailed account of how the objective will be accomplished using available resources. Somers (1998) reiterated that management issues were much more pivotal to the success of any new technology than the technical ones. She indicated that organisations had distinctive characteristics, which meant that strategies must differ. The purpose of an organisational strategy is to set a direction and have members agree on the approach for achieving the goal. It guides all the employees towards making good choices (Henderson and Venkatraman, 1999). In summary, strategy illustrates the link between leadership (organisational planning and direction), management (implementation) and employee understanding of the purpose of the planned or implemented change.

A technological change does not in itself have a particular impact on organisational members. However, the impact depends rather on intervening factors such as managerial involvement or practices. The conclusion to technological change in establishments is the greater need for planning with a focus on how to attain the laid down futuristic goal. The lack of a formal organisational plan for introducing a change is a key factor that leads to a negative perception of the change (Globerson *et al,.* 1995; Louw and Mtsweni, 2013; Luo *et al.,* 2006). The output of the innovation must be linked to the organisation's strategic objectives.

Careful selection of individuals to be involved in the new technology is a crucial managerial action that could promote technology acceptance. The strategy should enable everyone to be a change agent (Agarwal and Prasad, 1999; Schepers *et al.,* 2005). The key insight from the organisational change literature is that to reduce resistance there must be participation of staff in the change process (Edmonds, 2011; Harley *et al.,* 2006). Individuals should know their role in the project, and emphasis must be placed on the right tasks to the right people. The desired change aligns with the organisation's strategic vision, as it would ensure greater management control with access to needed information that enables accurate projections and decision-making, resulting in improved operational efficiency. However, the GIS issue indicates the need to explore the procedural and behavioural roles of the management and the users during implementation, as suggested by Miller (1992). According to Henderson and Venkatraman (1999), in using information technology to transform organisations to align with strategic plans, one must consider the various dynamics of leadership, task allotment and employee response. This leads us to consider the organisational structure.

3.6.2 Structure

The strategy and structure of an organisation are closely linked. The structure is how the entire organisation operates (Hall and Saias, 1980; Nag *et al.*, 2015). The organisational structure comprises of actions such as supervision, coordination and task allocation, which are geared towards achieving organisational goals. It is also said to be the perspective through which people see their organisation and the systems around it (Tatum, 1989). How hierarchical organisations introduce technologies and how organisations respond differ. Research suggests that an organisation's structure has an impact on information services. Thus, organisational structures

must be conducive to technological innovation (Agboola and Salawu, 2010; Neves, 2012). Venkatesh and his colleagues (2003) emphasise that for the technology to be accepted, the individual must believe that the organisational and technical infrastructure exists to support the use of the system. My organisation is a hierarchical one and this study considered its impact on the GIS situation. In a bureaucratic setting, decisions are made at the top and through a series of commands transmitted to lower levels. Lateral communication and coordination within a hierarchical bureaucracy is not a new thing, however, a dominant hierarchical structure has the propensity to be mechanistic and unappreciative of how complicated the implementation of an IS could become when dealing with human issues (Marais and Kruger, 2005). Successful change entails incorporating patterns of flexibility and self-organising while distancing from patterns of bureaucracy and control (Armenakis and Bedeian, 1999). Hierarchies are impediments to knowledge exchange and dissemination, thus the recommendation that in introducing IS in a public organisation more attention be paid to the cognitive and emotional responses of the users (Kim *et al.*, 2014). Information technology could be said to centralise an organisation by aiding managers to organise information more efficiently and swiftly providing them with higher decision-making powers. This is the expected impact of the GIS situation in FERMA because a central department (RMMS) is responsible for its functionality while other participants are end-users with only the capability to view, query and analyse the data. However, it is the purpose of this research to comprehend perceptions of users towards technological change.

From literature, much has been said on leadership influence on employees and the relationship of strategy to the organisational structure. It is all geared towards achieving the technological vision of an organisation. This thesis will consider if there was a precise alignment between the vision of the organisation for the GIS and the adopted implementation strategy.

3.6.3 Staff Capabilities

The support of employees is key to figuring out if actions advocating change would be a success or a failure (Cummings and Worley, 2005). There must be the development of the necessary competencies such that it is the employee's understanding that the organisation regards his or her concerns (Eisenberger *et al.,* 1986). An understanding of how end-users adjust to changes in

technology translates to improved managerial practices that would create an enabling atmosphere that is responsive to the efficient utilisation of a novel information system (Ouadahi, 2008).

In the IS context, such management practices could be service efforts curated for end-users which could include initial training, a resource that aids organisational learning (Agboola and Salawu, 2010; Davis *et al*., 1989; Stam and Stanton, 2010). The aim is to build capacity because the most common reason for challenges in IS implementation issues or complete project failure is due to problems faced training end-users (Amoaka-Gyampah, 2004). According to Arnold (1996), the customs of an organisation has an impact on the success of a new information system implementation. Cummings and Worley (2005) identified corporate culture change as a difficult task that could be necessary if a system was to succeed. Consequently, it is vital to make certain that users have understandings that would act as a buffer between the new system and implementation success. Sometimes first users strongly resist the technology and convey the existence of challenges (Rivard and Lapointe, 2012). However, once one gets users to try the innovation, it may just require nothing more than a well-structured, skilfully presented training session (Coeurderoy, Guilmot and Vas*,* 2014). User education and development is the most apparent technique to utilise to alter the perceptions of individuals (Arnold, 1996; Kim and Lee, 2008). Training provides information about the features of the innovation thus lessening uncertainty. Users have to be trained on the operation of the technology as well as how to improve on the job. Other scholars also reiterated the importance of training with regards to accepting technology (Davis and Bostrom,1993; Irani *et al.*, 2009; Marler *et al.*, 2006; Vadapalli and Mone, 2000). Training has a significant impact on perceived usefulness (PU), and usefulness has been well documented in the literature under the technology acceptance model as central drivers of intention to use technology. Perceived usefulness impacts acceptance. The perceptions about a new IT as defined by TAM (PU, PEOU) moderates the relationship between management interventions or actions and the individual's behaviour towards the use of technology (Chin and Lin, 2015; Chou *et al.,* 2014).

In the adoption of any new technology, the role of the users must be taken into account. It is crucial in the acceptance process. The attitude of the employees determines the realisation of desired goals in the change process (Lowry, 2002; Park and Delong, 2009). Thus, the place to begin an organisational change is with the understanding and perceptions of individuals.

According to Neumeier (2013), attitudes, competencies and environmental factors were the factors that could support or resist technological change. Where the employees do not accept the technology, the response could be resistance. Balogun (2006) focused on individual mental maps believing that an alteration in knowledge, beliefs and attitudes could be interpreted as a change within the organisation. It is the premise of this study. Resistance to change is a generally accepted thought process in organisational life. The researcher wants to explore this assertion concerning the GIS phenomenon. Also, where the competency of an individual on a new work process could be queried, fear sets in, thus the implied resistance (Davis, 1989; Kim and Kankanhalli, 2009). It is at this time that attitudes towards a new technology are formed. Acceptance of IT by managers and users was regarded as essential for its success (Davis *et al.,* 1989). Hornstein (2008) noted that the challenge that faced the introduction of new information technology was to involve those directly affected, especially those who were insecure by the change initiative. He insisted that they felt ill at ease due to lack of information about the extent of change, the training implications and the potential impact on role changes. Al-Qhatani and King (1999) affirmed that perception determines the attitude, which in turn precedes usage of the technology. Therefore, readiness to adopt an innovation and alter work processes is key to the efficient use of any technology (Mirvis *et al.,* 1991). Livingstone *et al.* (2002) in their study of implementation delay, also found that resistance due to uncertainty caused initial favourable attitudes to decline. Resistance is a complex manifestation (Boudreau and Robey, 2005; Durodolu, 2014; Tsai *et al.*, 2019; Hirsheim and Newman, 1988). There is need to unbundle the happenings within the organisation and give it interpretations as understood within the literature.

Furuholt and Orvik (2006) identified knowledge barriers, staff resistance and lack of top management engagement as factors that caused limited IT implementation. Similarly, Joshi (2005) acknowledged human factors like the lack of training, user participation and management support as causes for implementation failure. Nevertheless, personal willingness to accept an innovation is an essential factor in successfully implementing organisational change strategies (Aziz *et al.,* 2012; Frahm and Brown, 2007; Lapointe and Rivard, 2005). In a change program the overall views or perceptions of individuals involved are critical (Choi, 2011). According to Paré and Elam (1995), factors at the individual level such as attitude and perception would primarily contribute towards the success or failure of computerisation strategies.

Research suggests that when those affected by computerisation have knowledge of the need for new technology and perceive it as a way to solving the problem, there is less resistance to change. This is clearly expressed in the TAM model. IT knowledge and awareness are vital (Mirvis *et al.*, 1991). The success of technological change in organisations is contingent on the incorporation of both technical and social elements. The implementation of an information system is an organisational change that causes new work processes that affect the regular activities of the organisation (Delaney and D'Agostino, 2015; Hirscheim and Newman, 1988; Sligo *et al.,* 2017). Disruption of any kind from status quo tends to cause adverse reactions. This is as a result of an attachment to traditional ways of doing things, self-interest and a lack of understanding that change is needed (Cummings and Worley, 1997; Safi *et al.*, 2018; Tsai *et al*., 2019).

In summary, there is a need to pay close attention to the people greatly impacted by any new technology. In the words of Pliskin (c.f. Stone, 1994, p. 564), 'the successful introduction of computer systems in an organisation is not based solely on the support of top management, the establishment of a strategy, the compatibility of the information system or adequate training. It also requires the introduction of the human perspective during implementation in the form of leadership at the user level'. From the aforementioned, it is apparent that individuals act based on their interpretations of the world. The mindset of organisational members serves to organise and guide their interpretations of occurrences. Thus, by influencing individuals' interpretations of organisational phenomena, it would direct their sense making and subsequently actions within the organisations.

This sheds more light on the GIS issue within the organisation. I can relate wholly with the need to take into consideration the human perspective. It is on this premise that I want to find out how the GIS adoption could be improved with focus on the perception of the users and as indicated from literature align with the needed style of leadership, thus my consideration of this conceptual framework for the study.

3.7 Conceptual Framework and Research Questions

As a scholar-practitioner whose aim is to improve the organisation, I have identified the change management theory and the technology acceptance model for theorising on IT adoption in FERMA. TAM model is better at predicting intention and not actual use (Horton, Buck, Waterson and Clegg, 2001). TAM has been proven through various studies as a generic model that could be applied in diverse situations to all kinds of technologies. Thus, TAM would be used to address how to get the employees committed to GIS technology. I would be using the original TAM model (Davis *et al.*, 1989) as the foundation but extending it with new proposed elements and relations based on literature and my insider knowledge. I am using it as a basis for ascertaining the effect of the external factors of leadership and management practices on employee's perceptions, personal abilities, attitude and intention to use the GIS system. In this situation, the determinants of perceived usefulness (PU), perceived ease of use (PEOU), intentions and behaviours will not be conceived as summed products of perceptions and evaluations. They shall be viewed as parameters of the set goal to ensure actual use of the GIS system. This goal-setting approach gives a situation-specific model of decision-making. It is worthy to note that the underlying assumption of TAM is that once there is the intention to use an information system, it translates to actual usage. The research framework is illustrated in Figure 4 below. The broad areas of leadership and management practices have been identified as where PU and PEOU will happen.

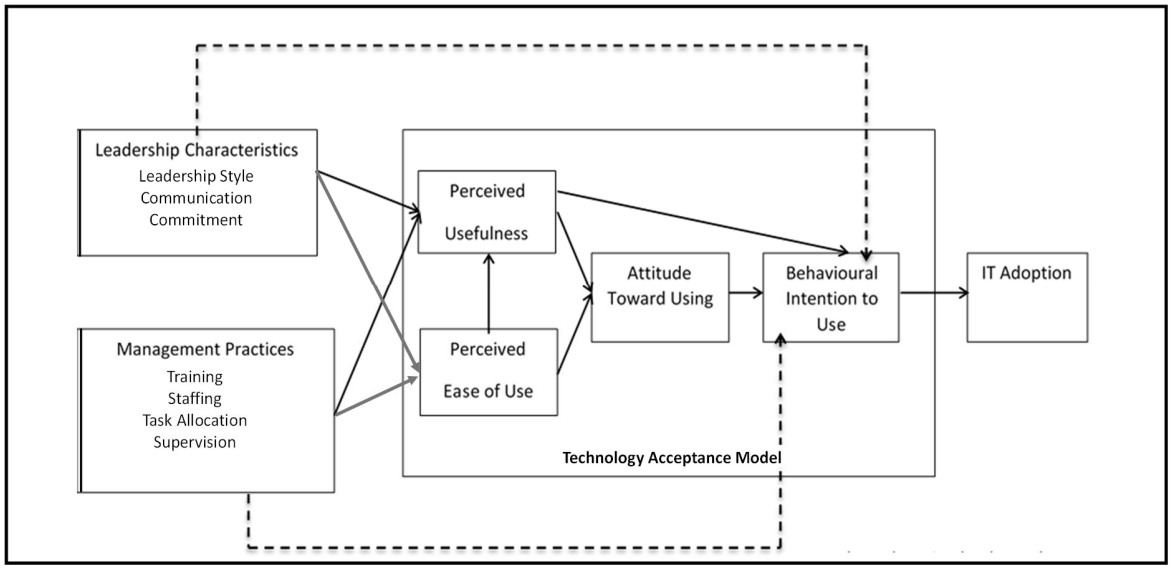

Figure 4: Conceptual Framework TAM (Davis *et al.,* 1989) – An adapted version by the author

Sustainability of this framework is dependent on these factors. In consideration of the external factors of leadership and management practices that could aid actual usage, the dotted lines aim to bridge any gap that could arise between attitude and intention to use. Bagozzi (2007) suggested that an individual who had the intention to use technology could change his or her mind depending on the time-lapse and several other uncertainties. Thus, the dotted lines indicate the presupposition that as leadership influence and management practices impact the adoption process, there is the need to sustain behavioural intention to use. It means that influences remain relevant far beyond the acceptance of new technology. Elbana (2010) showed that the actual use of an information system is not exclusively guided by initial intentions. She surmised that change of power networks supporting a new technology within an organisation could impact its use. This is in agreement with the suggestion by Brown and his colleagues (2002) that in organisations, senior management influence is critical in the use of new technology. For example, elements of leadership could affect perceived usefulness, such as where the middle manager having undergone a particular training extols the virtue of the new technology. In the same vein, a user could influence his peer to accept and use the new technology because he had tried it and found it beneficial or in the case of procedural roles ensure that the task allotment was such that aligned with the implementation. Conversely, leadership and management practices could also affect the intention to use negatively.

I acknowledge that the TAM model is from a positivist quantitative study (Davis 1989), but this research will be using a qualitative methodology to help produce robust human insights on the researched GIS phenomenon. In so doing, it is being applied with caution to suit this specific context. In the qualitative paradigm, this framework is viewed as a useful method for mapping processes and possible factors rather than a causative model (Bagozzi 2007) following positivist arrows where relationships of variables are tested. It is intended to clarify how proven entities of TAM could form a foundation for determining the effect of the external factors of leadership and management practices on perceptions, attitude and aiding actual use of the system.

The idea is that during technological change, management must exercise leadership (Beatty, 1992; Chau and Hu, 2004; Oreg and Berson, 2011, 2019). Other organisational members should look up to them for support and guidance. Their behaviour should demonstrate what is expected

in relation to the change. I have chosen to focus on these two external factors based on evidence gathered from literature and its relevance to my organisational problem. The focus of this study is on the human perspective rather than the technical system or design. Thus, factors that impact user perception like peer influence (Durodolu, 2016; Kim ,and Kankanhalli 2009; Tsai *et al.,* 2019), supervisor influence (Coeurderoy, Guilmot and Vas, 2014; Rezvani *et al.*, 2017) and IT knowledge will be considered.

After a deepened understanding from literature and also thinking of the users, I proposed my research questions first by considering the GIS and organisational leaders. Then I considered the users' perceptions in terms of TAM, which looks at ease of use and the usefulness of the GIS. This then lead to the consideration of the structural factors surrounding the GIS and the management practices impacted through some form of leadership. Finally, I reflected on the level of knowledge within the organisation and the possible forms of resistance.

Thus the broad research question to which this study is directed is as follows:

'Why is there a lack of adoption of the Geographic Information System in FERMA?'

In order to answer this question, the following secondary research questions in the order described above are posed for exploration:

1. In what ways do leadership factors affect information system adoption?
2. How does perception facilitate the factors of adoption?
3. In what ways do management practices affect information system adoption?
4. In what way does the level of knowledge and acceptability of the information system affect its adoption?
5. What are the forms of resistance to the use of the information system?

3.8 Summary

In this chapter, the literature on information technology, technology acceptance models and change management have been reviewed and synthesised. Information technology implementation and adoption is not a linear process. It differs according to organisations and context. The review revealed that leadership impacts the speed of adoption of a top-down technological change, while management support for change-related activities increases

employees' commitment to change. It highlighted that the focus should be on the middle managers, the key actors of the change because they impact user attitude and behaviours greatly. The managers must sustain the influence required for adoption with proper communication and understanding of the differences in perception of the new technology. It went further to emphasise the role of the users in the acceptance process and the need to provide capacity building through specific training.

The technology acceptance model (TAM) was identified and selected as a suitable model to be used as the basis for exploring the GIS phenomenon in FERMA. TAM favoured the transformational leadership style found to positively influence the perceived usefulness of a new information system, thus improving its success. It suggests that perceptions about innovation are contributory to the materialisation of attitudes that could result in acceptance and actual usage of the technology. I considered TAM an appropriate framework for initial exploration of the GIS phenomenon in FERMA.

Therefore, an adapted TAM using knowledge gained through literature and my insider knowledge provided the foundation for ascertaining the issues of the GIS within my organisation. It showed that attitudes, competencies and environmental factors must support the desired change. In line with the AR strategy of this research as outlined in section 2.6, this literature review culminating in the conceptual framework (Figure 4) was the first step of AR cycle 1, constructing the thesis problem (the GIS phenomenon). AR cycle 1, comprising constructing, planning, taking action and evaluating the action (Figure 5), comes up fully in the next chapter.

4. ACTION RESEARCH CYCLE ONE

4.1 Introduction

This chapter is devoted to data presentation and analysis of the action research cycle one (AR cycle 1). The purpose of this section is to show the interpretive understandings of all participants grouped as influencers and users towards improving the Geographic Information System (GIS) situation as defined within the dynamics of the conceptual framework. The influencers are persons who have some level of influence over the users of the GIS such as directors and managers, while users are those who are actively involved in the use of the GIS, as an important application in their daily functions. It begins with the construction of the problem where key findings from literature are used to understand the GIS problem. It then describes the analysis that took place in designing the interview questions in a view to exploring the constructed problem. Furthermore, it provides a summary of the planning phase, which includes the selection of participants and planning the interviews. In presenting the analysis of the data obtained and its interpretation, it is subsequently brought together with the emergence of a GIS ecosystem adoption model.

It is important to state that the analysis carried out was not a linear process of merely moving from one phase to the next. Instead, it was a recursive process, where the movement was back and forth as needed, throughout the stages. Figure 5 below provides a diagrammatic representation of the path applied in this section of the research and describes all major phases of the AR cycle 1, which includes constructing the problem, planning the research, taking action and analysing findings. The report of the analysis carried out follows a linear path.

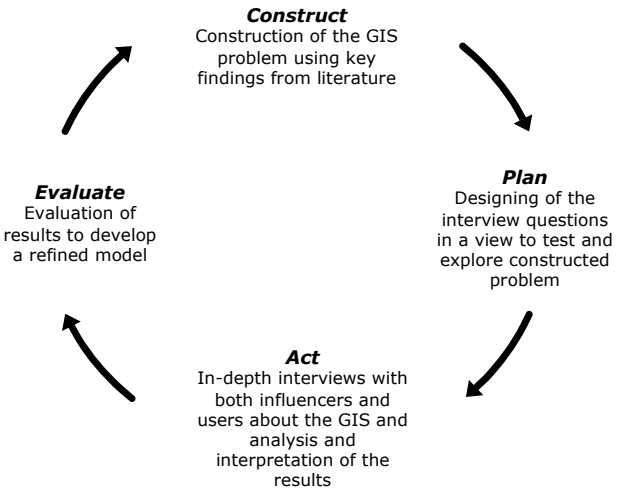

Figure 5: Action Research Cycle 1

Action research aims to transform attitudes and behaviours as well as assess the adopted change method. The organisational change management for this study could be considered as the process of identifying and managing the human element of technology change, most notably the responses to new goals and ways of achieving them (Ziemba and Oblak, 2015). Literature indicates that leadership at all levels could influence and persuade individuals of the benefits of a new system or planned change.

4.2 Constructing the Problem – Development of Conceptual Framework

The usefulness of maps in delivering reports of the organisation's activities gave rise to the introduction of the GIS in FERMA in 2012. It was an application expected to store data and information on Nigerian federal roads, bridges, road camps, construction sites and other road assets on a geo-referenced map of Nigerian federal roads for efficient information reporting and management. However, as at the time of this study, the system had not been fully adopted within the organisation.

