CHAPTER ONE

INTRODUCTION

Agriculture has been the mainstay of Nigeria's economy and that of many other countries of the world. More so, it is still contributing significantly to the Gross Domestic Product (GDP) of Nigeria (Pulitzer, 2012). According to the current report from the National Bureau of Statistics (NBS) (2017), agriculture contributes about 27.11% of the country's GDP and still has the potential of employment generation, food security and poverty reduction in Nigeria if properly harnessed.

These opportunities that abound in agriculture necessitated the age-long mandate of the Food and Agricultural Organization (FAO) to reduce world hunger by half from its 1990 level by 2015. This has made it even more important to look at ways of increasing agricultural productivity, especially in Africa where most of the agricultural producers are subsistence farmers (FAO, 2010). These farmers,among other things, depend on information that will improve their approach to agriculture based on recent technological innovations through agricultural communication, which in recent time has been expanded by the introduction of Mobile Telephony System (MTS).

Agricultural communication as a field of study in this regard focuses on communication about agriculture-related information among agricultural stakeholders establishing various forms of communication ranging from one-to-one communication (inter-personal communication) to one-to-many communication (mass communication). This makes Mobile Telephony System (MTS) a viable Information and Communication Technology (ICT) tool

that enables farmers gain useful agricultural-related information on ways of increasing agricultural productivity especially in developing countries.

Studies have shown that one of the major setbacks to all the previous attempts made by successive Nigerian governments in the agricultural sector is the activities of middlemen in the procurement and distribution of fertilizers and other farm inputs (Jato & Terna, 2015; Adebo, 2014; Fadairo, O. S., Nathaniel, S., Olutegbe, Adewale, M. & Tijani, 2015).

Recognizing the need to extricate the middlemen in the procurement and distribution chain so as to do away with the monumental fraud in fertilizer and other farm input distribution, the then minister of Agriculture, Dr. Akinwumi Adesina, in May, 2012 saw the need to introduce Mobile Telephony System (MTS) in the e-wallet (Electronic wallet) scheme which is first-of-its-kind in Nigeria (Jato & Terna, 2015). The e-wallet scheme is a programme that uses Mobile Telephony System as one of the mobile phone technologies adopted in the agricultural sector. It is a system that allows farmer have access to fertilizers and other farm inputs through subsidized electronic vouchers delivered directly to the farmers' mobile phones after which the vouchers are used like cash to purchase the inputs directly from agro dealers.

Reports from the Pilot Study of the E-wallet programme indicating the extent of Mobile Telephony System usage among rural farmers show that South East Nigeria recorded the lowest in the use of the MTS to access fertilizer and other farm inputs with Abia and Ebonyi states not having any records (NRAP Survey, 2013). This study then sought to investigate into the authenticity of such claim and provide the basis for the credibility of the report.

1.1 Background of the Study

As the population of Nigeria and that of other countries of the world continues to grow rapidly, the need to feed the people becomes a major concern. For more than four decades, the Nigerian government has made several attempts to support the agricultural sector through the procurement and distribution of fertilizer and other inputs to farmers in the country (Jato & Terna, 2015). These efforts have been bedevilled by different shades of sharp practices. According to Okunseinde (2015), these efforts failed due to 'government reliance on a broken and corrupt system resulting to the siphoning of billions of dollars and a small percentage of farmers actually receiving the inputs'.

An avalanche of policies and programmes have been initiated by past governments in Nigeria since independence in 1960 but the growing corrupt system with each new approach adopted by successive administrations have kept the economy of Nigeria in muddy waters. Some of the programmes adopted by different governments in Nigeria to achieve self-sufficiency include but not limited to the following: -

(a) National Accelerated Food Production Programme (NAFPP) in 1973

(b) Agricultural Development Project (ADP) in 1975

(c) Operation Feed the Nation (OFN) in 1976)

(d) River Basin Development Authorities (RBDA) in 1977

(e) National Seed Service (NSS) in 1977

(f) Agricultural Credit Guarantee Scheme (ACGS) in 1977

(g) Rural Banking Scheme (RBS) in 1977

(h) Green Revolution (GR) in 1979

(i) Directorate of Food, Road and Rural Infrastructure (DFRRI) in 1986

(j) National Agricultural Land Development Authority (NALDA) in 1992

(k) National Fadama Development Project (NFDP) in 1992

(l) Nigeria Agricultural Co-operatives and Rural Development Bank (NACRDB) in 2000