The purpose of this study was to positively transform the GIS technology in FERMA to a fully operational state with accurate data and seamless interdepartmental relations. The goal was that

the GIS be used as a decision-making tool in the management of road assets. GIS technology was introduced to the organisation in 2012. However, six years later, the technology was still not fully utilised. A conceptual framework adapted from Davis *et al.*, (1989) Technology Acceptance Model (TAM) represents the researcher's synthesis of the literature on how to explain the GIS phenomenon. It was discussed extensively in chapter 3, the literature review. TAM concentrates on an individual's perception of new technology. It illustrates how users come to accept and use technology. Thus, TAM appeared to best fit the GIS situation, as the core focus of the research was how to get individuals to use the system. The original TAM model (Davis *et al.,* 1989) was used as the core of this research. However, as I am interpreting the lack of adoption in terms of user perceptions and with the assumption that user perceptions are affected by organisational factors such as leadership and management practices, the model has been extended to include these elements (Figure 4). The benefit was that the adapted model was specific to the GIS problem and offered a basis for ascertaining the impact of the new technology within the organisation. Baliamoune-Lutz (2003) emphasised that a successful IT adoption requires awareness of all critical issues. From reviews, TAM accounts for 30-40% of IT acceptance (Holden and Karsh, 2009). TAM's widespread application in addressing factors of user acceptance of technology justifies the initial choice of the model. Hence, understanding the impact of leadership and management practices should help to improve user perceptions and thus use.

4.3 Planning Action – Designing the Interview Guide and Ancillary Items

Activities carried out in the planning action phase include: identification of interviewees, preparation of interview questions, interview schedule design, and development of a participation information guideline and consent form. Fifteen interviews were conducted. The 15 respondents comprised of six persons who influenced GIS users and nine who were meant to actively use the GIS platform. Questions were semi-structured, and respondents were occasionally probed to get a deeper understanding of their responses. All interviews were recorded using an audio recording device. Chapter two, the methodology discusses this in detail.

The overall goal of the questioning was the desire to know the human perspective as it relates to the GIS technology within the organisation with no inhibitions by the interviewee. The interview

guide was designed such that one does not pre-frame interviewee responses (Appendix B). It was divided into three sections: i) the first section was an introductory section, where questions were aimed at putting the interviewee at ease while endeavouring to build trust, ii) the next section had questions related to the respondent's general feelings and perceptions, users' knowledge, attitudes and practices on GIS as depicted within the adapted TAM model. The questions were open-ended requiring a response with the increased opportunity for the participants to share their points of view. My construction of the study was not revealed in the line of the query so as not to pre-empt participant responses. The basic TAM questionnaire according to Davis (1989) seen in Appendix A, was used in the form of probes where respondents were asked to provide more insights on their initial responses. It was necessary to explore the TAM model within the context of the GIS in FERMA. iii) questions in the third and final sections were designed to explore factors around the adoption of GIS technology. These came after the open-ended questions. The research explored extensively the leadership and management factors affecting use and bottlenecks around uptake within the organisation. It aided the identification of underlying themes for analysis and interpretation. The rationale for the interviews and this design was to explore and test the researcher's initial construction of the problem (Figure 4), by seeking the participant's perspectives and experiences.

4.4 Taking Action – Exploring the Initial Construct with GIS Users and Influencers

The purpose of data analysis in qualitative research is to use data obtained from interviews to understand the respondents' perspectives and to answer the research questions. Following the completion of interviews, data collected from the process was reviewed extensively in line with Esterberg's (2002) advice, which states that researchers should get to know and understand their data for ease of analysis. ATLAS.ti version 8.4, a qualitative data analysis software was used to arrange and manage the data. A form of template analysis was the choice of the thematic approach used for analysis (Braun and Clarke, 2006; King and Brooks, 2017). Appendix D shows the template for coding the data. I applied my preunderstanding and the additional knowledge obtained from literature in the thematic analysis of the data. It began with the interview guide, which was designed such that investigation of certain areas in line with the conceptual framework could be achieved. The seven a priori themes of leadership, staff capabilities, strategy, structure, perceived usefulness, perceived ease of use and intention to use

were also derived from the framework to commence the analysis (King and Brooks, 2017). It was a guide for me in trying to identify why there was the lack of adoption of the GIS. Questions were asked along these lines and I was attentive to the responses. The transcribed data were coded manually at the initial stage. Familiarisation with the data by reading through the notes multiple times and colour coding according to the template was very rewarding. I was able to understand and unpack what was important to the respondents. It made the use of ATLAS.ti much easier. Figure 6 is an example of how the analysis was carried out. I analysed data coded under each a priori theme to identify the different aspects and nuances of the theme as expressed and perceived by the participant.

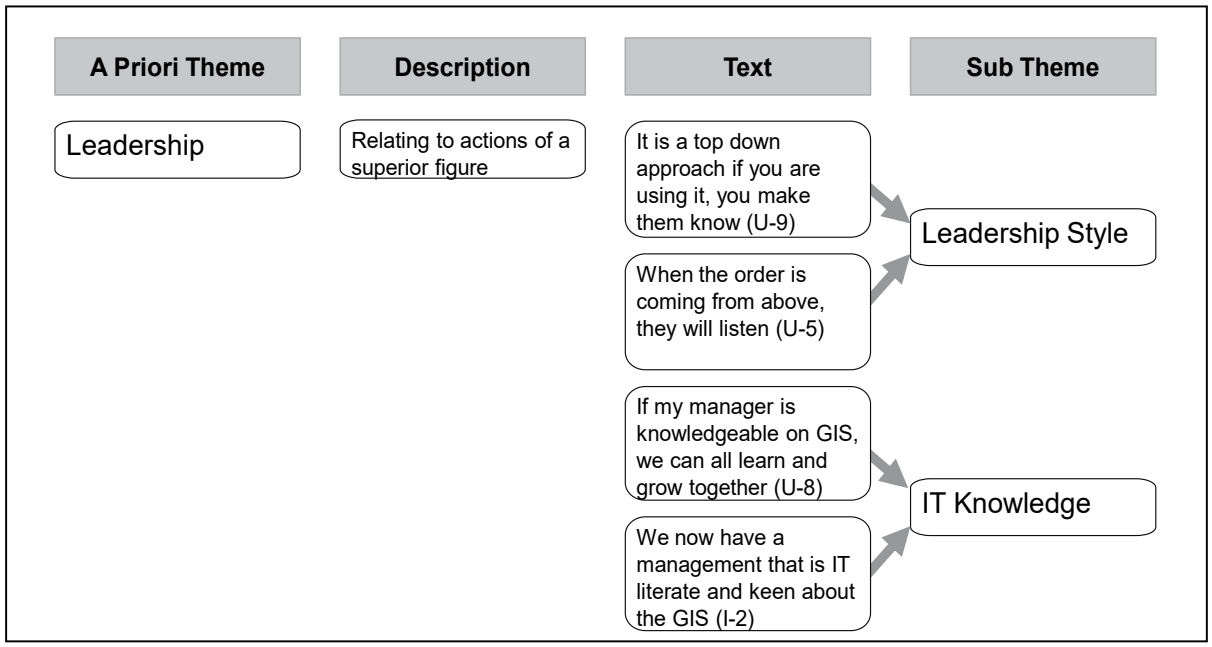

Figure 6: Coding Example

Having unpacked the responses along the lines of the seven a priori themes, I went further to reaggregate the identified aspects and nuances into three overarching themes underpinned by multiple dimensions drawn from the data. The themes identified for dominant discourse within the GIS problem were (i) leadership, (ii) strategy, and (iii) staff capabilities. Table 1 below summarises these themes and provides a breakdown of what they comprise of, while

representative interview quotes per sub-theme are highlighted in their respective subsections below. The sub-themes offer various solutions towards bridging identified gaps.

Table 1: Summary of Overarching Themes Within the GIS Context

Defining sub-components	Sub-themes	Overarching Theme
▪ Leadership by example ▪ Providing an enabling environment	Style of Leadership	Leadership
▪ Establishing clear lines of communication between management and staff ▪ Providing regular and constructive feedback	Communication	
▪ Managers having adequate knowledge of the importance of GIS ▪ Being IT Savvy ▪ Familiarity with relevant technology and software	IT Knowledge	
▪ Interest in GIS use and adoption within the organisation. ▪ Finding solutions to identified challenges affecting adoption and use. ▪ Developing internal policies and strategies to increase uptake	Commitment	
▪ Implementing a plan for GIS adoption ▪ Communicating details of the plan to all parties involved ▪ Interdepartmental collaboration (IT and other relevant departments)	IT Plan	Strategy
▪ Organising regular trainings (theory and practical) and capacity building sessions for GIS users ▪ Mentoring/hands holding until users become used to the GIS technology ▪ On-site supervision to ensure knowledge from training is applied properly	Training	
▪ Linking good organisational performance to GIS use ▪ Developing job descriptions that include GIS use	Development of KPIs	
▪ Phase out all old systems not in line with desired approach	Mandatory Usage	

Defining sub-components	Sub-themes	Overarching Theme
▪ Reject reports/data not generated using the GIS technology		
▪ Implement stiff penalties for non-use ▪ Celebrate compliance	Penalties for Non-use	
▪ Willingness to learn and use the GIS ▪ Sufficient interest in the GIS technology	Intention to Use	Staff Capabilities
▪ Knowledge of the GIS and its benefits ▪ High ability to use and manipulate GIS	High Technical Capacity	
▪ Adaptability ▪ User friendly	Perceived Ease of Use	
▪ Improved job performance ▪ Road asset data readily available	Perceived Usefulness	
▪ Fear of the unknown/ anxiety to new technology ▪ Prefer status quo ▪ Age and new technology	Resistance Factors	

4.4.1 Leadership

Excerpts from transcripts captured in this section were related to actions taken, or characteristics possessed by a superior figure in a position of influence within the organisation towards sustained adoption and use of GIS in FERMA. Key interpretations presented in Table 1 indicate that the four sub-themes, which made up the leadership theme were: (i) leadership style, which is the method adopted by persons in positions of influence within the organisation to provide direction, implement plans and motivate others concerning the GIS technology, (ii) communication, which involves interdepartmental collaboration and communication between staff and management, (iii) IT knowledge, which has to do with the leader's intellectual capacity and domain knowledge which encompasses tactical and technical knowledge as well as awareness of the GIS environment and history, and (iv) leader's commitment which is related to the interest in realising a successful implementation, uptake and use of GIS within the organisation. These represent the leadership characteristics that the participants expect of a manager to induce IT adoption. The table below presents a summary of some of these themes, as reported by the respondents. For ease of identification, influencers are coded ‘I’ and users ‘U’. Section 2.6.2.1 (Rationale for selecting the interviewees), explains the categorisation of participants further.

Table 2: Summary of Leadership Themes Within the GIS Context

Sn	Leadership Factors identified by respondents	Sub Theme
1	Provide an enabling environment by ensuring that all staff get a chance to practice and perfect use of the GIS platform (I3, I6, U1, U6, U7, U8)	Leadership Style
2	Leadership by example. People in leadership positions within the organisation should also make use of the GIS (I2, I6, U3, U4, U7, U9)	Leadership Style
3	Adequate collaboration between departments that will work together to ensure that the GIS use is optimal (I1, U4)	Communication
4	Providing clear instructions to staff on what is required of them in terms of GIS use and developing clear communication pathways between management and staff (I3)	Communication
5	Use of the GIS technology by management in all management functions (U1, U8)	IT Knowledge
6	Sustained interest and commitment by management (I1, U3, U5, U6, U7, U8)	Leader's commitment

4.4.1.1 Leadership style

Some respondents identified leadership-by-example as an important factor that could potentially influence GIS uptake within the organisation. Leadership-by-example was described in terms of leaders using the system and showing enough interest and commitment towards its uptake and use within the organisation.

> *"A particular leadership style we could use as a way of improving GIS use is leadership by example. For instance, if I want all my data that has all the necessary GIS components, definitely my subordinate will supply it and in the process of doing that, they learn and get proficient with it" (I2)*

Leading-by-example is a basic assumption of transformational leadership (Yaffe and Kark, 2011). A leader collaborates with teams to ascertain the required change and creates a corresponding vision, which will guide the process through inspiration. He or she would execute the change together with the committed members. In FERMA with its bureaucratic top-down approach, the importance of managers' providing clear and visible examples for followers was emphasised. However, it was recognised that sometimes the culture could discourage leadership by example – ' in the civil service, most top officers push work to their subordinates (U4).' Hence, the need for managers to be mindful of this fact and determine to overcome hierarchical nuances. The 'power distance' between managers and their subordinates is deeply woven into the civil service culture. On account of this, managers must view themselves as part of the system and not above it.

Another leadership factor identified under this sub-theme was the provision of an enabling environment such that all users could get equal opportunities to practice and perfect the use of the GIS platform. The provision of adequate Internet bandwidth, GPS devices and other hardware was specifically mentioned – 'A good step would be the distribution of more GPS devices (U6).' In effect, managers must pay attention to the needs of the users to identify further steps that could be taken to aid followership by example. The awareness of challenges facing the user can help define and shape the work setting, resulting in an improved workflow through the uptake of the GIS. Furthermore, a 'friendly ambience' (U8) was considered an enabling environment because users would be comfortable in making mistakes and taking corrections, resulting in the overall improvement on GIS adoption.

The transformational leadership style encourages and motivates followers through role modelling, challenging tasks and mentoring (Bass, 1999; Menzel, 2015). Supervisor influence as a prerequisite to GIS adoption is evident here. The understanding was that managers have the power to influence those whom they supervise. Once they lead by example say in the use of the GIS, others are expected to follow. Leadership style is a crucial factor in information systems adoption.

4.4.1.2 Communication

Adequate communication between management and users was also a leadership factor that respondents acknowledged could improve the use and uptake of GIS. Communication in this

context could be in terms of: (i) communicating what is required of the users and providing specific instructions, (ii) keeping users in the loop on updates and happenings concerning GIS within the organisation, and also (iii) requesting for and providing feedback to users. The quotes suggested a perceived disconnect between the top and the bottom of the organisation.

"There should be a change in style by management, have somebody that should talk to both the people on the field and also at the management level, one should be able to talk to them on the need to use the GIS software and its importance" (I3)
"If the unit/departmental head sought for an update in every departmental meeting and intentionally sought feedback I think it would help to improve the use of the GIS" (U4)

The top management was not communicating its strategic vision as expected. In the same vein, they were not taking notice of what was going on at the bottom. Honest feedback and suggestions across departments is integral as the areas of challenge experienced by one could be entirely different in another department. There was a need for improved communication between those in the field and those at the headquarters. A designated line of communication would ensure continuous conversation and proper feedback thus leading to improved usage. Awareness of a problem and proffered solutions are not a one-off topic – 'there are bound to be snags and kinks' (I6) – and through proper feedback such can be straightened. Consequently, it was necessary to do better in terms of the communication from managers as it relates to the GIS and its processes throughout the organisation. 'Specific instructions on manning the GPS devices (I3)' was an example. A clear instruction where the role description is defined. A mechanism for continued advocacy and feedback on the actions and outcomes of the GIS was desired. The flow of information in an organisation is the blood life of any operating unit (Sharma and Bhagwat, 2006). The top-down communication explaining the need for the GIS, plans for adoption and its impact on the organisation is very important and vice versa – 'forwarding information to the headquarters from the field' (I3).

4.4.1.3 IT knowledge

IT knowledge is described in terms of people in leadership and management positions within the organisation, having adequate IT knowledge and operational knowledge of the GIS software.

The literature stated that if leaders were conversant with new technology, it would be easier for them to push for its adoption and for their subordinates to pick up interest.

> *"The Manager that is fully knowledgeable on the GIS will make me love it more because if the manager is not knowledgeable about it, how will he know if the reading I have taken is correct so even if I am making a mistake, he does not know, so it will really help me a lot if my manager is knowledgeable about it. The will to know it, we can all learn and grow together." (U8)*

From the voices heard, leadership is a crucial component for the success of any project. It indicated that where the leader has good knowledge or strategic vision of the GIS goal, there are bound to be great strides in that direction. In FERMA, it took the coming of an IT-savvy CEO, to change the GIS dynamics. He understood what the organisation stood to gain once the GIS was fully operational and gingered both top management and other staff to be GIS compliant. He was in a position to advise on the 'kind of data set needed' (I1). His arduous support for the system enabled an increase in the favourable facilitating conditions. The CEO's IT knowledge and commitment was clearly reflected when he promoted me to head the RMMS department as a result of my passion in exploring the lack of adoption of the GIS. As a leader with IT knowledge fully committed to the change process my actions caused a participant to say, 'she has been up and doing, making sure that it works' (U5).

4.4.1.4 Leader's commitment

Leadership is ranked as a top facilitator of great transformation efforts, it makes a difference during IT implementation. A new initiative's implementation success or failure is largely dependent on top management's support and commitment. In this case, top management's commitment played a fundamental role in determining GIS technology implementation success. It is also essential to state that wholesome commitment by leaders is important for any organisation's long and short-term performance. This study emphasises the critical role of managers' commitment in improving the GIS situation in FERMA and the need to ensure that their actions are commensurate to the desired goal. 'The critical operators are the mid-level managers' (I6). Therefore, top management must strive to build their commitment. Several

voices acknowledged that there was some level of commitment towards promoting GIS use within the organisation. Nevertheless, there was room for improvement because not all persons in management position had shown enough commitment.

> *"One or two players are committed to it, but success does not rely on the commitment of one top player, the whole Executive Management, Senior Management needs to be carried along" (I1)*

Non-familiarity with the technology and being matured in age were factors that came up as hindrances. 'I am close to retirement, you should train the younger ones' (U6). It was a case of usability and a decreased expectancy of obtaining valued outcomes in the long term. Hands-on practice was identified as a needed approach to encourage GIS uptake.

Another key factor that came up for lack of adoption related to commitment of the leaders was the high turnover rate of top management.

> *"The management of today has an interest; they have shown more interest in GIS than the previous managements. They came, they taught us how to go about it……., this present management made it easier before it was difficult for us" (U5)*

This particular response making a comparison with previous managements highlights the risk or fragility of support. If there is high top management turnover, there is the risk of going backwards in terms of IT adoption rather than building on the gains.

Listening to the managers and the users, it is apparent that leadership and leadership style largely influences the adoption of new technology, the GIS to be specific. It is the upward perception by the users that is more critical because it is a window to their lack of adoption. There are actions that speak to the criticality of leadership in AR cycle 2 (Chapter 5) and the need to get everyone in management to own the technology besides the IT champion.

4.4.2 Strategy

This is the second overarching theme. It describes all steps taken or suggested towards actualising GIS usage within the organisation. Critical interpretations from the interviews, which make up the sub-themes include: (i) the development of a GIS adoption strategy, described as developing implementable guidelines for GIS deployment and use within the organisation, (ii) conducting staff training which include theory and practical sessions, (iii) enforcing mandatory usage, (iv) imposing penalties for non-use, and (v) developing key performance indices – KPIs for users as the identified probable interventions. The table below presents a summary of the identified sub-themes:

Table 3: Summary of Strategy Themes Within the GIS Context

Sn	Strategy	Sub-Theme
1	Developing a clear plan/strategy for GIS use and implementation (U3, U4, I3, I4, I6)	GIS adoption strategy
2	Training of staff on the technology. Training should be holistic, adequate and continuous (U1, U2, U5, U6, U7, U8, U9, I1, I2, I3, I4)	Training
3	Constant monitoring of projects and mentoring of project managers to ensure compliance in the use of the GIS software (U5, U6, I2, I6)	Training
4	Making GIS uptake and use mandatory for all staff. (U1, U2, U3, U6, U8, I1, I2, I4)	Enforcing mandatory usage
5	Attaching penalties to non-compliance (U1, U5, U7)	Penalties for non-use
6	All staff should be given KPIs based on GIS use and new job descriptions which include GIS use should be developed (I1)	Developing KPIs

4.4.2.1 Development of a GIS adoption strategy

It is a clear set of guidelines outlining an effective strategy and method of implementation within FERMA. A few respondents identified the absence of a clearly defined adoption strategy as a major problem facing GIS adoption and use within the organisation.

> *"So far the Agency may have a laid down plan and strategy but if it exist, I will say that the strategy has not been fully communicated to the staff because it is not enough for the Agency or management to have a strategy, it is enough when people are aware of the strategy and are able to apply it in order to make it successful." (U4)*

This demonstrates the fact that most respondents were not aware of any GIS adoption strategy within the organisation, and even if one existed, then it had not been fully communicated to members of staff within the organisation. An effect of this includes the lack of synergy within departments, gaps in GIS adoption within FERMA and other challenges related to the process. There was a pertinent need for the development and implementation of a GIS adoption strategy. Managers need to marshal subordinates with set targets towards improving adoption and further break it down into small steps. 'How do we validate the data?' (I6) There was a disruption in the workflow and this affirmed the need to revise the GIS processes within the organisation to smaller more manageable stages that could be measured and observed for regular evaluation. Incremental measurable goals would allow the user to improve on usage. The communication of a plan that identifies effective lines of creating awareness and understanding of the GIS was considered critical.

4.4.2.2 Conducting staff training

Training, education and technical support on a new process or technology delivered to potential users are prerequisites for adoption. From the interviews, the need for more training was a recurring sub-theme as all respondents identified this as a desired and essential strategy to improve GIS adoption within the organisation. While respondents acknowledged that training had been conducted for users, they also identified some issues they had with the training in terms of its content, effectiveness, coverage and completeness.

> *"The training was done for various levels of the users of the GIS, but we have decided to move on all the process owners and follow up with them, provide them with all necessary assistance in making use of the software." (I4)*

The desire was for more continuous training considering the evolving nature of technology. ‘Tailored training’ and ‘mid-level managers as critical operators’ (I6) was specifically mentioned, where the training is customised specific to each user group. The suggestion was made because individuals would more likely adopt the skills learned in training if it was relevant to the job role. Thus, more hands-on practice and focus on the mid-level managers was recommended. The interpretation being that hands-on experience could drive the user to achieve a certain conduct of usage through the act of guided repetition. Furthermore, it became obvious that there had to be a holistic approach to the interpretations of the information provided from the constant monitoring of the road projects. Training is a critical step for technological implementation and adoption.

4.4.2.3 Enforcing mandatory usage

Mandatory usage is defined in this context as one where use of the GIS technology to perform one's job is compulsory. Findings from interviews indicate that majority of the respondents acknowledged that enforcing mandatory usage would significantly increase uptake, making it worth considering as a managerial intervention going forward.

> *"I think we have to come to a point where it is mandatory for people to use the GIS system to provide specific information; either by producing a job description that ties it to their appraisals or you have processes and workflows that require them to use the system. We can also tie it to our internal processes and how we deliver our projects because, by the time you make it mandatory, people would use the system." (I1)*

Usage of the GIS, as conceived by top management, was never voluntary. However, during the interviews it was indicative that there was some form of disconnect between the top and the bottom. It became obvious that mandatory use would ensure retention of lessons learned from training, ensure full involvement and allow for feedback on challenges if any, because the user would be ‘forced to ask questions’ (U3). Through mandatory use the GIS technology would be institutionalised in the organisation because it is built into the routines of our daily activities.

4.4.2.4 Imposing penalties for non-use

This was also a factor identified by respondents, which could improve adoption and sustained use of GIS within the organisation.

> *"There should be a change in style by management, we should have somebody that should talk to both the people on the field and also at the management level, we should be able to talk to them on the need to use those things and the importance, and then if they can talk to them and there is no change, then the issue of punishment may now come in. Ab initio [from the beginning], I do not think it is good to start punishing people for what they do not even know" (I3)*

There is a school of thought that punishment rather than perceived usefulness drives mandated use of new technology, thus asking users to repeat the work at their own expense was one recommended form of punishment. If this were the case, then imposing punishments for non-use could considerably drive up adoption. This sub-theme was really worth considering because it could be very effective. A user categorically stated, 'non-use of the GIS platform should not be accepted' (U1). However, before imposing penalties for non-use, it was suggested that users should be educated further on the importance of GIS technology and that managers be accepting of mistakes at the initial stage because it forms part of the learning process.

4.4.2.5 Development of KPIs for staff

This was another sub-theme that emerged in considering various ways to actualise GIS usage. The idea was that the use of key performance indices would serve as a positive motivation for adoption and uptake of the GIS software.

> *"I think it is time we set ourselves, KPIs, look at different levels of usage then monitor and measure how those in the Agency are developing on the use of GIS. You may have super users, ordinary users, but you will have a stratified user base depending on the complexity of the work you want those people to do, but it has to be more accurate because anything that is not measured is a waste of time." (I1)*

In this case, a set of quantifiable measurements would be used to gauge the organisation's overall GIS use performance on a monthly basis.

4.4.2.6 Constraints to some components of strategy

Conversely, within the strategy theme, slow Internet speed was identified as a constraint to the adoption of the GIS.

> *"What I noticed was the Internet speed we have at the headquarters needs to be improved because the GIS is a little bit heavy. There is need to improve on the broadband to enjoy it. Sometimes, if I want to use it, I just use my personal modem because if I use what the Agency has, it takes a lot of time" (U3)*

A lot is still required concerning infrastructure to strengthen broadband penetration in Nigeria (Akinpelu, 2018). Scholars acknowledge that slow Internet speed is a factor that discourages the use of information systems (Afolayan et al., 2015; Osho *et al.*, 2016; Oyelaran-Oyeyinka and Adeya, 2004). However, even though slow Internet speed impedes the GIS adoption as it makes the use of the GIS platform cumbersome, the focus is to improve and change that which is within our purview as managers while making recommendations where appropriate.

4.4.3 Staff Capabilities

This refers to the employee's ability or perception towards using the GIS. Further consideration of excerpts of the transcripts under this theme revealed that some of the users had high technical capacity and positive perceptions towards the usefulness of the GIS to their jobs albeit with some challenges. In the context of this research the sub-theme, perceived usefulness was described in terms of the benefit of the GIS to one's performance on the job, while perceived ease of use was described as how easy it was to use the GIS and finally one's intention to use referred to the desire to use the GIS on a regular basis.

Table 4: Summary of Staff Capabilities Themes Within the GIS Context

Sn	Staff Capabilities	Sub-Theme
1	Useful to the job – provides a database, graphical interface, keeps track (U3, U4, I3, I4, I6)	Perceived usefulness (PU)
2	Increased productivity (U1, U2, U5, U6, U7, U8, U9, I1, I2, I3, I4)	Perceived usefulness (PU)
3	Readily accessible, user friendly and easy to comprehend the fundamentals of the software (I6, U1, U2, U3, U5, U6, U7, U9)	Perceived ease of use (PEOU)
4	Seek to maintain status quo, fear of the unknown (I3, I6, U4, U6, U7, U8)	Resistance factors
5	Matured age, thus anxious about new learning (U6, U7)	Resistance factors

4.4.3.1 Perceived usefulness (PU)

Respondents were in agreement on the perceived usefulness of GIS within the organisation. However, they were quite divided on their usage, with some acknowledging its use while others reported low levels of use. The reasons for non-use include the fact that data were still being uploaded onto the server and there had been some delay in implementation.

> *"The GIS provides geospatial information that is released to the asset inventory that also has to do with where our plants and equipment are located and also the condition information of our road network. GIS also provides the user with a graphical interface where you can clearly see where our assets are located" (I1)*

Other reported benefits of using the GIS software include improving management's monitoring function, obtaining historical information on road assets and shifting from an analogue to a digital-based system, which is more efficient. This was reflected clearly by an influencer, 'the GIS has improved my productivity' (I6). It is also pertinent to state that both influencers and users share similar views on the benefits of GIS. This is further depicted in Tables 4 and 5.

The responses affirmed the need for further advocacy and awareness on the GIS and the overall vision. There were different individual perceptions ranging from data gathering to the impact of road maintenance information made readily accessible, but the organisational goal remains dominant. The GIS as a decision-making tool must be understood and used at all levels where it is required.

4.4.3.2 Perceived ease of use (PEOU)

Responses on PEOU appeared varied, but on closer investigation, it was found that the software was easy to use but much dependent on individual interest. Even though IT knowledge had been fully cascaded down to all levels, officers in the operations and other departments still carried out their daily tasks manually rather than adopt the GIS. This admittedly showed that full usage could take some time to happen, considering that learning and adopting a new technology takes time.

> *"I think it is reasonably easy. It depends on interest, if people will indicate more interest; it is a very good thing. It is not a difficult technology to handle"(U1)*

The collective knowledge here was that those in the Management Information Systems division had fully understood the GIS technology and were ready to support others towards full usage. This was a case of peer influence leading adoption. A good example of this is reflected in the quote below.

> *"Yes, for people that are working with me, they are supposed to use the GIS regularly and they are beginning to do that now, like where we are now, we have captured from inception to 2017 on roads projects and engineering services" (I4)*

4.4.3.3 Resistance factors

Major resistance factors affecting the adoption of GIS include difficulty in grasping new concepts, poor acceptance of the technology, fear of change and new technologies, and preference of the old ways of doing things. Fear of change or of grasping new technologies was

identified as the primary resistance factor affecting uptake and use of GIS within the organisation.

> *"People like the way they are doing things, so if you want to bring a technology that would do or make it easier for them to do their work, they find it very difficult to accept it." (U6) "We still have some group of people that do not want to change the old way of doing business"*

Several respondents acknowledged this. It was expressed in terms of the technology being relatively new. Routine is valued and the introduction of change brought about anxiety, mainly due to the uncertainty in being able to use the new system. This mindset also hinders learning. Therefore, time needs to be allowed before users could fully accept the technology. Adoption is a gradual process.

Another factor that was considered from the literature was redundancy. However, the fear of losing one's job due to the introduction of GIS in FERMA was not a cause of resistance among users. On the contrary, users acknowledged that the introduction of the GIS would make their work a lot easier among other benefits. Full adoption of the GIS, guarantees an increase in the efficiency of operations.

> *"The GIS makes the job a lot easier, it does not make anybody redundant, everybody will be doing their work but this time around, it will be easier and more accurate and it gives the MD the ability to present to the public in a few easy steps what the Agency is doing." (I4)*

4.4.4 Influencers vs Users

The analysis went further to investigate whether the views of the influencers differed from that of the users (Table 5).

Table 5: Recurring Views of Influencers Versus Users

Description/ Meaning	**Influencer**	**User**
Leadership-by- Example: if the leaders use the GIS then followers will too	I2, I6	U7, U3
Need adequate Communication: set clear expectations and defined roles	I1, I3, I6	U4, U9
Leadership IT knowledge: managers that have knowledge of the GIS	I1, I2, I6	U1, U4, U6, U7, U8, U9
Leaders commitment: the manager is committed to the change, thinks it's someone else's fault but users push the blame to managers	I1, I2, I6	U3, U5, U6, U7 and U9
IT strategy: no clear steps or plan of action to follow towards adoption	I3, I4, I6	U2, U3, U4, U8, U9
Need for hands-on-training: users being guided at their workstations	I1, I2, I3, I4, I5, I6	U1, U2, U3, U4, U5, U6, U7, U8, U9
Mandatory Usage: make use of the GIS compulsory for daily tasks	I1, I2, I4	U1, U2, U3, U5, U6, U7, U8, U9
Imposing Penalties: punitive measures for non-use of the GIS	I3, I6	U1, U7
Development of KPIs	I1	
Internet Speed Constraint: slow speed		U2, U3, U6, U7
Perceived Usefulness: GIS useful on the job	I1, I2, I3, I4, I5, I6	U1, U2, U3, U4, U5, UG, U7, U8, U9
Perceived Ease of Use: easy to use the GIS	I3, I6	U1, U2, U6
Resistant Factors: anxiety, fear of new technology, preference for status quo	I1, I2, I3, I4, I6	U4, U6 U8
No Redundancy: no loss of job	I4, I2, I6	U1, U2, U6

It can be seen in Table 5 above that both groups expressed similar views on almost all identified themes but there were also a few differences. For example, only influencers indicated the development of KPIs as a strategy for improving GIS use. It was suggested that the use of KPIs would aid in monitoring GIS use through focus on its processes, which in the long term would result in improved productivity for the organisation. Conversely, only users identified Internet speed as a constraint affecting GIS use of which the leadership was unaware. This knowledge was reflected in the table above under leadership commitment, where users emphasised their lack of commitment. This was the upward perception by the users, a critical factor in terms of acceptance of new technology.

Table 6 focuses on the three overarching themes of leadership, strategy and staff capabilities. It captures the differences in perceptions by the two distinct groups. It shows that for the leadership and strategy themes there were slight differences in perception, while the recorded perceptions under the staff capabilities theme were similar for both influencers and users.

Table 6: Comparison of Influencers' Vs Users' Views

Theme	Influencers' Views	Users' Views
Leadership		
Style of leadership	*"It is leadership by example,..... my subordinate will supply it and in the process of doing that, they learn and get proficient with it" (I2)* The focus here was on encouragement by prompting the use of the GIS through assigned tasks. Thus subordinates would have no option but to adopt it.	*"FRMEs can really make others to participate, it is through being a participant himself, because you teach by examples, (U3)* Emphasis was on following the leader. A show of high interest in the GIS by the leader would be contagious, encouraging users to learn and use. A case of the field supervisors (FRMEs) guiding their subordinates.
Commitment	*"we are giving them all the kind of support that can be given to anybody" (I6)*	*"One or two players are committed to it but success does not rely on the commitment of one top player, the whole Executive Management, Senior Management needs to be carried along" (U4)*

Theme	Influencers' Views	Users' Views
	Influencers took things for granted. So far as the system was evaluated to be satisfactory then usage should follow automatically.	Users emphasised the lack of commitment to the GIS by management. This was the upward perception by the users, a critical factor in terms of acceptance of new technology.
Strategy		
Training	*" we need to tailor our training to the need and the function." (I6)* From the perspective of influencers, tailored, bespoke training with adequate feedback would improve the uptake of the GIS.	*"more training and awareness should be created for the users and the Agency as a whole, especially in the field offices" (U5)* The users insisted on training that includes both the theoretical and practical aspects, thus the focus on hands-on training.
Communication	*"we should have somebody that should talk to both the people on the field and also at the management level, we should be able to talk to them on the need to use the GIS and the importance." (I3)* Influencers suggested a multipronged approach that involves an individual communicating clearly with key parties involved including field workers and management staff. Communication was more in relation to the message relayed on the job as is experienced during training.	*"I am not aware of any particular laid down steps to follow, the strategy has not been fully communicated to the staff" (U2)* The users were unaware of any IT-plan for adoption and indicated that no staff should be left out of the communication loop regardless of their roles or rank. Their emphasis was on feedback to understand the effect of their previous actions or inaction and what changes or improvements needed to be done.
Mandatory Usage	*"we need to get them fully involved, and it requires a lot of awareness and lot of training and if possible coercion." (I2)* It was all about an identified system of improving GIS use. Mandatory use tied to processes and workflows was suggested, indicative of specific instructions.	*"you must use the GIS to get your report and readings, and any readings that come without the coordinate will not be accepted," (U8)* Mandatory usage should be tied to deliverables such as the rejection of reports processed outside the GIS system.

Theme	Influencer's View	User's View
Staff Capabilities		
Perceived usefulness	*"The GIS enables you to tap into what everybody else is doing and retrieve what you need to use for better decision-making. " (I6)* Both influencers and users acknowledged the usefulness of the GIS platform. The reported advantages included better decision-making, improved productivity and improved project monitoring.	*"we have realised that the advantage is more than the disadvantage, so everybody is more inclined towards the GIS" (U9)* Users views were similar to the influencers.
Resistance Factors	*"Change is one of the most difficult things for a human being to embrace especially in a system that has been for a long time analogue. " (I6)* Technological change is not easy. It comes with a myriad of challenges most especially with the individuals who must accept the new technology. The introduction of the GIS impacted both influencers and users.	*"People are usually scared of change, usually scared of something coming new" (U4)* Users perceived change similar to influencers.

4.4.5 Summary of Analysis

Figures 7, 8 and 9 provide visual representations of the summary of the analysis discussed above under the three themes leadership, strategy and staff capabilities. They indicate those factors that enable adoption and the constraints under the various themes.

A. Leadership

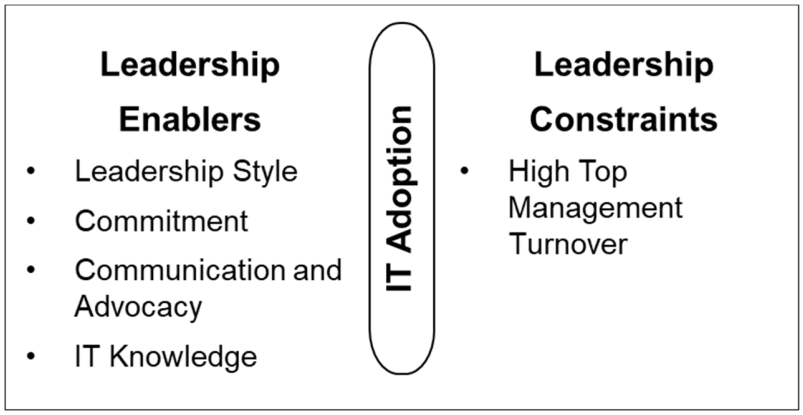

Figure 7: Leadership vs IT adoption

Figure 7 summarises the five factors that were identified by the participants to impact IT adoption within the leadership theme. In technological change the leadership style, commitment towards the new technology, communication, and IT knowledge were considered to enable adoption while the high turnover rate of top management within FERMA was considered to be a constraint.

B. Strategy

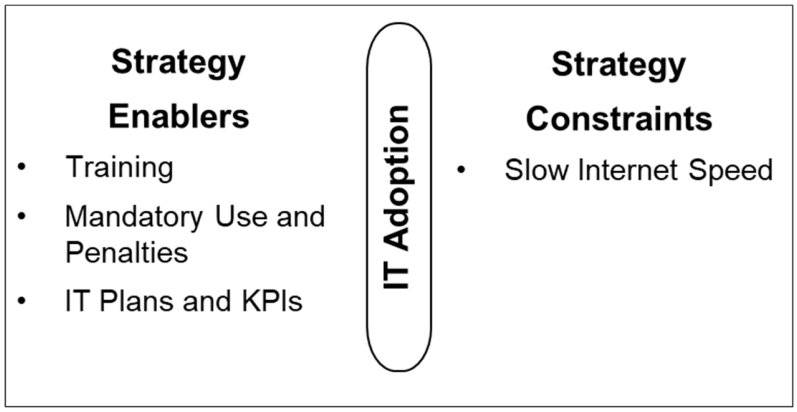

Figure 8: Strategy vs IT adoption

Figure 8 indicates the various steps suggested by participants that could influence the actual usage of the GIS. They are training, enforcing mandatory usage and imposing penalties for non-use, the development of a GIS adoption plan and the establishment of key performance indicators (KPIs) for GIS use. Conversely, the slow Internet speed was advocated by most of the users to be a major constraint to the GIS adoption.

C. Staff Capabilities

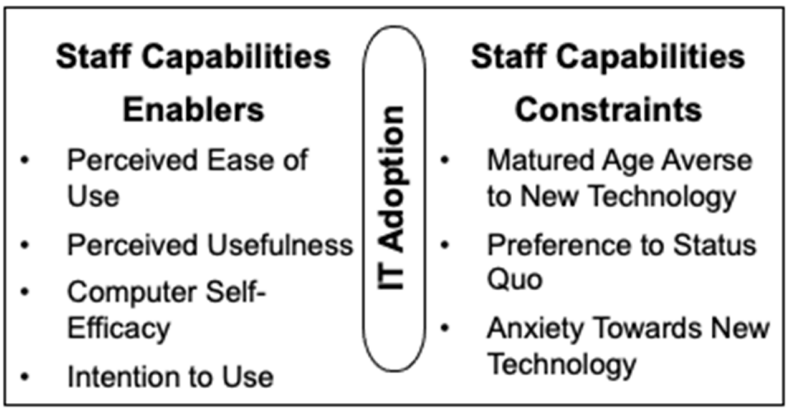

Figure 9: Staff Capabilities vs IT adoption

The staff capabilities theme depicted in Figure 9, identified the key elements captured in the conceptual framework as enablers to IT adoption. They were perceived ease of use (PEOU), perceived usefulness (PU) and intention to use the GIS technology. Computer self-efficacy was also considered to be an enabler of IT adoption. It was only this theme that had more than one constraint to the GIS adoption. Employees who were of matured age and closer to retirement from the organisation were averse to new technology. Participants also indicated the preference to the status quo as well as an overall anxiety towards the GIS.

4.5 Evaluation – Emergence of GIS Ecosystem Adoption Model

4.5.1 Interpretation of Preliminary Analysis and Emergent GIS Adoption Model

The adapted TAM model (refer to Figure 4) provided an initial understanding of the GIS situation in FERMA. It predicts that when a new technology is perceived to make the job easier as well as being easy to operate it logically translates to user acceptance or intention to use. However, from the analysis conducted, the GIS is generally perceived as useful on the job, easy to use and most concerned have positive intentions towards regular usage albeit with valid constraints such as slow Internet speed, fear of the unknown, and the preference of the old ways of doing things. Thus, in line with the conceptual framework, this should have resulted in major progress towards full adoption of the GIS in FERMA. Unfortunately, this was not the case. The problem was not that of the technology itself. The fact reflected was that the GIS was more than a product. It was part of a much wider system where everything was connected to something else, and one part could not be removed without consequences to the other, a fact that was observed by one of the participants, an influencer.

> *"It is an ecosystem, everybody from their respective unit is feeding the system. It will continually need to be improved for as long as we have roads, individuals and various methods by which those problems can be resolved on the roads because for every distress on the roads, there is going to be choices of treatment. They have no choice if they are not going to be outside the ecosystem, they must use the GIS" (I6)*

This was a flash of inspiration, as a manager and leader it became apparent that my assumption was that the GIS was a stand-alone product, which led to the choice of the TAM as the foundation on which to build the research. However, there were indications that it was wise to consider the GIS problem metaphorically speaking, as a technology ecosystem, where one needed to think carefully for all actions from leadership to strategy to staff capabilities [user characteristics] as depicted from the data analysis above and in Figure 10. It was necessary to rethink the organisation's approach to implementing and getting people to use GIS technology. In line with this conceptual leap, the figure shows the intersection of all three elements. Thus, there must be synergy or interaction of the three elements to achieve GIS adoption.

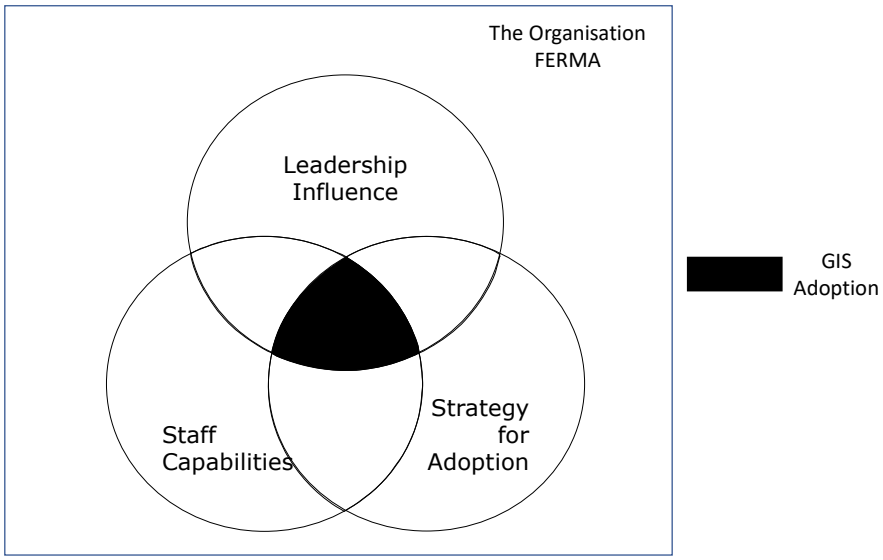

Figure 10: The Three Elements for GIS adoption in FERMA

A closer look at the figure above sets the GIS issue in context. From data gathered for each of the identified themes, some factors engender GIS adoption, which should be sustained or improved upon, while those that are acting against adoption need to be examined. There is apparent interdependency, can it be viewed as an ecosystem?