(m) National Agricultural Development Fund (NADF) in 2002

(n) Commodity Marketing and Development Companies (CMDC) in 2003

(Source: Ayanda and Subar, 2015)

The MTS was designed for small-holder farmers in the e-wallet scheme of the Growth Enhancement Support Scheme (GESS) under the Agricultural Transformation Agenda (ATA) of the then president of Nigeria, Goodluck Ebele Jonathan in 2012. These small-holder farmers appear to be the most hit and vulnerable by the impropriety in the fertilizer and other input sector of the Agriculture Ministry (Fadairo et al, 2015). According to the GESS Project (2012) cited in Fadairo, et al (2015) the criteria for farmer's participation in the e-wallet system includes:

- Farmers must be above 18 years
- Farmers must have participated in a survey authorized by the government to capture farmers personal detailed information
- Farmers must own a cell phone with a registered SIM card and have at least sixty (60) naira credit in the cell phone.
- The fulfilment of these conditions guarantees the issuance of an e-wallet voucher to the farmer.

The voucher is used to redeem fertilizers, seeds and other agricultural inputs from agro-dealers at half the cost (Signal Alliance, 2014). However, Adebo (2014) further added that for an agro-dealer to participate in the programme, he/she must own a cell phone with a registered SIM card, understand the process of using the MTS in the e-wallet program, and attend training programmes designed for the project. The agro-dealers are required to conduct

honest business and guide against fraud; choose and prepare a location for the business transaction; provide storage facilities and be available at the appropriate time to attend to farmers' needs.

Figure 1.1:*A typical message received by a rural farmer through the Mobile Telephony System*(Martin, 2010)

Other important personalities in the scheme are the help line personnel and redemption supervisors. Each state Agricultural Development Project (ADP) supplied the help line staff, and about 3-5 help line Area. The help line staff and supervisors connect to the farmers on a daily basis to attend to their needs. The redemption supervisor helps in verifying farmer's identity as well as farmer's code in the text message received by the farmer, and then compares it with the name and code listed in the farmer'sregister, which the supervisor received from the cellular. The subsidized farm inputs are delivered directly to farmer through their mobile phones. (Fadairo et al 2015).

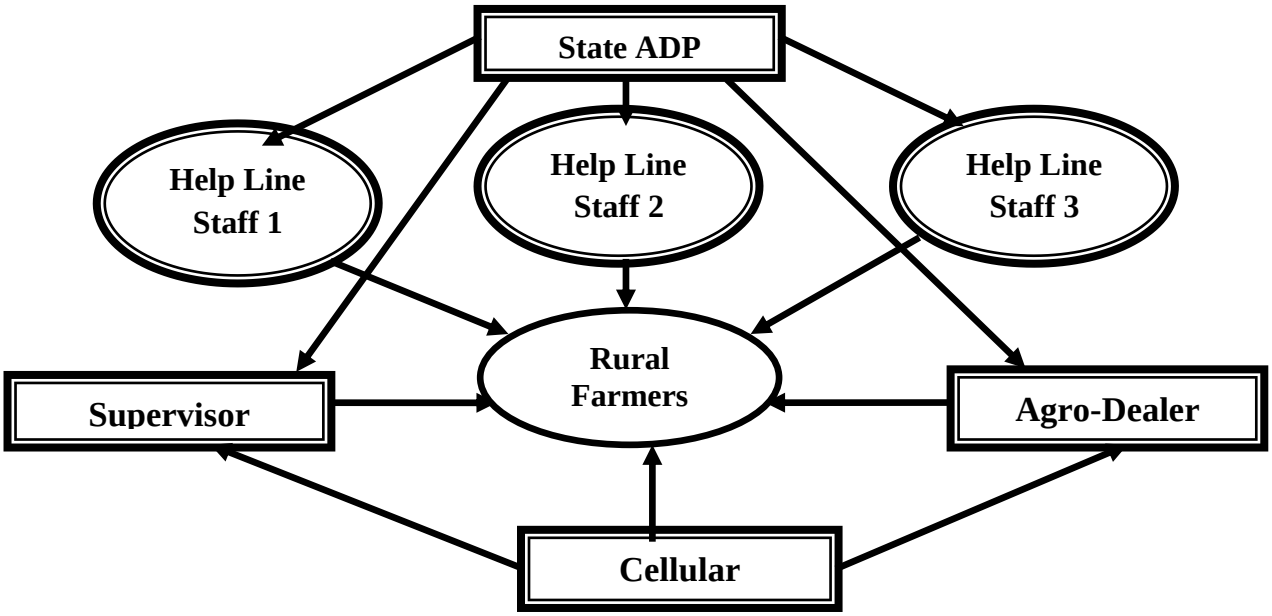


Figure 1.2:*Graphical representation of Stakeholders in the E-Wallet Program that uses the Mobile Telephony System*(as designed fromFadairo *et al.*, 2015)

Studies have shown that this project is expected to provide the necessary linkage between farmers and the government; thus enabling government to disseminate valuable agriculture-related information to the farmers, thereby ensuring farmers' progress (Ezeh, 2013; Fadairo et al, 2015).