4.5.2 Representing and Visualising the GIS Ecosystem

As a tactic for generating meaning, the use of a metaphor was considered. Metaphors involve comparing two things through their similarities and disregarding their differences. Thus, metaphors create clarity (Van Engen, 2008). The concept of metaphors is central to how anyone understands and reasons about their experience. Metaphors are utilised to aid an individual in experiencing and understanding a phenomenon (Lakoff and Johnson, 1980; Morgan, 1993). Studies have shown that metaphors have the capacity to condition individual mindsets trapped in a specific manner (Itken and Nagy, 2014; Jermier and Forbes, 2011). The use of metaphors creates comparisons between two separate phenomena symbolising one in reference to the other in order to recall pre-existing information about the accustomed and conveying this information

to relatively new scenarios. As a practitioner, this has provided an alternative way of understanding the organisational issue, thus engendering creative action and reflexive practice.

Pickett and Cadenasso (2002) identified three dimensions within the ecosystem concept: meaning, model and metaphor. The study considered the flexible use of ecosystem as a metaphor in a symbolic and functionalist manner. In line with the new insight of interdependency to cause GIS adoption (Figure 10), and thinking metaphorically, the figure below depicts how to aid creative action.

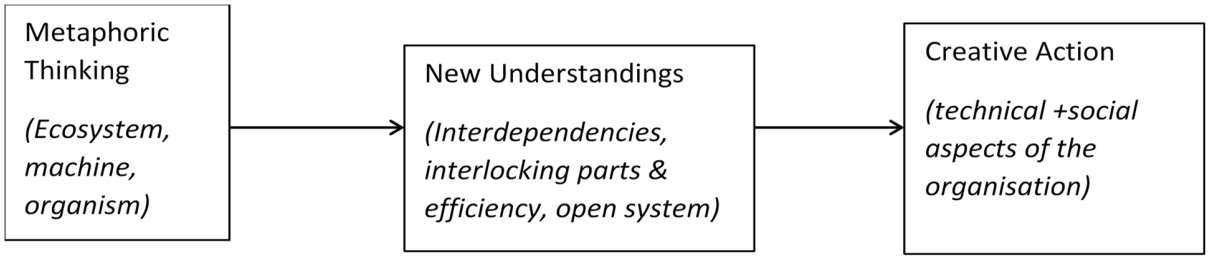

Figure 11: Using Metaphors for Creative Action

In Images of Organisation, a seminal paper by Gareth Morgan (1986), eight metaphors were used for organisations namely: machine, organism, brain, culture, political system, psychic prison, flux and transformation, and instrument of domination. For the GIS phenomenon, the focus was narrowed to the machine and organism metaphor (Figure 11). In the machine metaphor, organisations are viewed as interlocking parts that make up a machine each having a specific function that ensures the smooth running of the machine as a whole (Morgan, 1986). It is a logical, rational perspective of input versus output but fails to take into cognisance the organisation's response to outside change. On the contrary, the organism metaphor looks at an organisation as an open system adjusting to its surroundings. It considers growth, incremental change and guided development but is not good at understanding processes. It has been suggested that scholars in interpretations of occurrences in their organisations could use those metaphors that direct them towards the right path (Cornelissen and Kafouros, 2008; Itken and Nagy, 2014; Jermier and Forbes, 2011). For example, Jermier and Forbes (2016) and McCabe (2016) indicated that the machine and organism metaphor depicts efficiency and effectiveness

when associated with managerial functions. Thus as practitioners, we must direct our attention towards the multiplicity of an organisation.

The above precipitated the development of an insightful model of this emerging GIS ecosystem metaphor indicating the relationship between the user and the GIS going through all the identified layers (refer to section 4.4.5) that seem to be significant to the progress of the GIS adoption in FERMA while taking into cognisance the external environment. The ecosystem metaphor includes the machine and organism metaphor. It allows the GIS issue to be broken down in terms of organisational performance and structure [machine]; and human perceptions of the technology, leadership characteristics and staff capabilities [organism]. These insights affirm that one should focus on the interdependencies of the overarching themes leadership, strategy and staff capabilities in improving the GIS adoption. It was different from the initial adapted TAM model (Figure 4), where the focus of the GIS acceptance or adoption rested solely on the individual. Thus the GIS issue had to be tackled holistically with a definite change to the managerial practices, which were in existence.

A model, which is a microcosm of some portion of the real world, for understanding and visualising the issue under investigation (Burch, 2003; Pickett and Cadenasso, 2002) was developed. The term ecosystem connotes connectedness, ‘everything is connected to everything else’ (Pickett and Cadenasso, 2002, p. 6). The visual representation below was used to explore the interpretations of the data gathered in an inferential manner to explain or contextualise the GIS lack of adoption. The model (Figure 12) was a combination of figures 7, 8, and 9 representing the three main themes of leadership, strategy and staff capabilities. From the analysis, it is suggestive that all parts must work together to make a balanced, functional system. The identified factors from these themes aimed at improving the adoption of the GIS have been categorised as enablers while the constraints, which resulted in the non-usage of the GIS before this study were also drawn from their respective themes accordingly. Going forward in AR cycle 2, the enabling factors were applied to the system, and the constraints were minimised where possible. The GIS ecosystem adoption model (Figure 12) provided a better, more informed and more useful tool for addressing the GIS problem in FERMA.

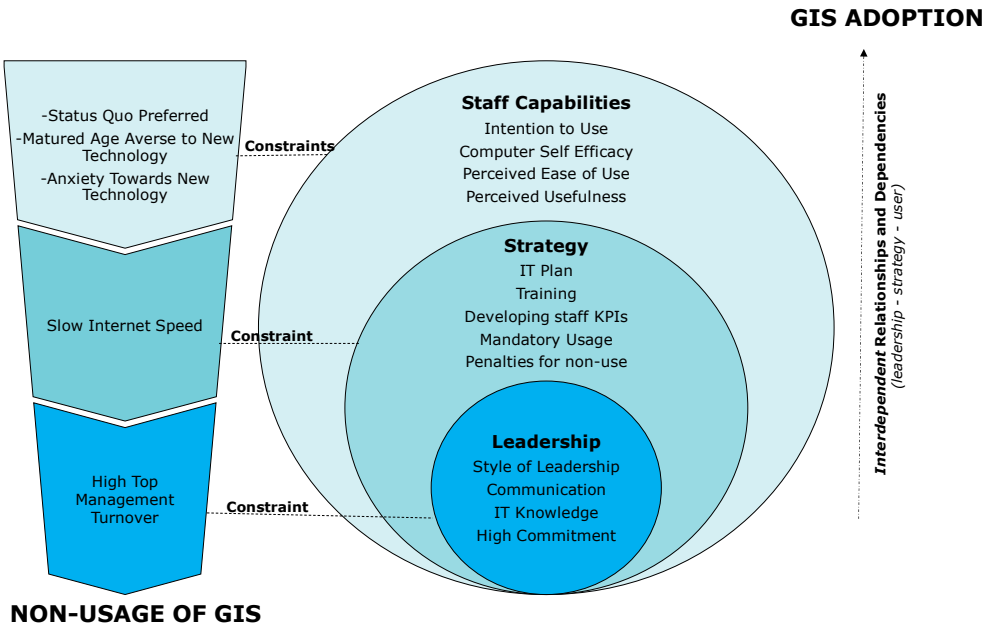

Figure 12: GIS Ecosystem Adoption Model

It could be argued that the bureaucratic nature of the organisation with leadership at the top followed accordingly with management structures is more of a cascade process. However, in this particular study reflecting on the voices of the participants regarding communication, the top management was unaware of what was going on at the bottom. In the same vein, the users were unable to decipher what top management was thinking. The ecosystem model reflected the situation the best. We were acting as if we were unconnected with each other. It was the beginning of a change of mindset in tackling the GIS problem.

4.6 Summary

This chapter was the first action research cycle. At this stage, the initial data were gathered through in-depth interviews and analysed using thematic analysis. The overarching themes of leadership, strategy and staff capabilities were extensively discussed as it relates to the GIS phenomenon. Several sub-themes were apparent within each theme. Leadership factors found to influence adoption and use of the GIS technology were leadership style, leadership commitment, communication and IT knowledge. Overall, these leadership factors were found to influence the

adoption of GIS technology within the organisation, while leadership-by-example was identified as a leadership style that could potentially influence uptake. It was all about the manager setting the right example and helping others to see what lies ahead through adequate communication. Much of the data collected reflected that leadership influence is noteworthy as the observed actions of the users were in response to the prevailing circumstances. From the analysis, the views of the influencers and users were similar across the identified themes. The need for more training was emphasised with a call to mandate compulsory usage of the GIS. The enthusiasm for the GIS by the users is noteworthy because the research commenced with the belief that the major challenge was that of resistance to new technology. The views differed in identified constraints. The users stressed slow Internet speed, of which the influencers were unaware of its impact. This upward perception was very critical. The development of key performance indicators (KPIs) for different levels of usage was a unique suggestion by an influencer. The outcome of this preliminary analysis was that the TAM model was not sufficient for the GIS situation in FERMA. The respondents perceived the GIS to be useful on the job, easy to use, and they were optimistic towards regular use despite observed constraints of Internet speed and status quo. However, one has come to realise that the GIS problem is more intricate than earlier conceived. It is not a stand-alone product. Rather, the manager's plan for adoption and the user's will and ability must synchronise. The GIS formed part of a broader system where everything was connected. This new thinking of the problem is a key learning for the organisation. This conceptual leap resulted in the development of the GIS ecosystem adoption model (Figure 12), which has set the direction for AR cycle 2.

The model provides a better tool for addressing the GIS phenomenon. The attributes required for GIS adoption from a leader are commitment, knowledge of the technology, effective communication of the overall strategic vision or goal and above all, to maintain a firm but approachable manner. To achieve adoption the managerial interventions proposed were: 1) development of a GIS adoption plan, 2) development of key performance indicators for users, 3) conducting hands-on training, and 4) enforcing mandatory usage of the GIS with penalties for non-compliance. This is what would be presented to the Action Learning Set (ALS) for deliberation and collaborative consideration of needed managerial intervention(s) to be applied in AR cycle 2. It will be discussed extensively in the next chapter, which is the action chapter.

5 ACTION RESEARCH CYCLE TWO

5.1 Introduction

This chapter describes action research (AR) cycle 2 (Figure 13). The focus is on the application of the research findings from AR cycle 1. AR cycle 2 comprises of four phases: (i) the construction phase, which represents the first stage of AR cycle 2. It presents a brief synopsis of AR cycle 1, which also had four stages construct, plan, act and evaluate (see Figure 6). The findings of AR cycle 1, were presented to the Action Learning Set (ALS), a group made up of managers who had the potential to influence users of the GIS within the organisation. The presentation provided an avenue for collaboration and identification of appropriate managerial interventions that could potentially improve the GIS problem as well as assess the validity of the findings. (ii) the planning phase. Here, the focus was on steps to be taken to apply the managerial interventions and collaboration with the ALS was most important. A strategy of application was agreed bearing in mind the organisational context. (iii) the action phase describes the implementation of the plan and the data generated through interviews, meetings and observations, and (iv) the evaluation phase, which discusses the outcomes of the action and examines if the desired goals were achieved or not.

It must be pointed out that the data collection in this cycle spanned six months. However, the actual events tailored the pace within the organisation.

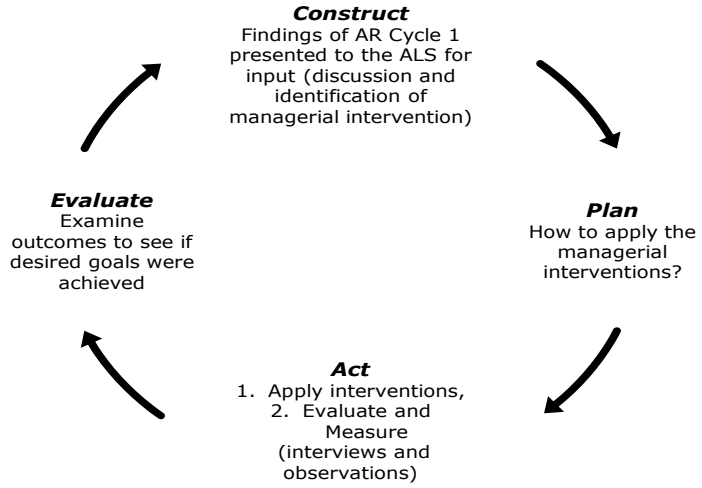

Figure 13: Action Research Cycle 2

5.2 Construction Phase

The construction phase of AR cycle 2, is made up of all the phases carried out in AR cycle 1. In this phase, a preliminary assessment of the GIS phenomenon led to the development of a conceptual framework using the technology acceptance model (TAM) as the foundation of the research (Figure 4). The adapted model included other factors such as leadership and management practices because they had a considerable impact on the acceptance or adoption of the GIS technology within the organisation. From the analysis of qualitative data gathered, the model was deficient in tackling the GIS problem. A major finding suggested that the GIS was more than a product and should be viewed as part of a more extensive system where actions are interdependent, and everything is interconnected. A respondent referred to the GIS as an ecosystem (section 4.5.1). Following this insight, I made inferences and formalised a new way of looking at the GIS problem in a simple ecosystem model (Figure12). This model had several proposed interventions for GIS adoption in FERMA such as the development of an IT adoption strategy, development of key performance indicators for users, conducting hands-on training for all those involved and enforcing mandatory usage of the GIS with penalties imposed on defaulters. The ALS gave their opinion and suggestions on the proposed managerial interventions during a collaborative session with the researcher (Appendix E).

The concept of action research involves extensive collaboration amongst the participants and the researcher in data collection, data discussion and planning throughout the change event or process. The ALS was a six-member group brought together to collaborate on research findings and to discuss the GIS issues identified from AR cycle 1. They were key influencers in AR cycle 1, based on their organisational roles. The selection of these individuals was because of their insider knowledge, commitment and ability to influence the actions and perceptions of GIS users in FERMA. At the same time, I acted as the group facilitator to guide discussions. The second chapter explained in detail the rationale for the selection of all the participants. The ALS undertook an active role in collaboratively improving the GIS issue. Briner, Denyer and Rousseau (2009) suggested that when utilising evidence from a study to inform a particular inference in a specific scenario, critical appraisal and judgment of evidence are of utmost importance. It is worthy to note that collaboration with the ALS was vital because of their level of responsibility within the organisation and knowledge of the GIS problem.

Presentations in the form of PowerPoint slides were made to the ALS to remind them of the series of activities that took place in AR cycle 1, and the interpretations arrived at from the data collected. The initial meetings were weekly as I attempted to provide a diagrammatic representation of the GIS ecosystem model that reflects the actual situation at a glance. Figure 12 was the third trial. The ALS appraised the overall construction of the GIS ecosystem model to be suitable for the context. They acknowledged it as new insight on how to tackle the GIS phenomenon with the consideration of interdependencies and how everything is interconnected. For example, when it became apparent that the impact of the message was dependent on the messenger, each influencer had a takeaway learning that aided better response from GIS users.

Subsequently, the ALS met monthly to review learning points and identify further actions that could be taken based on insights gained. The GIS situation was well known to the ALS. However, as a group, the information base of GIS in FERMA was broadened through discussion. The final model, with its three layers of leadership, strategy and the users, was not challenged. It was considered logical based on the data gathered. From literature, leadership characteristics specifically in terms of technology acceptance had leadership style, communication and commitment as recurring elements (Brown *et al.*, 2007; Coeurderoy, Guilmot and Vas, 2014; Nag *et al.,* 2015; Ouadahi, 2008; Rezvani *et al.*, 2017). The ALS raised questions from the data gathered and agreed that the responses were in the affirmative. It indicated that any improvement sought could only be achieved by acting through improved or new strategies. The ALS then agreed that the ecosystem model would be applied as there were bound to be gains achieved from whatever learning came from it. They emphasised the 'strategy layer' [management practices].

Nevertheless, a member insisted that with the proposed tools identified under 'strategy', more focus should be on the way we work because there must be an understanding of the processes. For example, there was a need to clearly define the source of data input and expected output for each activity. Identifying the right manner of the intervention was critical to a successful outcome because where properly monitored all actions would invariably connect to the users improved usage of the GIS.

Members of the ALS agreed and suggested that the priority would be the application of the following three managerial interventions: developing a GIS adoption strategy, conducting hands-

on training, and enforcing mandatory usage within the organisation. This was arrived at following the conclusion that full GIS adoption within the organisation would be a gradual process that would require some time before full compliance could be achieved. The voices below validate the above interpretation.

We should not just expect immediate compliance and result because like every innovation, people need to be conversant with it and use it over and over again to get acquainted with it (I1)
Practice makes perfect; mandatory usage should engender familiarity towards the use of the GIS (I2)
Individuals cannot readily embrace change. When change happens all of a sudden, it can be overwhelming so it has to be gradual so that they can grow accustomed to it (I4)

The ALS decided that developing staff KPIs and imposing penalties for non-use would be considered later because of the concern of scaring off potential adopters.

We should be able to talk to them on the need to use the GIS and the importance, and if there is no change, then the issue of punishment may now come in, ab initio [from the beginning], it is not good to start punishing people for what they do not even know (I3)

5.3 Planning Action

The planning action section describes all activities that occurred during the planning action phase of AR cycle 2. The ALS reinforced skills such as problem identification, decision-making and cooperation as the outcome of deliberations among members within a collaborative climate. I applied the managerial interventions following the laid down steps in table 7. The three identified interventions chosen are discussed individually in the sections below.

5.3.1 IT Strategy

An IT strategy in this context was a plan of action designed to achieve full GIS adoption within FERMA taking into consideration challenges and proposing mitigation strategies to identified challenges. It was needed to set specific objectives for the managers. The plan suggested that the strategy formulation should highlight priorities, appropriate courses of action and specific action points needed to realise the desired success of GIS adoption. In this case, the strategy would become an essential tool for control. It was important because developing an IT strategy was identified as a managerial intervention capable of improving GIS adoption. Most respondents reported the absence/lack of awareness of an IT/GIS plan within the organisation stressing the need for one. In the voices of the users:

"I don't know of any particular strategy or plan the management is using for now." (U8)
"So far the Agency may have a laid down plan and strategy, but if it exists, I will say that the strategy has not been fully communicated to the staff because it is not enough for the Agency or management to have a strategy, it is enough that people are aware of the strategy and be able to apply it in order to make it successful"(U4)

Some guidelines on how to develop an effective strategy were also put forward by a manager and member of the ALS.

so developing a strategy, first, we need to just start with what is in existence. (I6)
What is the strategy, how do we get that information, how do we use that information, how do we validate that information to know that they were not conjured, they are actually the information that we need. (I6)

Members of the ALS agreed that lack of focus on the processes of the GIS contributed to its unfortunate situation. They recommended that management, supervisors and users must share a clear understanding of the goal. The developed strategy for GIS adoption had five major components which are: (i) setting right expectations for everyone, (ii) hands-on training, (iii)

setting timelines, (iv) routine monitoring, and (v) routine evaluation. The action phase of this AR cycle 2 formed the developed strategy presented in table 7 below.

Table 7: Strategy for GIS Adoption

S/No	Strategy	Description
1.	Set Clear Expectation	The first step in the developed strategy was to set the right expectations for both managers and users with regards to the GIS software. • This involved setting roles and responsibilities of all participating departments: Operations, RMMS, Field Offices etc • Developing clear instructions for all managers and users on their roles in ensuring full adoption • Developing clear communication pathways between managers and users • Setting up feedback mechanism systems • Ensuring top management support
2.	Training	This step involved building and improving on the capacity of staff on the GIS software. Specific actions included: • Providing more training opportunities with focus on hands-on/continuous training • Improving the awareness levels by conducting awareness campaigns on the importance and benefits of the software • Increased involvement of all staff that have a GIS component of their work
3.	Set Timelines	This step involves creating timelines and tasks at all levels. Timelines were set for: • Procurement of all hardware required for full GIS adoption • Training of all staff • Ensuring full compliance of all trained staff • Monitoring and evaluation by management
4.	Monitor	This is more of a management task. It involves: • Constant and periodic monitoring of all users and set up systems to ensure compliance • Identification of challenges and addressing them promptly • Keeping weekly status of the implementation progress
5.	Evaluate	• Evaluate outcomes to check progress and provide immediate feedback • Identify critical success factors • Celebrate successes/develop success stories

The most important part of developing a strategy is implementing it. This means in addition to developing a strategy, action points for each step should be indicated and progress should be measured.

> *"Strategy needs to be developed, and it is a different thing from development when you have to implement that strategy, so developing and implementing strategy are two different things. There are many ways to develop strategy, but it will not become strategy except you have the input which is called the feedback from the user." (I6)*

5.3.2 Training

From the data gathered, the training specified was hands-on. In the context of this research, hands-on training involves active participation rather than theory alone. It provides an opportunity for the learner to get practical experience. Therefore, it dives straight to the practical aspect of the use of GIS technology. Another characteristic of hands-on training is the fact that it is a continuous process until trainees become very conversant with using the technology. Hands-on training is learning by doing, according to Boshyk and Dilworth (2010). People become proficient at an activity through regular practice and can willingly transfer the knowledge having done it by themselves (Coghlan and Brannick, 2014). The hands-on training was the planned intervention for GIS adoption. It is a situation where users are guided at their workstations, and challenges are attended to on the spot.

5.3.3 Mandatory Usage

The third intervention selected for implementation was mandatory usage. Mandatory usage was pertinent because commitment to adopting the GIS software within the organisation was found to be tied to enforcement for all concerned.

> *"This management has made it mandatory for all staff under them, all technical staff and those that have to use the GIS are using it and management is providing any additional hardware that they need to make sure they are using the software, and that is a huge plus to the management of the Agency" (U6)*

Hartwick and Barki (1994) identified that in compulsory scenarios, attitude towards use of the information system was primarily influenced by the attitude directed at the system itself. Brown *et al.* (2002), on the other hand, identified a disparity between intention to use and attitude in a mandated environment. The belief was that compulsory adoption by users might be more associated to rewards and punishment as opposed to confidence about the effectiveness of the technology. However, these conditions do not apply to the FERMA case as all users acknowledge the usefulness of the technology, which presupposes that mandatory usage should trigger full adoption. User acceptance epitomises a critical component that determines whether an information system succeeds or fails, particularly in mandatory environments (Hwang, Al-Arabiat and Shin, 2016). Enforcing mandatory usage was an important strategy that made those meant to use the GIS software to actually use it.

5.4 Taking Action

Taking action was the action phase of AR cycle 2, represented as 'Strategy' on the GIS adoption model Figure 12. In line with results obtained, an adoption strategy was developed (Table 7). The goal was to validate the GIS model (Figure 12) as a useful tool for its adoption. It is worthy to note that in terms of leadership characteristics highlighted in the conceptual model (Figure 4), the organisation was seen to be doing right as deduced from data gathered. The findings were presented to the ALS (Appendix E) to test plausibility. It was agreed that focus had to be on 'Strategy' [management practices] to do better. Thus, action was taken with the application of the three identified interventions. The action was located with the middle managers on the field and the progress officers at the headquarters. In taking action, the steps in the developed strategy in Table 7 were followed. These include:

5.4.1 Providing a Holistic View/Setting Clear Expectations

At the first managerial meeting accommodated within AR cycle 2, a demonstration and practical session on how the FERMA GIS platform functions, was delivered to the progress officers. It was carried out to provide a holistic view of the GIS as a decision-making tool. The demonstration helped explain not just the functions of the GIS system but what it was meant to

solve or deliver. Besides, individuals were able to see the gains of the GIS concerning their performance on the job. A clear communication pathway was established to carry everyone along and leave no one in doubt. The progress officers were to pass information through their heads of department for onward transmission to the field supervisors (FRMEs) and vice-versa.

5.4.2 Be Action-oriented (Hands-on Training)

Instructions for mandatory use of the GIS commenced on January 28, 2019. Mandatory use was followed simultaneously with hands-on training accompanied by close monitoring and guidance. The need to educate and train users on the importance of accurate data and correct data input was identified as a critical requirement for the GIS system to function correctly. During the training sessions, the users were more open to making suggestions that were related to their job description, seeking clarification while encouraging and supporting each other. Some of the quotes captured from observation notes are below:

"Now I understand it and having used it myself, I have a sense of ownership." (U2)
"It is now that I appreciate the use of latitude and longitude readings to locate actual assets as was described theoretically." (U3)
"Now the trainer is always with us, and when we have issues, he is ready and willing which was not the experience we had in time passed, the trainer is willing to help anytime we need assistance, he is always ready to help which is good, and the training has to be consistent." (U8)
"More tasks need to be assigned so that I can learn faster, making mistakes and noting the corrections accordingly." (U3)

It was observed that compliance with the mandatory use directive was not absolute. The observed resistance to change was meaningful, and a justified reaction to the situation because accepting change is a gradual process. The salient use of power by such instruction was in the best interest of attaining FERMA's desired goal of GIS adoption. During this intervention stage, much effort was targeted in this direction.

5.4.3 Build Out Timelines and Tasks

The following instructions and timelines were set in this stage:

- Field officers were mandated to collect coordinates with the Garmin 650 GPS devices provided which ensured a more accurate reading than mobile phones. Also, a request was placed for the procurement of more GPS devices, tablets and scanners.
- Management was implored to monitor the adoption process. There was a need to set targets in a bid to improve the speed of adoption.
- Weekly managerial meetings were convened with the users (progress officers) in the various offices to monitor the adoption progress and note the challenges faced. The officers brought their perspectives to bear, which facilitated further understanding of the GIS situation.

The main focus was on how the new GIS adoption strategy, hands-on training and mandatory use fit together.

5.4.4 Monitor and Track Progress

Additional data gathering and analysis were carried out in this monitor and track the progress stage of the developed strategy for GIS adoption. It was to assist the researcher better understand the GIS phenomenon concerning the applied interventions. I engaged in the observation of progress officers' routines while conducting their daily activities on the GIS platform. The type was semi-overt user observation where my dual role as a member of the organisation and a researcher was known (Whyte, 1984).

Detailed notes were taken during the observations, which on review provided an awareness of the GIS problem. The focus of data collection was on events after GIS use was made mandatory. Data from observing the users informed my interpretation that the introduction of mandatory use of the GIS was the catalyst required to provide a sense of ownership of the process. There was a fundamental change in their perceptions of GIS use.

Observation of these interventions spanned six months. There was weekly monitoring through managerial meetings. In addition, meetings with the ALS were held monthly to discuss progress made through the applied interventions. Users of the GIS were observed across five major

processes within FERMA. These are the procurement process, the contract validation process, fieldwork progress updates, project completion and project sign-off and payment.

Key steps in the observation process and stages involved are presented below:

1. **Procurement Process**

   Summary: This is the first step to be completed once a contract has been awarded. The process involves uploading all contract documents on the GIS portal by procurement progress officers. These documents include contract number, letter of award, CAC registration documents, company profile and other required licenses and permits. The procurement department is largely responsible for this process.

   Key Observations

   The following were observed during the process:

   - Procurement progress officers gained adequate knowledge in the use of the platform.
   - Some challenges were faced in uploading the contract documents on the portal. These include slow Internet speed and erratic power supply exacerbated by the absence of a functional standby generating set.
   - Despite these challenges, all projects were successfully uploaded onto the platform.

2. **Validation by the Operations Department**

   Summary: This is the next stage following the completion of the procurement process. Here, the operations progress officers look at what was awarded and approved in the contract in terms of project specification, scope and duration. They then upload the Bill of Engineering Measurement and Evaluation (BEME). Once done, the operations progress officer uploads the information on the GIS platform.

Key Observations

- Operations progress officers had adequate knowledge and were quite enthusiastic about using the GIS platform for their work. They preferred it to the previous analogue/hardcopy system.
- Operations progress officers responded better to instructions from the directors in the operations department than they did from the IT Director [me]. On reflection, the implication was that the immediate supervisor had a better grip on monitoring set targets and deadlines as queries could be issued for any delays or errors.
- Typical problems associated with erratic power supply and reduced Internet speed persisted, and progress officers had trouble in uploading relevant documents.
- Also, the hardware (computers) used by operations officers had single-core processors; therefore, low efficiency in hosting the GIS leading to a significantly reduced buffering speed.
- Though operations progress officers had the knowledge, use had not been ingrained in them to a point where it became a habit or a culture.

Despite these challenges, operations progress officers were able to validate and administer the project from the GIS platform successfully.

3. Fieldwork and progress updates

Process summary: The first task undertaken when handing over the site to the contractor is to collect the GPS coordinates of the approved site. This includes GPS coordinates of the beginning and end of the road and coordinates of all accompanying road furniture such as bridge and culvert locations. These are collected by the field supervisors (FRMEs) and sent to the headquarters through the zonal directors each signing off his section on the GIS platform. The operations progress officer then enters the coordinates on the GIS map along with all other project information. Once the cursor is placed on that location, all project information pops up.

In addition, the FRMEs upload periodic updates on the progress of contracts within their purview on the GIS platform, typically before and after pictures of the worked-on location.

Once the job is completed, the zonal director then gives a final approval after physically inspecting the site to ensure that the completed job met all specifications as agreed in the contract.

Key Observations

- The FRMEs showed enthusiasm and a keen interest in using GIS software.
- A state headed by an FRME, where there were four on-going projects situated poles apart, and each supervisor had to upload the coordinates of the roads in question. There were only two GPS devices provided for the FRME. This lack of equipment was hampering the performance of one of the supervisors who decided to use his cell phone to take coordinates. Unfortunately, the readings, when uploaded on the GIS platform, were way off the mark. Validation was impossible as readings were erroneous. It was discovered that that error was introduced from signals bouncing off several telecommunication masts.
- Internet speed in uploading the pictures and erratic power supply was a typical challenge encountered in uploading progress updates onto the GIS platform.

4. Project Completion

Process Summary: after the zonal director inspects and approves, the operations progress officers in the headquarters login to the GIS platform and enter all the relevant data from the final version of the job after they have completed their validation.

Key Observations

- Once again, poor Internet affected the uploading process.
- In order to meet up with the closeout of the 2018 National budget cycle, which was terribly delayed, contractors were requested to submit their interim certificates and final project documents within a 3-week period so they could be paid their fees accordingly. This led to a rush period where almost all contractors were submitting payment documents.

- There were only four operations progress officers with access to the GIS platform that were handling all these files and attending to about 200 contracts within a 3-week period. Though they had the capacity, they could not meet up with uploads, needed inspection and approval across the country within the stipulated time.
- Therefore, not all completed projects were successfully uploaded before the deadline, despite the fact that the officer's put in their best by working extra hours.

5. **Final Approval and Payment:**

Process Summary: This represents the final stage in the life cycle of a project within the organisation. The MD logs onto the GIS platform with his user ID and password. He then inspects all that had been uploaded by the operations department and signs off on all jobs ready for payment. Once the MD signs off, the accounts department are automatically authorised to make payment to the contractors.

Key Observations

- The MD/CEO was proficient in the use of the GIS software. However, as the sole authority for final approval, this became a major bottleneck in the contract administration process.
- Due to the short time frame for final approvals and payment, the MD had to give an order that payment be made outside of the GIS platform.
- The organisation resorted to manual review and approvals of completed projects to meet up with the deadline.
- A new link had to be created on the portal for express capture of all relevant contract information omitted when payments were made outside the GIS platform. This resulted in progress officers in the IT department, uploading data directly onto the GIS platform without passing through the various stages where it would have been validated accordingly.
- The initial momentum that was gained where people left the use of hard copy files and began to use the GIS system suffered a setback.

5.5 Evaluate and Reflect on Outcomes

From the observations and interactions, the interdependence of actions where everything is connected was evident. The GIS ecosystem model influenced how I charted the course of this study. There was a major change in mental models, which was a great insight. The managers needed to be clear about the GIS purpose and processes. This had to be effectively relayed to the users, emphasising the responsibility that each person brought to the GIS technology. The five key outcomes were:

5.5.1 The Criticality of Leadership

This study shows that leadership in technology-enabled change is of high importance. The operations progress officers responded better to instructions from the operations director than the RMMS director who they typically received instructions from while implementing the GIS intervention within the organisation. This brought to the fore the importance of leadership in championing a process. Operations progress officers viewed the intervention as external when it was coming from the RMMS director and acted promptly when the instruction to use the GIS came from a director within their department. 'Nearby' leadership has a positive effect on a follower's motivation, trust and task-related behaviours (Alimo-Metcalfe and Alban-Metcalfe, 2005, 2008, 2013; Farahnak *et al.,* 2019). It was also seen that where the supervisor was actively involved with the GIS, it was easier for the progress officers to emulate and identify with the leader. The hands-on training was a clear example.

Another major challenge identified was ownership of the platform by the actual user department. The RMMS department owns the software or technology but, the process of usage is domiciled in the operations department so rather than I, the director of the RMMS department, be the sole figure giving out instructions, the directors in East and West Operations should have been actively involved. It was then agreed that all day-to-day instructions on the GIS should be handed over to the leadership of the operations department because they know at a glance and have all the information on their fingertips. They could immediately tell the number of contracts awarded, the number that is on-going and those that are near completion or completed. They also know how to put pressure and increase the department's speed of work, as they know what is

coming ahead. They are also in the best position to foresee any potential challenges with GIS use and any needed adjustments for the next budget year.

Positive outcomes were recorded from the hands-on training conducted for users of GIS. This was part of the IT strategy agreed on during the planning stage of AR cycle 2, where it was stated that users should be trained more extensively. Some users had the following to say about the hands-on training they received during the second round of interviews.

"*I would say that the training has been beneficial to me as a progress officer from West Operations of the Agency, the training has really helped. I have gotten so conversant with the application such that if I go back to the office. Often times I try to do those things the consultant taught us during the training, so the training has been very impactful, and it has exposed us to some of the challenges and some of the advantages and every other information we need about the software, the training helped us to get conversant with them*" (U3)
"*I must say that if the training, targets/goals and assigned task were not put in place, we would not have been where we are today and this training has broadened our understanding concerning the system, keeping everyone in touch on how projects are managed and our weekly meetings where targets are set before the meetings and at the end, we come together to see how far we have gone, it is actually an additional proof and I wish that we will continue in this training and re-training of staff so that we can have more understanding. The training with well-set targets is a welcome development*" (U4)

One must know where he or she is going so as to understand what it takes to get there. The effective management of people and processes during technology-enabled change facilitates success of an innovation (Basu, 2015). Engagement of all involved depends on their comprehension of common goals and acceptance of the technology.

5.5.2 Problems Associated with Poor Infrastructure

Undoubtedly, poor Internet speed was the most recurring challenge identified across all the stages of GIS use. For the GIS platform to function correctly, this challenge must be surmounted

by the organisation otherwise progress officers would continually face difficulties in using the platform. In addition, poor power supply also hinders efficient operations of the GIS, as most of the hardware needs the power to be functional. In Nigeria, power outage is a common phenomenon (Ahmad, Abdullah and Arshad, 2015), and poor information communication technology infrastructure is an inherent characteristic (Omekwu, 2003; Osibanjo and Damagun, 2011). All this is a major setback to IT adoption in Nigeria. Thus, effort must be made towards improvement or alternate means provided because Internet connectivity at the desired speed is crucial. Only training users on how to use the GIS does not achieve user adoption, one must also provide all they need to work effectively. The frustration is clear from the voices below:

"*I would want the GIS to be taken as the official method of presentation and data capturing in the Agency in the long run, but truly there are challenges from the network, sometimes I have to use my WiFi, hot spot to connect to my system and I see that the data consumption rate is high, but the official network of the Agency can be so slow and frustrating, you could have this burning desire to go to the application to do what you want to do, but you see that you have been slow by this particular challenge"* (U3)
"The only thing now is the Internet is also another challenge, and there is a need for the Internet to be upgraded in terms of speed because it is slow. The bandwidth of the Internet can be increased to solve the challenge of the slow speed of the Internet" (U7)

Learning the impact of slow Internet speed and how it cascades down to other processes has been very insightful in understanding the GIS dynamics and challenges of adoption. As a senior manager, the greatest lessons learned were that there had to be a mindset change where departments worked together. Rather than work in silos, users need to see GIS technology as one affecting the organisation as a whole. On reflection of earlier interview responses, it is now apparent that we take note of our environment listening to everything. As managers, we are more aware of each other and our activities.

5.5.3 Improved User Attitude

Generally, attitude and perceptions towards GIS use have greatly increased, and all users of the GIS have accepted that going forward, the GIS is the only way. A few excerpts below affirm this. Users also appreciated the enforcement of mandatory usage of the GIS within the organisation. It goes to show that the managerial interventions have had a positive impact on the GIS adoption.

"It has helped a lot because it made us to be up and doing because without the set target, we would just relax and see it as a normal thing and at the end of the day, the software would fade away, but due to the task assigned, we will make sure that we can do better. So, with the set target, we were able to achieve greatly." (U5)
"*The coming of GIS in FERMA is like a new dawn, and it is something that must be embraced, it is taking us from one stage to another, I see it as a giant stride. GIS is helping us that wherever we are irrespective of our position, we can access our projects and monitor them. As a progress officer, I must say that I am equally learning a lot, and my knowledge about GIS has highly improved. We must all embrace it, and we should all take it up as a task that must be accomplished.*" (U4)

5.5.4 Inadequate Relevant Hardware

In addition to poor Internet and erratic power supply, the research found associated hardware, GPS devices and computers to be insufficient. The insufficiency led to FRMEs, and progress officers taking coordinates with their phones, which on uploading to the GIS platform software was found to be wrong. The provision of more GPS devices is non-negotiable as wrong readings can affect the entire system as much as any other challenge. Thus, I proposed investment in new, highly efficient computers for the organisation.

5.5.5 Insufficiency of Skilled Personnel

Significant strides have been achieved in GIS adoption and use. Most users have adequate knowledge of the GIS system and are willing to apply themselves in its use. However, there are only very few users handling this process in the organisation. This problem became evident

when there were only four progress officers in the headquarters, uploading data of completed projects on the GIS platform. As discussed earlier, some bottlenecks hindered meeting the set deadline of two weeks. So the platform was boycotted, and the administrator had to create a direct link for uploads without the necessary validations and approvals. Also, on occasions, these progress officers were overwhelmed and began to complain as one user rightfully noted.

> *When we ask the progress officers to give us feedback, they usually take longer than they should. A lot of them are complaining about manpower, that they have their task to carry out, and this is added to them. They do not have enough time, meaning that they do not understand that it is also going to help them with their jobs. There is the need to ensure that they take ownership of its usage and the IT department supervises the back end.* (U7)

There was also the case of the bottlenecks at the level of the MD/ CEO on GIS. He reinstated the manual approval and validation process, leading to a reversal of achieved gains on GIS use within the organisation. It called for an alternate strategy, as this was the most crucial link in final GIS use. Subsequently, privileges were granted the executive director (west operations) to sign off, acknowledging final approval for payment whenever the need arose. There is more to GIS adoption than the product itself. Special attention needed to be paid to several activities to support the new technology. Managers had to work closely with users.

In consideration of the interventions, on completion of AR cycle 2, active user training has affected adoption positively because the technology became familiar. From the information gathered, the designated improvements have begun. Procedures have been put in place to attend to the outcomes. For example, the procurement of more GPS devices and further adjustments on communication between the field officers and the headquarters has commenced. This evaluation phase also lends itself to beginning another AR cycle as a continuous monitoring and management process. At the moment, the gains achieved are being reinforced. However, as a practice-based research, AR cycle 3 (Figure 14) could not be conducted as part of this study because of the time allotted for the DBA program.

Nonetheless, the cycle would comprise of the application of the earlier stepped down managerial interventions (section 5) namely: 1) development of KPIs, and 2) introduction of penalties for

non-compliance. The knowledge gained is real as we strive for sustained change in the organisation. The goal is to institutionalise GIS use as a culture.

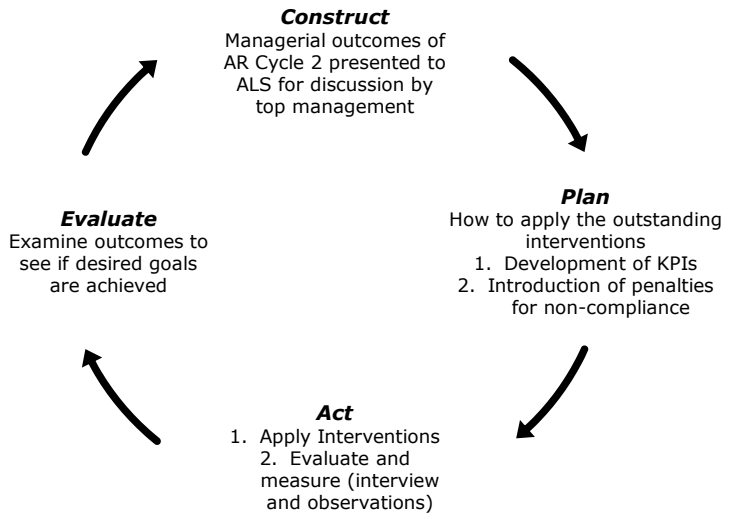

Figure 14: Action Research Cycle 3

5.6 Summary

This chapter has been a structured process of inquiry in a bid to improve the GIS situation. It shows a step-by-step approach of the four phases of AR cycle 2 in a somewhat linear fashion. Nevertheless, since the investigation was undertaken in a dynamic organisation, there were bound to be uncertainties and overlap. However, the ability to consciously accommodate emerging data due to the flexible nature of action research was a great advantage. Implementing a change initiative requires planning and monitoring with appropriate milestones.

In AR cycle 2, the focus was on the application of the three managerial interventions of developing a GIS adoption strategy, conducting hands-on training and enforcing mandatory usage of the GIS after deliberation with the ALS. The decision was based on the developed GIS ecosystem model Figure 12, which was appraised to be suitable for the FERMA GIS context. The ALS acknowledged that the ecosystem approach with consideration of interdependencies of

departments and actions was a new insight on how to tackle the lack of GIS adoption. The action was located with the middle managers on the field and the progress officers at the headquarters. The steps in the developed adoption strategy of Table 7 were followed. Observation of these interventions spanned six months. The users of the GIS were observed across five essential processes of the organisation. The procurement of road contracts process was one of them. From observations carried out and interactions, the interdependence of actions where everything is connected was evident. The focus of the data collection during this cycle was on events after GIS use was made mandatory. There was a fundamental change in the perceptions of the users towards the GIS technology. For example, the silos mentality was changed to that which favoured working in teams with the overall picture in focus. The key outcomes of AR cycle 2 were:

- The criticality of leadership in technological change, where users are more receptive to their immediate supervisors.
- The challenge of poor information technology infrastructure was a recurring factor, which indicated that training users alone could not deliver adoption.
- The needed tools such as efficient computers, GPS devices and other relevant hardware had to be provided.
- This action would engender improved user attitude towards the GIS platform and guide towards the recruitment of more skilled personnel capable of efficiently managing the GIS portal.