In the MTS, the government of Nigeria totally withdraws itself from both the procurement and distribution of the farm input. However, government also ensures the overall involvement of the private sector in agricultural input supply, News Agency of Nigeria (NAN) (2012). According to the Federal Ministry of Agriculture and Rural Development (FMARD, 2011), about 14 million farmers were registered for the scheme throughout the federation. Inputs were distributed along seasonal production cycles to farmers for their needs and interest, for which the programme was primarily designed.

Figure 1.3:*A smiling farmer who had just redeemed seeds and fertilizers using Mobile Telephony System (in the e-wallet scheme) from an agro dealer*(as designed fromFadairo *et al.,* 2015)

The Africa Agriculture Status Report (AASR) (2015) has it that within one year of the introduction of the MTS in the e-wallet scheme, it has reached a total of 1.7 million farmers; fertilizer companies sold USD 100 million worth of fertilizers directly to farmers, instead of the government. Seed companies sold USD 10 million worth of seeds directly to farmers. Banks lent USD 20 million to seed companies, fertilizer companies and Agro-dealers. The default rate under the scheme was zero percent and targeted farmers produced an additional food supply of 8.1 million MT, which was 21% above the target set for the program in the first year (Source: Adesina/IFAD, 2013).

Below is a table showing the outcome of the pilot phase of the MTS used in the e-wallet program in fertilizer distribution across the six (6) geo-political zones in Nigeria.

Table 1: Report on the pilot phase of the Growth Enhancement Support Scheme (GESS) in the six geo-political zones of Nigeria in 2012

Geo-political zones/ states	**Input (Fertilizer)**	**Quantity Received**	**Quantity Distributed**	**Timeliness of Receipt**
(North East) Adamawa Gombe	NPK Urea NPK & Urea	9,344.2MT 8,443.3 MT 281,466 bags	7,239.4MT 6,557.25MT 261,466 bags	Supply of fertilizer was early Supply of fertilize was early
(North West) Kaduna	NPK Urea	20,056. 5 bag 20,056.5 bags	20,056. 5 bag 20,056.5 bags	Supply of fertilize were early
Kebbi	NPK Urea SSP	538,829 bags 212,189 bags 8,000bags	538,829 bags 212,189 bags 8,000bags	
Sokoto	NPK Urea Agrolizer SSP	284,230 bags 284,230 bags 5,900 bags 600 bags	284,230 bags 284,230 bags 5,900 bags 600 bags	Fertilizer were supplied late
Zamfara	-	37,680 MT	37,680 MT	

(NRAP, Survey, 2013, wet season in Nigeria)

Geo-political zones/ states	**Input (Fertilizer)**	**Quantity Received**	**Quantity Distributed**	**Timeliness of Receipt**
(North Central)				
Benue	NPK Urea	22,723 MT 12,755 MT	8037.95 MT (Combined)	
Kogi	Urea NKP SSP (Soya bean) NPK (agbadu) NPK (Cassava) NPK (Sesame) Urea (Sesame)	1130,306 bags 124,837 bags 3,000 bags 800 bags 2,400 bags 300 bags 300 bags	1130,306 bags 124,837 bags 3,000 bags 800 bags 2,400 bags 300 bags 300 bags	All fertilizers supplied were early 127,572 farmers benefits from e-wallet fertilizer distribution
FCT	NPK Urea SSP	4291.15 MT 4,796.6 MT 200 MT	4291.15 MT 4796.6 MT 200 MT	Fertilizer were supplied early 8523,95931 & 2000 farmers obtained NPK, Urea & SSP respectively
Kwara	Urea NPK	53450 bags 5400 bags	53450 bags 5400 bags	Supplies were early 83,700 farmer benefited
Nasarawa	Urea NPK	3151 MT 3948.90 MT	3151 MT 3948.90 MT	Supplies were early
Niger	NPK Urea	27,000 MT 27,000MT	6739 MT 6744 MT	Supplies were early
Taraba	NPK Urea	9130.85MT 9130.85 MT	9130.85MT 9130.85 MT	Supplies were early 182617 farmers benefited