The next chapter (Chapter 6) highlights the lessons learned through the research and its implication. Further, the impact of the study on the researcher, as an individual, on the organisation and possible translation of the GIS adoption model in practice would be discussed.

6. DISCUSSIONS OF RESULTS AND CONCLUSION

6.1 Introduction

This research was conducted with the practical objective of improving the status of GIS adoption and use. The argument was that focusing on understanding the perceptions of actors to new technology could uncover factors impeding adoption. The aim was to make sense of the GIS phenomenon with attention to the various voices of the actors within the practice. It is in line with Fadahunsi's (2010) suggestion on the implementation of GIS facilities where he argued that perceptions vary, and a higher skill is required for interpretation and understanding. With special attention to the human perspective of the new GIS technology in FERMA, this study has triggered an improvement in its use. In order to discuss this, the chapter is structured in the form of the first, second and third person learning as it underpins the notion of the scholar-practitioner.

The inquiry facilitates both knowledge generation and change. It begins with the first person inquiry, which shows how the author, as the researcher and manager, was impacted. It shows the effort made to understand one's role as a scholar-practitioner and how the knowledge gained was applied within the organisation. As the leader tasked with implementing the GIS, I was directly involved with the change process. I choose to begin this discussion with the first person inquiry (self) because I had to inquire inwards into the understanding of what I was learning as a scholar and about the happenings around me with focus on the GIS phenomenon. As the key actor, I learned to be both active and receptive. Only then could I effectively drive the change towards GIS adoption. The chapter then moves on to the learning of the organisation. In this second person inquiry, the framed research questions are answered based on the findings from AR cycle 1 and 2. A detailed dialogue within the organisation occurred during the iterative cycles of construct, plan, act and evaluate. The adapted TAM model (Figure 4), which focused on how users come to accept and use technology, provided the initial understanding of the GIS situation in FERMA. This research sought to answer the question, 'Why is there a lack of adoption of the Geographic Information System in FERMA?' The secondary research questions were:

1. In what ways do leadership factors affect information system adoption?
2. How does perception facilitate the factors of adoption?
3. In what ways do management practices affect information system adoption?

4. In what way does the level of knowledge and acceptability of the information system affect its adoption?
5. What are the forms of resistance to the use of the information system?

The GIS ecosystem adoption model (Figure 12) emerged after AR cycle 1, and it guided the application of the identified managerial interventions and the consequent outcomes.

Subsequently, the third person inquiry is discussed. It is the application of our learning for other organisations. It considers how the research findings fit with insights drawn from the literature, how the GIS adoption model was translated into practice within FERMA context and the major outcomes of the applied managerial interventions. It also draws particular attention to the actionable knowledge gained (Figure 15). It highlights new insights for other managers on the broader practice community to assess the transfer of the knowledge with proper consideration of the context.

6.2 First-Person Inquiry

First-person inquiry furnishes the foundation for examining one's engagement with action research. It addresses my reflections and inward inquiry in action. It also examines everyday behaviour and the impact of actions taken. Authenticity as first-person practice involves being attentive to the data, intelligent in inquiry, reasonable in making judgements and responsible in acting (Coghlan and Brannick, 2014).

Personally, I have experienced frustration, anger, and fear. I had to contend with poor writing techniques, the lack of self-confidence, feeling isolated, and poor time management. Nevertheless, the format of the DBA program was appropriate in my training to be a doctoral researcher. My conference paper for my residency was my first attempt at being a qualitative researcher. I was not skilled in reporting the study, as I did not adequately reflect the voices of the participants to provide context and validation for the reader. This resulted in a fail score with a chance for resubmission. It was the lowest point of this DBA journey. I was distraught, discouraged and highly disappointed because I was aware of my effort and knew that I gave my best. I was uncertain as to what was left to offer. My colleagues in the program gave me the

necessary support and the much needed strength to persevere. It was a critical learning point for me as I realised that it was not enough just to work hard. There would be times that things just had to be done differently. This skill was brought to bear during the exploration as I studied the data gathered for interpretations and inferences in an attempt to find connections or relationships amongst the collected data. It took me twelve months of poring over the initial data transcribed to arrive at interpretations that were considered adequate for the GIS phenomenon. The bright side is that I am now more discerning, analytical and relentless in my pursuit. I was able to reconceptualise the GIS problem and approach it in a completely different manner. It was a pivot learning opportunity for me as well as the organisation.

Before I took up this research, my managerial style was to focus on tackling those issues that affect my department directly. This research has described it as working in silos, a trait that was common within the organisation. Today, I collaborate efficiently and take the initiative with my colleagues and subordinates across departments on any related issue. I now see the organisation as a whole rather than discrete problems, as was depicted in the developed ecosystem model (Figure 12). In the case of the GIS adoption by users, emerging challenges were broken down into smaller units, brainstormed with the action learning set (ALS) for viable options with consideration of the holistic impact and decisions taken based on rational judgements. To shed better light to the ALS on how to bridge academia and practice, I had earlier provided sessions directed towards the action research concept and the expectations of an ALS. Regular progress updates formed part of the agenda at monthly management meetings to keep the managers informed on GIS adoption. This in itself was an added innovation to improving the GIS issue in the organisation as it put everyone on the same page and made it easier for me to track the developed and accepted GIS adoption plan. Today in FERMA, the consideration of problems as impacting the organisation as a whole rather than specific to discrete units is a new way of thinking that is permeating the organisation.

Within my organisation and being part of the system, I have gained knowledge that has helped me to apply critical thinking about complex problems. Also, it has enabled me to have deep introspection about my attitude and prejudices along with the consequences of actions taken. Scenarios are now viewed through different vantage points bearing in mind that every individual has his or her own understanding and interpretation. I am now more accommodating and willing

to accept varied opinions. This approach has yielded good results in my workplace as I now standout in the midst of my peers with improved leadership skills, which resulted in my promotion as a director heading the RMMS department. The skill of taking the initiative was further developed through the planning, reflection, taking action and inquiry sequence of action research (AR). The initiative of weekly meetings with the users for feedback and to discuss progress made is a typical example. Its validation was in the application of findings in a penultimate week that resulted in improved GIS use. For example, in the case where individuals were unable to meet set targets on data upload from particular sites, assistance was provided to bridge the gap. Two of my peers acknowledged the cohesion and sense of ownership exhibited by the users. It was agreed that my listening ear and belief that everyone has something to offer made the difference. I informed them of leaderful practice knowledge gained as a DBA scholar. I learned that it is good to challenge one's subordinates with responsibility as it brings out the best in them (Raelin, 2000).

Insider research brings the problem solving of puzzles in the workplace to a formal level that entails systematic data gathering and analysis. As an insider researcher, this study was not bound by semesters or arbitrary timelines. Rather, there was the advantage of the project progressing seamlessly in tandem with organisational dynamics. The adoption of GIS was the main focus, and I worked with a sense of determination to improve its status. I was proactive in communicating my expectations and all actions carried out were based upon the understanding arrived at through the analysis of data gathered. I focused on the routines, methods and tools that could be institutionalised in FERMA to encourage and sustain learning. Routine steps were defined in the GIS work processes as developed in chapter five.

I had the advantage of knowing my participants' roles in the office and the work tools available. Coghlan and Brannick (2014) call it preunderstanding. However, the preunderstanding made it challenging to separate my knowledge of the GIS from theirs. The ability to be close to my data sources enabled in-depth observations. It could also be viewed in a negative light with claims that I might not be objective in the evaluation. However, this notion was addressed extensively during the meetings with the ALS, where the different ways of minimising the 'subjectivity trap' were suggested. For example, the interviews began with a disclaimer, indicating that although topics may have been discussed earlier, a response must be addressed as if it were being

discussed for the first time. Also, with the knowledge that my position in the organisation could impact the interview, I took great care to remain in a neutral position during the interviews. The interview questions were also carefully crafted in an attempt to eliminate researcher bias. A concerted effort was applied to stay on course.

I encountered other challenges notwithstanding the benefits insider research offers, such as:

1. Role ambiguity, where I am a colleague, senior manager and researcher. Roth and his colleagues (2007) define it as 'putting on different hats'. The skill was developed through the DBA modules and the critical action learning assignments. During data collection of AR cycle 2, I found myself thinking whether the participants were viewing me as a researcher or their superior on the job. Burns and his colleagues (2012) affirm this as they argued that insider researchers experience varying degrees of role ambiguity. It is true that role ambiguity cannot be completely eradicated. However, my aim with the hats of a manager and a researcher were literally the same. Nevertheless, I cannot be sure on how I was viewed by the participants. Suffice to say that I had a good working relationship with the individuals involved and took all necessary steps to clearly define my role when the need arose, thus adding further integrity to the responses. It was a case of 'divide', wearing the hats individually on separate occasions and 'switch', wearing both hats but exchanging one for the other on a single occasion (Hall and Earley, 2019) such as when I was in a departmental meeting as the head of the department and reflecting on what was going on with the researcher's eye. The most important thing was that I was adept at operating successfully within each role to ensure that having multiple roles remained an asset and did not become a liability. The participants acknowledged that both roles were focused on improving the GIS situation.
2. Organisational politics could not be ruled out in the research as I tried to balance FERMA's formal ways of approaching the GIS with my personal justified ways of getting things done. A scenario was when applying the intervention of mandatory usage of the GIS into the regular practice of the organisation. It was a change to how road project data used to be captured. Initially, data obtained on the field was recorded in logbooks and later compiled and forwarded to the headquarters. This new instruction meant that the matured managers who had a preference for the status quo were compelled to use the

GIS. As I had no intention of losing my job, I had to find a way to introduce the change in a 'politically correct' way and still get the desired results making sure that the managers had the opportunity to be part of the decision rather than be seen by their subordinates as having it forced upon them. I achieved this through my successive presentations at various management meetings on the progress of the GIS and the proposed actions to take it further. This approach allowed for manager buy-in and provided the platform for further query and understanding. The specific issues addressed here were resistance to the GIS use, which led to non-availability of road data for decision-making.

3. Another example was the manner used to obtain the needed 104 GPS devices and other work tools outside of the regular budget line items. It was achieved by gaining the individual support of the executive management members before the meeting, where I presented my proposal. The action ensured the long-term success of the GIS adoption project. Roth and his colleagues (2007) call these manoeuvres, acting in the political landscape.

I now display specialised proficiency with cognitive abilities that enable critical thinking with the ability to produce new` insights. I also pay close attention to actions taken and reflect-in-action on emerging occurrences before deliberating on the next step. This new understanding has improved my decision-making. Going forward for future practice, when implementing any change, it is best to start with the full participation of all who will be impacted by the change. It is salient to listen to their perspective.

6.3 Second-Person Inquiry

Action research underpins engagement with others. The second-person inquiry focuses on inquiry with others through dialogue and applying iterative cycles of constructing, planning, action and evaluation (Coghlan and Brannick, 2014). Second person inquiry attracts the most attention and appears to have the most immediate impact in terms of changes in practice. It reflects on how the action project is progressing. Myers (2013) reported that proper reflection was central in carrying out a robust research because it provided the chance for one to bridge theory and practice. Research also offers the platform for new insights and knowledge. Leitch and Day (2000) emphasised the benefits of reflective practice noting that it allows one to make

improvements on the way processes were carried out in the past in conformity with recent occurrences. To report the second person learning this section has been divided into five subsections, namely: Technology acceptance model, leadership, management practices, forms of resistance, and outcomes of managerial interventions.

6.3.1 Technology Acceptance Model

The Technology Acceptance Model (TAM) was used as the initial conceptual framing for this research. It was an adapted TAM (Figure 4). Adapted in the sense that external variables of leadership and management practices were added constructs based on literature and my insider knowledge. It explained the behavioural aspect of the user with technology acceptance. TAM postulates that an individual's perception of a technology's usefulness (PU) and ease of use (PEOU) describes and predicts one's acceptance and use of a technology (De Vreede, Jones and Mgaya, 1998). The vast areas of leadership and management practices were identified as where PU and PEOU would happen. TAM as a diagnostic tool was not wrong, but it did not help me sufficiently in tackling the GIS problem. It was not adequate in understanding the lack of GIS adoption in FERMA. As an engineer in an engineering company trained with a positivist mindset, the initial deductions of the TAM model were tailored along this line. The facts that emerged indicated that the GIS was generally perceived as useful on the job and easy to use, notwithstanding the valid constraints such as slow Internet speed and the preference for the old ways of doing things. However, it did not translate to full adoption. The learning here through much reflection was the fact that the assumption that the GIS was a stand-alone product encouraged one to think in narrow, discrete ways about the GIS as a problem between users and the GIS in FERMA, a public organisation within the Nigerian space. It was not sufficient. The perspective then shifted to viewing the GIS as a problem embedded within a wider system, where everything was connected to something else, and one part could not be removed without consequences to the other.

Thus, in trying to translate this new awareness through critical analysis, the use of the ecosystem metaphor was developed. I was then able to reconsider the GIS problem and see it differently. The GIS phenomenon viewed as a system that was interlocking and interdependent, indicating the relationship between the user and the GIS considering leadership factors and management

practices. Everyone had to understand his or her role in the GIS adoption process. According to Bubshait, Burney and Nadeem (2014), any planned change is the outcome of multifaceted interactions. The GIS ecosystem adoption model (Figure 12) was developed as a result of the action research cyclical process. The conditions of TAM on technology acceptance, where the participants perceived the GIS to be useful to the job (PU) and easy to use were still predominant. It came out of working with the participants.

The ecosystem concept was used in a symbolic and functionalist manner (Pickett and Cadenasso, 2002). It helped in the interpretation and analysis to consider the GIS issue holistically across all relevant departments and not just a problem of the RMMS department. This insight was only possible by spanning the boundaries as a scholar and a manager through collaboration with relevant individuals. I used my practitioner knowledge to explore and refine the technology acceptance theory within FERMA context. It led to the GIS ecosystem adoption model (Figure 12), a translation of the specific practice. The model showed the relationship between the user and the GIS going through the identified significant layers of interdependencies for GIS adoption, which were leadership, strategy (management practices) and staff capabilities (users). Action research guided us [managers], to focus and narrow our thinking and reflections to the translation of the model within a practice in a particular context. In the case of FERMA, it was changing the generally accepted TAM model into something practical and useful. The gained insights on individual perceptions allowed the development of the GIS adoption model, which guided the interventions of mandatory usage, hands-on training and an adoption strategy, communicated to all. The outcome of the managerial interventions is discussed later in section 6.3.5.

6.3.2 Leadership

6.3.2.1 Transformational leadership

The focus of this research was the lack of GIS adoption. Thus, the discussion on leadership is precisely in terms of technology adoption. How did GIS users perceive and experience leadership of the technological change? From the analysis of data gathered in AR cycle 1, leadership was an essential factor that affects GIS adoption. The most recurring sub-theme under leadership was leadership style, highlighted as leading-by-example. Where a technology is

demonstrated, it is seen as being more straightforward to operate than if the individual had to acquire the knowledge independently. From the findings, the favoured leadership style to engender adoption of the GIS was transformational leadership. Transformational approaches to leadership suggest that practices following transformational methods add to the development of commitment and capacity among users of new technology (Limsili and Ogunlana, 2008; Seyal, 2015). Transformational leaders inspire through leading-by-example (Bass 1999; Cho *et al.*, 2011; Menzel, 2015; Schepers *et al.*, 2005). They encourage and motivate others with whom they work, with a vision of what they are capable of accomplishing through extra personal effort (Avolio and , 2004). According to Bass (1997), four factors make up transformational leadership: 1) idealised influence, provides a compelling vision and places on purpose and commitment. Then, the followers observe the leader and in turn, act out accordingly (Gambrell *et al.,* 2011). 2) inspirational motivation sees the future as appealing. The leader then inspires others to perform and aids followers to achieve more than they thought possible. 3) individualised consideration refers to compassionate leadership with empathy for individual needs. Development is encouraged through advice, teaching and mentoring. Finally, 4) intellectual stimulation, the leader looks at new ways of doing old things and questions old assumptions and traditions. It summarised the needed change for improved GIS use, which was conveyed to the field managers (FRMEs).

Other leadership qualities identified by respondents included effective and clear communication lines from leaders to subordinates, leader's knowledge and commitment to using the GIS. This is also a key point for transformational leadership. In addition, transformational leaders possess vision that is interactive and extremely attentive to promoting effective communication and value sharing (Adair, 2006). Top management support and commitment are required for an organisation to adopt new technology (Fernandez and Rainey, 2006; Hwang *et al.*, 2004; Neufeld *et al.*, 2007). Literature affirms the fact that the CEO's approach towards IT and his knowledge is an additive characteristic towards the adoption of new technology in an organisation (Damanpour and Schneider, 2009). In the case of FERMA, the presence of an IT-savvy CEO was a great advantage because GIS-based requisitions sent were readily approved. A good example was the prompt response to the request for more GPS devices. Both the users and an influencer expressed this during the second round of interviews.

"..commitment of the Managing Director I should give him 100%, handicap in the sense that he could not be a one-man evangelist." (I1)
" ...with the new management that we have and the new HOD who is IT savvy. She pushed and made sure that her colleagues in the management buy-in to the usage of GIS software." (U6)
"..this management is more interested in this GIS, especially the Managing Director" (U5)
"..with you at the helm of this department, at the top of this assignment, at the moment all field offices have a minimum of one GPS, some have two and some have more than two." (U3)

The importance of collaboration and making everyone feel like an insider and a part of the GIS team was also a major outcome of AR cycle 2. On reflection, the collaborative nature adopted in AR cycle 1, made it possible to attain and apply the managerial interventions of AR cycle 2. Collaborative leadership relies on natural principles regarding humankind that states that where an individual has interest in a project and is allowed to participate in its implementation their dedication would be assured (Vroom and Yetton, 1973). It does not rule out the fact that there may always be some resisters. Participatory leadership techniques (transformational) that allow collaboration are likely to encourage innovation within an organisation (Garcia-Morales *et al.*, 2012; Kanter, 1988). This was the case in FERMA. Tackling the uncovered uncertainties such as slow Internet speed, preference for the status quo, and the rest became the source of learning for everyone.

By listening to the voices of others, a manager could understand the perception of others and the workplace problem in general. As a manager one had to continuously critically reflect on the assumptions upon which interpretations were based as it helped transform one's criteria for making a judgment. Furthermore, it was observed that progress officers (users) in the operations department responded better to their immediate supervisors rather than the director from the RMMS department. This exposed me to 'perception by others'. How I was perceived was not what I thought. I realised that within the organisation, the message depends on the messenger. The definition of collaboration varied from person to person. For those in the operations

department, they viewed themselves as a group. Thus it was best to tackle the problem with this mindset rather than attempt to force the situation by selling the one organisation concept. Group managers were thus encouraged to oversee their teams and ensure progress towards GIS adoption. On reflection, this is evidence to the fact that we work and possibly think in silos. It could be due to the existing hierarchical culture or the chain of command within the organisation. Although, according to literature, direct managers are essential in promoting the use of new technology (Bassellier *et al.*, 2003; Chau and Hu, 2004). Working in discrete units was a situation that was identified and acknowledged as needing enhancement for improved GIS adoption.

RQ1: In what ways do leadership factors affect information system adoption?

Findings from this research have it that management behaviours are important because once the managers adopted the transformational style of leadership. There was a noticeable improvement in the demeanour of the users. They guided the proficient and keen desire of staff to use the GIS. There was also an improved understanding of the strategic vision and a sense of ownership with the desire for the successful adoption of the GIS. A leader has a powerful influence on an individual's perceived ease of use of technology, while training and more general end-user support enhances individual adoption of new technology (Amoako-Gyampah &and Salam, 2004; Venkatesh *et al.*, 2002). This was clearly depicted in the conceptual framework (Figure 4) and the expected organisational outcome of GIS adoption. However, this action research led me towards new leadership behaviours and practices where the lack of adoption was viewed holistically, using the GIS ecosystem adoption model (Figure 12).

The particular aspect of leadership that showed dominance was the act of working alongside and being a role model, 'do as I do' with direct supervision. It emphasised the fact that the focus needed to be on the managers directly involved with the GIS rather than the heroes at the top as generally implied by various scholars on transformational leadership. The approach is called 'nearby' leadership (Alimo-Metcalfe and Alban-Metcalfe, 2005, 2008, 2013). It had a positive impact on daily activities of the GIS. This was a great insight as much of the literature focused on transformational leadership from heroes at the top rather than heroes from the rank and file.

6.3.2.2 User perceptions

The focal point of the study was about the individual perceptions of the actors within the GIS environment. The qualitative findings provided evidence that the perceptions of the leaders' impact perceptions of new technology. Dong, Sun and Fang (2007) state that the behaviour of the leaders impacts various influences on the belief of the users. In this study, those involved in the GIS spoke on issues like leader's commitment and accessibility, the need for hands-on training, enforcing mandatory usage and most especially the development of an adoption plan that is known to all. The revelation was enlightening. The integration of the findings resulted in the development of the GIS ecosystem model for GIS adoption (Figure 12). It changed FERMA management's approach to introducing new technology, with the concerted effort to integrating operational relationships within the GIS platform focussing strictly on the users and not the overall organisational outcome or performance. The required actions in the form of managerial interventions helped to facilitate adoption. The increased acceptance of the GIS platform, as was observed after AR cycle 2, was evident during the second round of interviews.

"..knowledge about GIS has highly improved." (U4)
" ... I have gotten so conversant with the application. The hands-on training helped us to get conversant." (U3)
"The GIS has helped us a lot in data keeping because most times the manual way of doing things made it difficult, but with the use of the GIS, at a glance, you can access 2015 – 2017 projects and give an overview of the work done." (U5)

RQ2: How does perception facilitate the factors of adoption?

TAM illustrates how users come to accept and use technology. It focuses on an individual's perception of new technology. Perceived usefulness (PU) and perceived ease of use (PEOU) of the GIS were viewed as determinants of the set goal of ensuring the actual use of GIS technology. Generally, PU and PEOU were the optimistic views of the nine users and six influencers as reflected from data gathered and an assumption provided for in developing the

GIS ecosystem model. Their views were also similar on almost all identified themes, but there were peculiar instances of PEOU by the users with different nuances such as:

1. There was the perception of the system itself with its maintenance and performance. Some viewed the fact that the GIS needed to be updated regularly as a challenge. However, the added training and guidance positively altered the perception.
2. Another nuance was the perception in the context of its availability for use at a particular time in question with sufficient signal or other Internet-related desires. The focus here was on infrastructural problems. The experience of slow Internet speed frustrated some users and led to the preference of the status quo. Others made their earlier responses with the focus on the GPS as discrete equipment. The limited number of GPS devices made daily activities of obtaining the coordinates of the road maintained very cumbersome, leading to some individuals seeking alternate means. It was an area that the leadership was unaware, but with the clarity gained steps were taken to mitigate the situation.
3. Perception through commitment of the top management or change agents.
   The perceived lack of commitment of the leaders by the users [upward perception] accounted for their preference to the old ways of doing things, which still allowed them to perform their daily activities. It was more of a blame game as the leaders were unaware of this interpretation and were convinced that the technology was provided and the lack of adoption was solely the problem of the users.

This study has uncovered that the lack of adoption was a problem in the organisational context where different individuals perceived ease of use differently. It was this knowledge that led to the need for further training to focus on the identified gaps and needed linkages due to the interdependencies of actions and the GIS processes. It showed the need for ownership of the GIS by those affected and the demand for 'nearby' leadership.

After AR cycle 2, where use was made mandatory, hands-on training applied and tackled holistically, there was increased acceptance. It was because the net benefits in terms of performance to the individual and the organisation as a whole became more evident. The research affirms the need for advocacy and awareness of the overall vision when introducing new technology. This was the role of perception in facilitating the adoption of the GIS.

6.3.3 Management Practices

6.3.3.1 Managerial interventions

Similar to leadership, management practice was one of the added external factors to the adapted TAM model (Figure 4). In AR cycle 1, respondents identified five management practices that potentially affect GIS uptake or adoption within the organisation. They were conducting hands-on training exercises, developing an IT adoption plan, enforcing mandatory usage, developing KPIs for users and penalties for non-use. It affirmed the suggestion by Amoako-Gyampah and Salam (2004) that managerial interventions such as training and communication influence technology adoption. Successful technology adoption requires effective communication, hands-on training and support. The practices form part of the technology adoption plan (Louw and Mtsweni, 2013). The training addressed the critical elements that lessen the resistance of users to changes, thus increasing the probability of systems adoption (Kim and Lee, 2008). Three out of the five acknowledged managerial interventions were applied in AR cycle 2. A GIS adoption plan was developed, hands-on training was conducted repeatedly at workstations, and GIS use was made mandatory. These practices saw an improvement in the adoption of GIS within FERMA, evidenced by the renewed interest and desire to use the GIS exhibited by the users. This goes to show that effective management practices promote the adoption of new technology in line with our conceived GIS adoption model. It indicates the impact of management practices on user's capabilities like computer self-efficacy and the intention to use the GIS. These practices seem fairly obvious and are known. However, it was only through targeted interviews where the voices of the users were heard and related to existing literature that a bespoke version for GIS adoption in FERMA emerged. It was the choice of an action research project where the focus was on actionable knowledge that made the difference. Earlier, we (managers) all had a narrow outlook to the GIS problem and were unable to link our problems of usage. Organisational dynamics is not as straight forward as a management textbook. The holistic approach of the GIS ecosystem adoption model was the turning point.

> *"It is an ecosystem, everybody from their units are feeding the system, and you are calling what has been fed into the back office." (I6)*

After that light bulb moment, the problem was reassessed and put in perspective where the interdependencies of the overarching themes of leadership, strategy and staff capabilities were considered. The GIS technology was not just a stand-alone. It demanded top management commitment and understanding of all this by all the actors.

RQ3; In what ways do management practices affect information system adoption?

Management practice refers to those procedures or working methods taken by management to improve the effectiveness of the GIS. The adoption of an information system is contingent on the people rather than the technology. It needs the active participation of staff throughout the organisation. The chosen working methods focused on adoption because an information system is not successful if not in use. People must work together when implementing new information technology. Developing an understanding and appreciation of the GIS was a necessary first step. The setting of targets to deliver tangible and visible results was a great motivation. At the same time, the mandatory usage was an effort to generate a feeling of exigency to facilitate the adoption of the GIS. The issue was to make certain that the necessary information was inputted in the system such that the actions could translate to gradual adoption. Communication was essential, the message of the purpose and benefit of the GIS had to be evident to all. It allowed everyone to align himself or herself appropriately towards one goal, adoption. Aligning FERMA strategic vision of the GIS with the organisational behaviour was a crucial function of the managers. The hands-on training provided the needed feedback and guidance. The chosen managerial interventions demanded strong and focused transformational leadership that defined a clear direction and always kept track. All management practices were geared towards seamless user experience.

From the textbook perspective, regarding the adapted TAM model, earlier actions carried out towards adoption of the GIS were broadly correct, but it was not adequate. The managers were not fully aware of the practicalities involved. Instructions were issued and subordinates expected to follow through, but they did not. It was discovered that the application of management practices on discrete problems and working in silos was a considerable hindrance. The key to the management practices was not the different entities themselves but rather the realisation that they needed to be implemented holistically with the full commitment of the managers from top to bottom, in consideration of the interdependencies and interactions. This led to the development

of the GIS ecosystem adoption model. In practice, this actionable knowledge was translated at each stage where the GIS was embedded.

6.3.3.2 Staff knowledge of the GIS

The responses regarding PU and PEOU inferred poor staff knowledge and acceptability of the GIS. A majority of the respondents showed interest and acknowledged that the GIS was useful to their jobs. However, the capability to use was low. This was traced to the level of knowledge of the application of the GIS. It indicated the need to conduct additional training with a focus on more hands-on training. Also, the data revealed that Internet connectivity was a notable challenge. It had a rippling effect on capability and acceptability, resulting in reduced performance in terms of daily targets. Although there are bureaucratic laws guiding Internet service providers to public sector agencies in Nigeria, suggestions were proffered and documented for improved services. In AR cycle 2, additional training was conducted during the action phase, and this led to improved use and acceptability of the GIS. The training was not just a means of transferring the necessary skills but also as a means to reduce the difficulties caused by organisational ambiguities to the introduction of the GIS. Thus increased knowledge and acceptability of the GIS within a favourable environment (Internet, equipment etc) was important in its uptake in the organisation. Management had to provide the needed resources to learn and operate the new system such as improved Internet bandwidth, computers and GPS devices.

RQ4; In what ways does the level of knowledge and acceptability of the information system affect its adoption?

An obstacle to use was the lack of knowledge of the GIS and its capabilities. Factual knowledge of its capabilities and the overall vision of FERMA as regards the GIS were limited. It gave rise to negative attitudes towards technology, causing individuals to escalate any unforeseen obstacle. Research uncovered the discrete focus on GPS devices, which were insufficient by those in the field. On the other hand, the progress officers in the headquarters focused more on the software itself and validation of data from the field. This was why they found the slow Internet speed to be a notable constraint. Each individual's response was, according to his/ her role within the GIS system. There was a need to improve the level of knowledge of the users in a holistic manner.

Such that everyone was aware of the strategic vision of management and how each person's activity fits into the overall GIS technology.

The hands-on training improved the knowledge of the GIS and its capabilities, thus improving the acceptability of the new technology. Furthermore, to improve GIS use, management had to provide a clear strategy on adoption, and expectations spelt out. It provided a map that users could easily follow. They engaged more with the processes, had increased knowledge of the software and had to use it more in their daily activities. The users had to be supervised and assisted for FERMA to realise an improvement in GIS usage.

6.3.4 Forms of Resistance

Resistance towards the use of new technology is not a new phenomenon. Much on this is discussed in extant literature. The forms of resistance to the GIS in FERMA identified in AR cycle 1, include fear of the change, anxiety towards new technology, preference for status quo and difficulty in grasping new concepts mostly amongst older users. The respondents expressed fear in terms of the technology being relatively new, requesting that they needed more time to acclimatise. Samuelson and Zeckhauser (1988) emphasised the relevance of status quo bias to the adoption of an information system. The user must be convinced of the benefits of the change before moving to a new alternative. The resistance from older adults affirmed decades of research, which showed that matured age is a salient barrier to adoption of new technology (Chen and Chan, 2011; Knowles and Hansen, 2018; Magsamen-Conrad *et al.,* 2015). Some of the voices are captured below:

"..we still have personal issues whereby some group of people do not want to change their old ways of doing business." (U6)
"... a lot of them are not computer savvy, so this alone discourages them." (U7)
"..age bracket of some managers is a problem, they will tell you oh, I am close to retirement, you should train the younger ones." (U6)

Steps were taken to mitigate these factors when the GIS adoption plan was being developed, but it turned out not to be the main issue. Further learning came from the respondents in AR cycle 1, where one discovered other forms of what appeared to be resistance. For example, individuals were just not using the GIS or the data-collecting devices like GPS. Instead, they preferred to use their phones to register route coordinates and other data. This form of resistance was not the user being awkward. Rather, it could be considered as users using another form of technology to bridge the gap of limited GPS devices. It must be stated that resistance during a change process is not a negative thing. However, top management viewed it as such because they considered the initiated change to be a positive one where a better system that works was provided. So the puzzle was why the lack of adoption of the GIS? The research highlighted otherwise, the study uncovered all the complicated factors that came to light.

RQ5; What are the forms of resistance towards the use of the information system?

It is entirely reasonable for people to resist change, as there is always a preference for the status quo or traditional ways of doing things. The introduction of new technology can be alarming, as was the case in FERMA due to limited knowledge of the GIS and its capabilities. From initial data gathered for lack of GIS adoption, influencers absolved themselves and focused solely on the users. Amongst the users, comments were generic. The views of those operating from the headquarters were different from those in the field. The study uncovered resistance to be a combination of factors such as lack of management and leadership commitment, lack of training, lack of access to equipment and lack of appropriate infrastructure. Resistance to the use of the GIS was the outcome of the individual perceptions of the GIS from their workstations oblivious to the interdependencies of their actions to the overall success of the GIS. The knowledge of the holistic view of how all actions and interactions were interdependent was found to be lacking.

6.3.5 Major Outcomes of the Managerial Interventions

From the second round of interviews and observations carried out in AR cycle 2, which spanned over six months, the following were the key results. The findings were discussed in detail in chapter 5, section 5.5, under the reflection of the outcomes of identified interventions.

- Regarding leadership, the study revealed that in the particular context of the GIS adoption issue, a transformational leadership style was most appropriate. It came out of focused inquiry and just listening to the voices of individuals within the GIS system. Application of this intervention highly motivated the users as managers were readily accessible, and the introduction of weekly GIS team meetings to brainstorm and gather feedback was considered a favourable innovation. The group would meet to discuss and decide the worth and validity of new data, ways of thinking and practices, then integrate them into further planning and operating practices. Much of the accepted new knowledge has developed into new group competencies.
- Hands-on training sessions employed at this stage drastically improved user attitude to the GIS platform. As manager information gathered was first-hand, and close attention was paid to individual needs. It was an opportunity to encourage the new way of thinking where one should reflect-on-action and not operate in silos. The feedback created learning experiences through reflective practice.
- The associated problems with slow Internet speed and erratic power supply became clearer as it explained the continuous desire of users to maintain the status quo in order to achieve their daily task targets. The slow Internet speed had a snowball effect. The prolonged buffering time delayed tasks and made use of the system, both cumbersome and tiresome. From a manager's standpoint, this was a new perspective on existing knowledge. We had been unaware of obstacles faced by the users and its full implication.
- The need for more skilled personnel (staffing) who are capable of efficiently managing the GIS portal and the need for more computers that can host the GIS software was another key finding. This became apparent during the close of the 2018 financial year, which was late [June 2019], the four operations progress officers', users of the GIS were overwhelmed having to treat more than 200 contracts within three weeks.

The above outcomes could only be achieved through the application of the findings in AR cycle 1. Action research bridges the gap between theory and practice. In summary, the essential parameter for change was for managers to own the GIS vision. It was accomplished through advocacy and presentation of the overall strategic vision of how the organisation's performance would improve once the GIS technology was entirely accepted. I set clear expectations, which

users followed. Through adequate collaboration and understanding between departments, one has learned to consciously plan, describe and reflect on the processes and outcomes of actions. The use of inquiry strategies to find out more about one's practice or a phenomenon has become second nature. For example, the knowledge gained in this study is already being transferred to the Human Resources Department, where a new information system [HCMatrix] has been deployed. The managers are aware of FERMA infused with top-down, hierarchical, departmental silos and the need to view the system as operating in an ecosystem interdependent and connected with the managers and the users. Thus, the earlier delay observed on the GIS that warranted this study is non-existent. There are definite signs of early adoption, with an existent adoption plan that is known by all involved and is being measured accordingly in line with feedback received.

6.4 Third Person Inquiry

Third-person inquiry looks to the dissemination of findings to a broader audience. The writing up of this study is a step in this direction. As seen in this research, the adoption of new technology requires an integrated approach where leadership characteristics and managerial practices are viewed holistically in the management of the desired change. Management should not consider an IT innovation as a stand-alone product. This was the mistake in FERMA. Once the system was implemented, top management assumed that with the earlier training provided by the vendors, the technology would be accepted and used. The fact that FERMA is an engineering organisation played a significant role in the early focus being on the technology aspect and leaving out the human factor. IT changes require changes in work processes (Dixon, 1999). Managing employees' acceptance of new technology can be an issue for any organisation, thus to ensure its adoption and usage, several areas need to be effectively addressed. In this particular context, the gained insight was the need to give technology change a holistic approach considering the nuances of the user and the GIS.

The nature of this research was specifically aimed at making an improvement in FERMA GIS use. Thus the onus of transferability lies with the person who seeks to transfer the actionable knowledge. The insight gained from this study is depicted below (Figure 15).

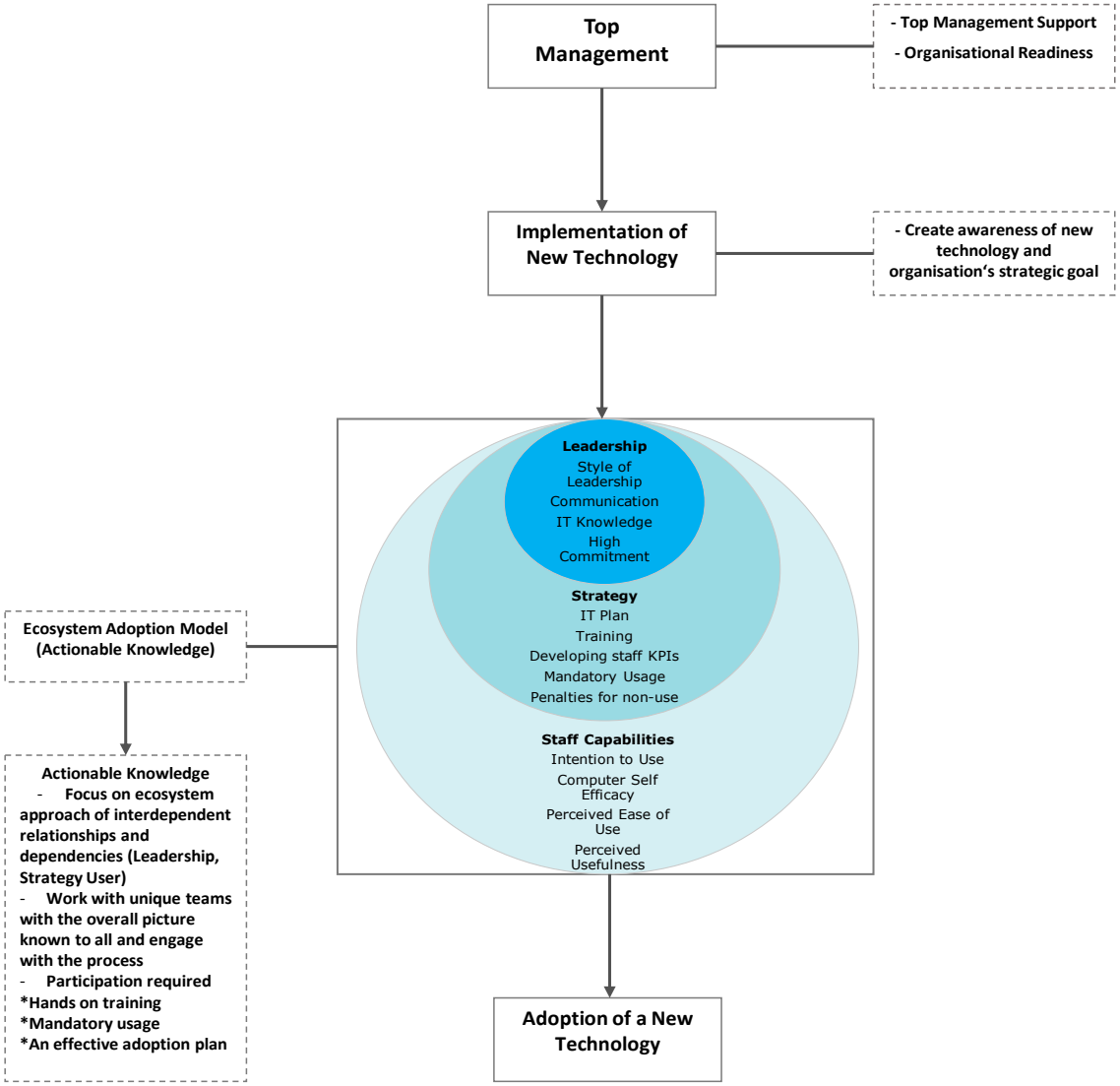

Figure 15: Transferrable Actionable Knowledge for Adoption of New Technology

Figure 15 clearly shows that the process of change starts with a clear decision by the top management to implement a program of change with the understanding that there must be top management support for the new direction and a readiness by organisational members to implement the change. This is already established in change management literature (Kotter, 1996; Armenakis and Harris, 2009). The process of implementation of the technology must go simultaneously with the dissemination of information about the new technology and how it impacts the organisation's strategic goals. The transferrable actionable knowledge is the

ecosystem adoption model, which was built on existing change management literature. It depicts interdependent relationships and dependencies of leadership, strategy for adoption and users across departments. It indicates the characteristics of leadership for technological change, the interventions as well as the required capacity and perceptions of the users. The actionable insight is threefold with the main understanding being that one needs to consider the effects of all three as an ecosystem. Initially, I had taken the first two for granted and focused on the users with the assumption that the GIS adoption was a given because it was self-evidently useful.

The first actionable knowledge is the need to get out of silo mentality. It is necessary to rethink one's mindset. A manager is responsible for coordinating activities concerning any new technology with peers and other groups because there are interdependent relationships and dependencies between leadership, strategy for adoption and the user. The integration of operational relationships across departments is the key.

The second is engagement. Everyone impacted by the new technology must be involved. It can be accomplished through working in different teams with the overall picture known to all. The line of communication in getting the user to understand the expectations is crucial. A message transmitted and its response can depend on the messenger. I discovered that direct managers wield more considerable influence on the users. Collaboration means different things to different people. Thus small groups may be preferred where group managers are responsible for their teams and getting the required outcomes.

Finally, the interventions of mandatory usage, hands-on training and the development of a valid adoption plan improved the adoption of the new technology in the organisation. Mandatory usage of the technology ensured that a habit of use was formed. It is not useful on its own if one does not take note of the other factors. It emerged as a practical solution to the observed lack of adoption. No one embraces change wholeheartedly. There is always bound to be some form of resistance. Hands-on training with improved communication through the adoption of a transformational leadership style was a needed guide. Having someone on hand to direct the user proved to be very important. The provision of a well-defined and effective adoption plan provided the needed focus as well as ensuring that management, supervisors and users shared a clear understanding of the goal(s). As senior managers in an engineering organisation, the explicit knowledge gained was that we should take nothing for granted. In arriving at these

interpretations I had to go beyond our usual prescriptions and reflect deeply on the occurrences within the GIS phenomenon. These interventions are not necessarily the only ones that could be considered. I am sensitive to the particular context and knowledge of FERMA to suggest any form of generalisation of which I am not certain. However, the actionable knowledge gained is likely to work elsewhere with proper consideration of that particular context and the needed alterations or extensions. As a leader at the top, do not assume that you have the full picture. Adopt inclusive leadership where everyone is carried along. Thus leading to the adoption of new technology.

6.5 Conclusion

This thesis was an action research project seeking to explore the lack of adoption of the GIS technology in FERMA, six years after implementation. Action research is a process that produces local knowledge. Looking back at the GIS issue where the lack of adoption was a puzzle, significant inroads have been made. The turning point was the insight to view the GIS phenomenon as an ecosystem where its acceptability and usage was interconnected and impacted from leadership through management practices to the users. The enforced usage with a laid down plan and constant feedback was the added catalyst as the required processes for full GIS use were spelt out and followed. The users looked forward to the introduced weekly meetings, where they learned from others, shared ideas and collaboratively decided on the next line of action. The hands-on training provided the individualised considerations, which the users responded to satisfactorily, and it resulted in enhanced GIS use. Data are now being uploaded regularly, and the road maintenance works monitored accordingly for any delays or errors. It includes updates on the progress of road contracts complete with geo-referenced photographs of on-going works. With an improvement in Internet service, there was an apparent reduction in buffering time. Thus boosting the efforts of the users as well as correcting past hindrances.

This research has been of immense benefit to my professional development. The scholar-practitioner thinking, sensing and acting in response to occurrences around me is greatly admired and sought by my colleagues. It has provided new inroads to my career as well as to my personal life. I am now critically reflexive, embracing subjective understandings of the perception of others and the impact of my assumptions. With regards to the organisational performance, there

is appreciable improvement with indication of greater milestones being accomplished. The study emphasised that for technology adoption, the manager is a 'role model' who must work alongside the user with direct supervision. The insight of viewing the GIS phenomenon as a system that was interlocking and interdependent, considering the relationships between the users, leadership factors and management practices was only made possible by spanning the boundaries as a scholar and a practitioner through collaboration with relevant individuals. This is the actionable knowledge that could be transferrable to other organisations mindful of the context and possible needed alterations or extensions. The AR cyclical practice of construct, plan, act and evaluate have been embedded within the GIS team during the course of this study. It is an on-going process of instilling the practice of taking action and creating knowledge about the action taken as the action unfolds.

It is only the formal action research study for the thesis that has come to an end. The learning and work in FERMA continues. In an attempt to embed this knowledge within the organisation to ensure sustained adoption, management is to consider the third cycle. In this cycle, the stepped down managerial interventions identified after AR cycle 1, would be applied. An outline indicating specific steps was shown in Figure 14. The construction phase of AR cycle 3, commenced when the outcome of AR cycle 2 was presented to the ALS. The need for more skilled personnel, hardware and improved infrastructure was conveyed to top management. Also, the positive gains in terms of actual usage were noted and the need for continuous monitoring emphasised to ensure adoption. The weekly feedback meetings are maintained and timelines are now stipulated at various stages to track performance. For example, once an interim certificate is sent from the field a 14-day period is provided for the contract to pass through the system and payment made. In the event that there are queries or inconsistent results, it is expected that it would be resolved at the next meeting. The penalty for non-compliance is non-payment of the contract. GIS use is now tied to an event. Contracts not captured at all stages on the GIS platform cannot get payment. This is an added stimulus to ensuring adoption, as no individual wants to be held responsible for a contractor not being paid. In addition, such a report would reflect badly on ones appraisal at the end of the year. The on-going AR cycle 3, overlaps some activities of AR cycle 2 that have been sustained like mandatory usage and weekly feedback sessions. AR is not linear and this has been clearly established from this study. As a manager and scholar-practitioner, one shall continue to monitor and reinforce the sustained change towards full GIS

use. The third cycle should routinise the new skills such that usage becomes a culture of the organisation.

Finally, I plan to disseminate the findings from this research to the wider community through several platforms both formal and informal. There will be publications to industry bodies like the National Council of Works and the Council of Registered Engineers of Nigeria to mention a few. In addition authored and co-authored papers will be presented at various conferences, and ideas exchanged informally while networking with relevant communities of practice. I hope that my contribution to the knowledge base through this thesis and future publications will aid in bridging the practice-theory divide.

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APPENDICES

Appendix A: The Basic TAM Questionnaire

The specific name of the technology (e.g. the GIS) would replace '*the technology'* in a specific questionnaire.

Perceived Usefulness Statements

Using *the technology* would improve my performance in doing my job.

Using *the technology* at work would improve my productivity.

Using *the technology* would enhance my effectiveness on the job.

I would find *the technology* useful in my job.

Perceived Ease of Use Statements

Learning to operate *the technology* would be easy for me.

I would find it easy to get *the technology* to do what I want it to do.

It would be easy for me to become skilful in the use of *the technology*.

I would find *the technology* easy to use.

Behavioural Intention to Use

I intend to use *the technology* regularly.

Appendix B: Interview Guide

INTERVIEW GUIDE (AR cycle 1)	
Questions	**Rationale**
Part 1 – Introduction 1. Kindly introduce yourself, who are you and what do you do? 2. What do you know about GIS? 3. Tell me the story of the GIS in FERMA? 4. How did you become aware of it? 5. What has been your involvement to date? 6. How has it impacted you?	▪ Warm up question to put interviewee at ease and enable him/her to speak freely ▪ Endeavour to build trust ▪ Get a general overview of the GIS phenomenon
Part 2 – TAM Model (general feelings/ perception) 1. How do you see the use of the GIS presently? 2. Is it easy to use? (PEOU) 3. Would you consider it useful in your job? In what ways? (PU) 4. Going forward do you see yourself using the GIS regularly? (Intention to use)	▪ To explore the TAM model (use of the basic TAM questionnaire in the form of probes)
Part 3 – Factors Impeding Adoption 1. From your perspective, why are we where we are today with regards to the GIS implementation? 2. Leadership in the organisation; how do you think top management use the GIS? What of the middle managers (FRMEs)? 3. What are your views on their influence to subordinates or their peers as regards the use of the GIS? Is there a particular style in existence or way to improve? We have been talking of leadership, now I would like to move to management practices:	▪ Aid in identification of themes for ease of analysis and inferences

INTERVIEW GUIDE (AR cycle 1)	
4. Would you say there is a strategy towards managing this technological innovation? Do you think it impacts the GIS use in anyway? 5. How do you see staff capabilities and the GIS? What do you have to say about the training? Is there any form of resistance? What of redundancy? 6. What do you have to say about our hierarchical structure and the implementation of the GIS?	
Part 4 – Conclusion 1. Is there anything else that you would like to tell me or ask me? 2. Can I contact you later if I have additional questions? 3. Thank you for your time.	▪ Be courteous and show respect for the interviewee, indicating that he/she is not being coerced (ethical considerations - though reflected upon at all stages of this interview process)

Appendix C: Interview Questions

Interview questions (AR cycle 2)

1. As a progress officer, what have you to say about the GIS today?

2. There have been series of trainings and targets set with assigned tasks. What are your views?

3. In what ways has your manager impacted you in the GIS use? Is there anything that he / she could do differently to improve the status.

4. In terms of GIS use and further adoption, what suggestions do you have? What are your present challenges?

Appendix D: Template for Coding Data

Template for Coding Data

S/N	THEME	DESCRIPTION
1.	Leadership	Anything that relates to actions of a superior figure.
2.	Staff Capabilities	Look out for resistance, knowledge, adaptability, attitude etc.
3.	Strategy	It is all about steps taken towards actualising the GIS Implementation / usage
4.	Structure	This has to do with the hierarchy within the organisation or that, which is related to departments.
5.	Perceived Usefulness	Any segment that describes the GIS and reflects the GIS as a useful technology.
6.	Perceived Ease of Use	Whatever depicts the ease of using the GIS technology
7.	Intention to Use	Related with the desire to use the GIS technology going forward.

Appendix E: Presentation to Action Learning Set

Implementing Change in a Public Organisation:

An Action Research Inquiry of Information Technology Implementation and Adoption

INIOBONG USORO (H00038763)

RESEARCH QUESTIONS

PRIMARY RESEARCH QUESTION

- Why is there a lack of adoption of the Geographic Information System in FERMA?

SECONDARY RESEARCH QUESTIONS

- In what ways do leadership factors affect information system adoption?
- How does perception facilitate the factors of adoption?
- In what ways management practices affect information system adoption?
- What are the forms of resistance towards the use of the information system?

2

WHAT IS ACTION RESEARCH?

- Action Research (AR) is a collaborative effort in which all individuals involved in the study are knowing and contributing participants. (Kuhne & Quigley, 1997)
- Dick (2002) defines Action Research as a flexible spiral process that allows action and research to be achieved at the same time where action is about change or improvement and research about understanding or knowledge.
- AR bridges theory with practice. It also requires the level of thorough preunderstanding of the organizational environment, structures and systems in which the intervention is situated.

This study follows an action research protocol, where the problem under study is located within the framework of the technology acceptance model.

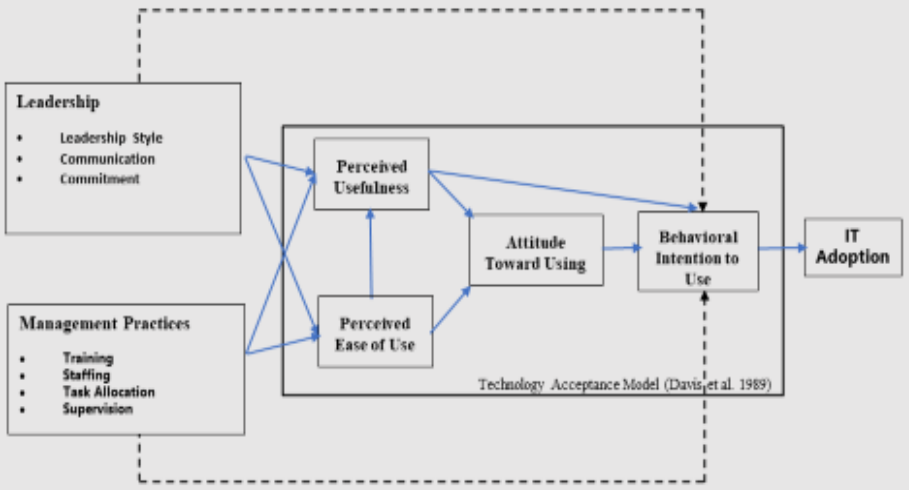
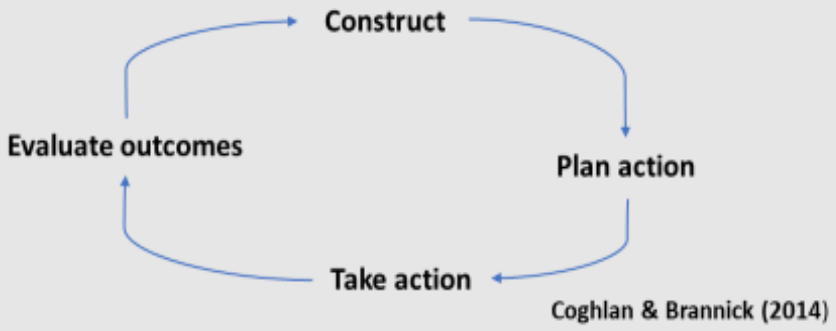


Fig. 1 Conceptual Framework

Action Research Cycle

The quality of AR is grounded in the cycles of action and reflection. It is an iterative process.

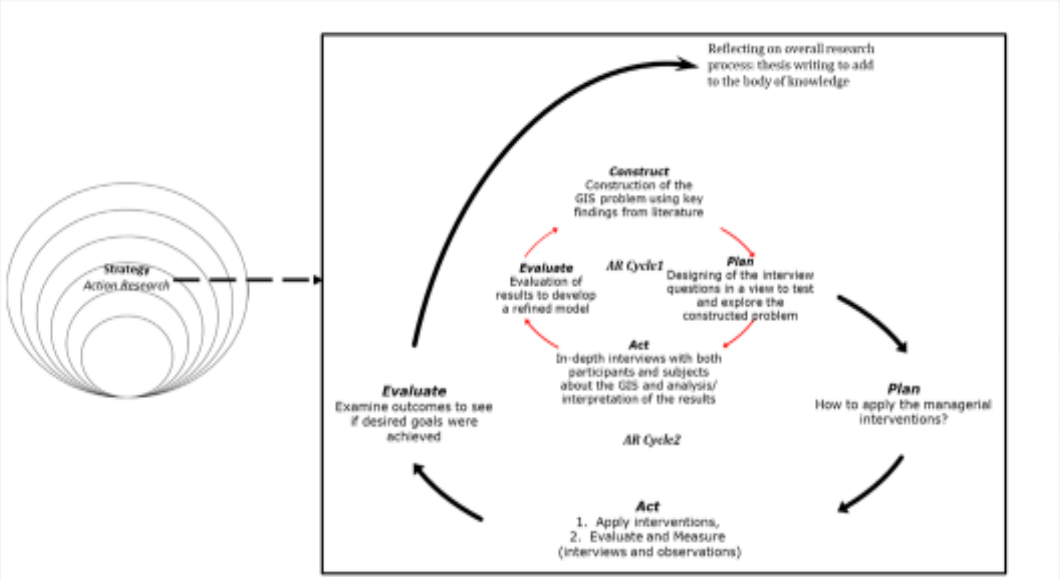


Coghlan & Brannick (2014)

Action Research Cycle

- The acts of interpreting the solution, planning to take action and reviewing the outcomes are subjected to critical thought and discussion.
- My action research project consists of two robust action research cycles with an opportunity to continue beyond the DBA thesis.
- The second AR Cycle represents where the identified interventions are applied within the GIS ecosystem for improvement and desired adoption.

Action Research Cycles



7

Data Collection and Analysis

The influencers and users were purposefully selected based on their involvement with the GIS technology.

- 6 influencers, senior manager who can influence the desired change form the action learning set whom through collaboration and brainstorming together we can identify the needed managerial intervention(s)
- 9 users, middle managers who shall be observed within the workspace to test out managerial actions/interventions

8

Data Collection and Analysis

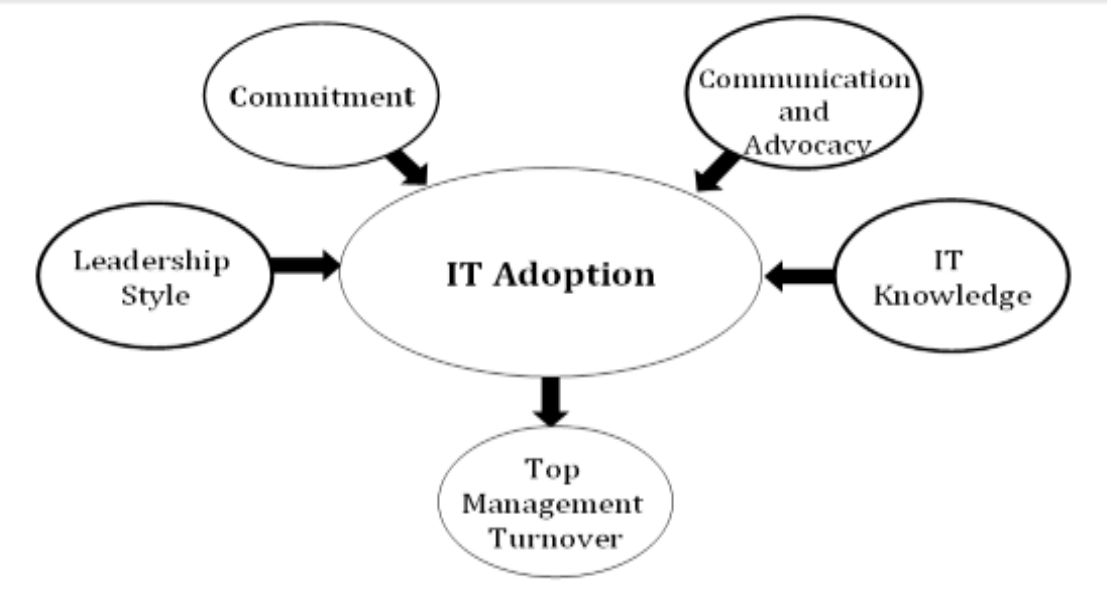
Interviews were conducted, transcribed, coded and analyzed.

I began with seven (7) themes: leadership, perceived usefulness, perceived ease of use, strategy, staff capabilities, intention-to-use and structure.

This has been collapsed to three main themes: leadership, strategy and staff capabilities.

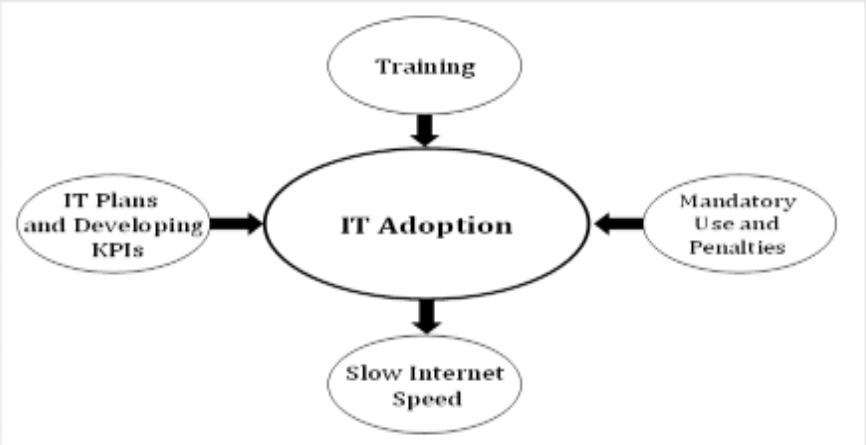
9

Leadership



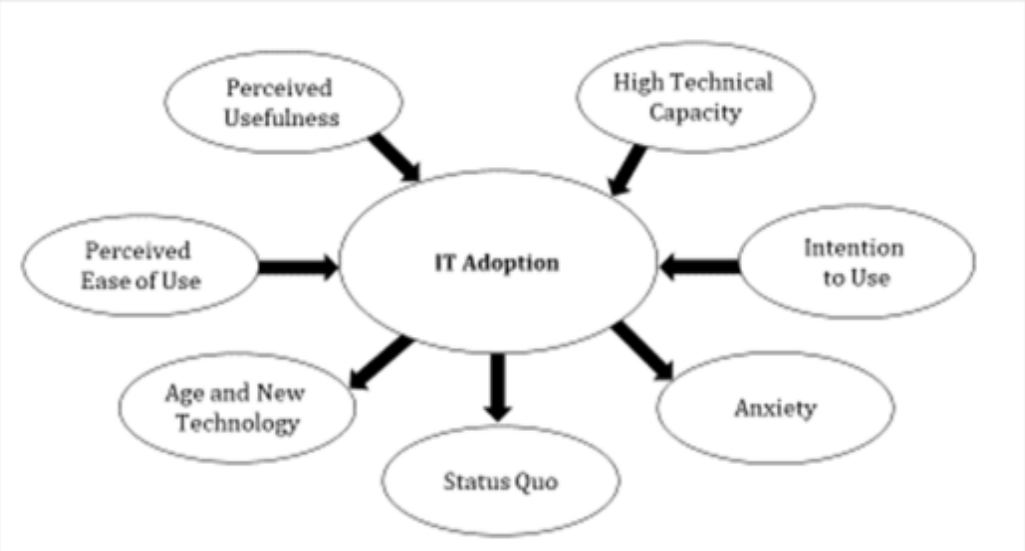
10

Strategy



11

Staff Capabilities



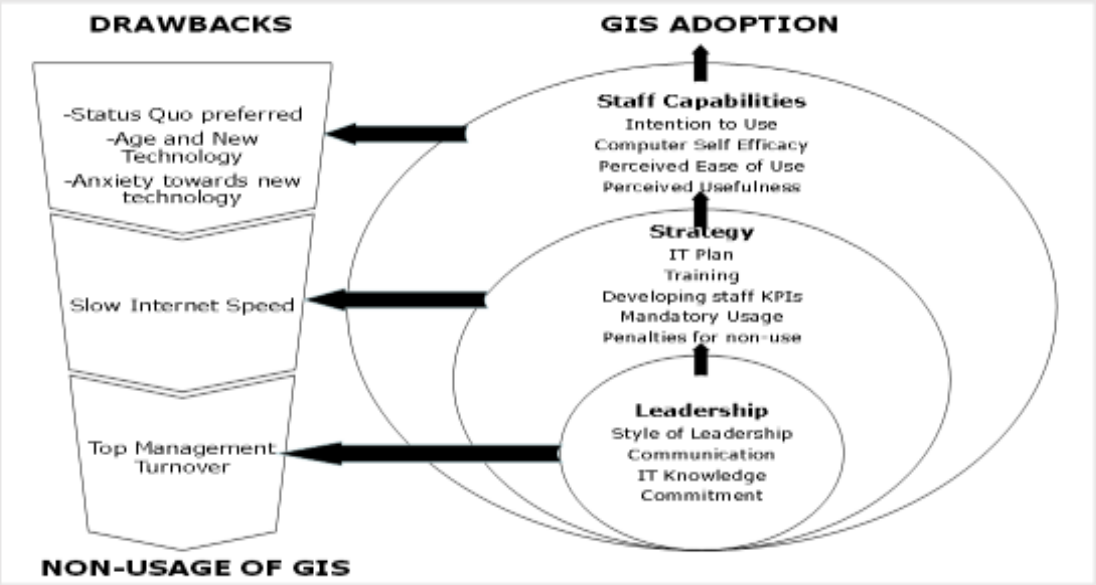
12

GIS Ecosystem

This research began with an adapted TAM model but from data gathered and further interpretation the problem can be better described using the technology ecosystem as a metaphor

13

Model for Adoption



14

Conclusion

- Everything is connected to something else. It is not a stand-alone technology.
- One needs to think carefully for all actions and be aware of the entire environment.
- This is a summary of my key findings. I present them to you for further exploration as well as to test the authenticity of my ideas seeing that we are all senior managers in FERMA connected to the GIS in one way or theother

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