(South-West)				
Ekiti	NPK (15:15:15) Urea NPK (12:12:17) Teractive	48222 bags 50022 bags 3000 bags 1500 bags	48222 bags 50022 bags 3000 bags 1500 bags	
Lagos	NPK	33,050 bags	33050 bags	
Ondo	NpK (15:15:15)	21,66 bags 15,811 bags	21666 bags 15811 bags	18443 farmer benefited
Ogun	NPK Urea	955.22MT 955.22 MT	955.22MT 955.22 MT	Supply of fertilizer was early
Osun	-	-	-	-
Oyo	Teractive NPK (12:12:17) SSP Urea NPK (15:15:15)	8.75MT 210 MT 90 MT 4774.15 MT 4774.15 MT	8.75MT 210 MT 90 MT 4774.15 MT 4774.15 MT	Supply of fertilizer was late
(South-East)				
Anambra	NPK Urea	3,618.3 MT 4,601.4 MT	3,618.3MT 4,601.4MT	Supply of fertilizer was early
Ebonyi	-	-	-	-
Enugu	NPK Urea	18,809.5 MT 30,623 Mt	18,809.5 Mt 30,623.0 MT	Supply of fertilizer was early
Imo	NPK Urea	2,460 MT 2,460 MT	1193.15 MT 1193.15 MT	Supply of fertilizer was early
Abia	-	-	-	-

(South –South)				
Akwa-Ibom	NPK Urea	186000 bags	186000 bags	Supply was early & 6200 farmers benefited
Bayelsa	NPK & Urea	1336.6 MT	1336.6MT	
Cross River	NPK Urea	5000 MT 4930 MT	5000 MT 4930 MT	Supply was early & 99300 farmers benefited
Delta	NPK (20:10:10) Urea NPK (12:12:17)	6340.25 MT 1964.5 MT 90 MT	6340.25 MT 1964.5 MT 90 MT	Supply was late 126,555 farmer benefited
Edo	NPK & Urea	5,850 MT	4775.05 MT	Supply was late 47,928 farmers benefited
Rivers	NPK Urea	38,255 bags 38,255 bags	38,255 bags 38,255 bags	Supply was early

(Source: **NRAP** Survey, 2013 wet season in Nigeria)

The need to harness the opportunities abound in mobile technology via MTS in communicating agricultural related information to rural farmers is vital in achieving sustainable development in the agricultural sector. Research findings have proved that mobile phones, radio and television are the most important tools of communication which can be accessed by farmers for agricultural related information (Olaniyi, 2013; Chhachhar, A.R., Querestic, B., Khushk, G.M. and Ahmed, S. 2014; Syiem and Raj, 2015). Most significantly, mobile phone has been reported to increase the opportunity of getting access to the people living in rural areas (Gupta, 2005).

Research findings have also shown that the use of mobile technology has set an unprecedented pace despite the poorly developed rural electrification. Also, mobile technology has provided multi-dimensional benefits to the rural people. For instance, Oyeyinka and Bello (2013) reported that farmers use mobile phones to know the market days; where products could be sold and identifying different market locations for efficient marketing of produce. Also, Mtega and Msungu (2013) added that calls and short messaging services (SMS) are mostly used by farmers to gain knowledge of agricultural related information and also access to agro input needed during farming activities.

1.2 Statement of the Problem

Agricultural communication, which focuses on the use of Mobile Telephony System in disseminating agricultural related information and ideas to rural farmers, is perceived as a catalyst for change in agro-input delivery in the Agricultural sector in Nigeria and the world at large. While Nigerians have vast access to various mobile networks, it is not certain how they use mobile phones for agricultural communication, especially farmers, in the area of access to farm inputs as well as factors that affect their use of the technology.

Review of available literature shows that lack of key information on agricultural related issues among farmers which can improve productivity and sales has been responsible for the low output delivery and poor market turn-over recorded in most developing countries (Anjum, 2015; Wei & Zhang, 2008; Martin, 2010, Aker, 2011; Vodafone Group & Accenture, 2011; Baumuller, 2015).

Anjum (2015) argues that farmers do not have enough key information of agriculture market to get a good price and sometimes they could not get market where they could sell their

products on time especially for products that have short life span. He added that these farmers rely on other farmers as source of information and they often depend on middlemen who take advantage of their illiteracy or unawareness of market information.

In Nigeria, the Mobile Telephony System adopted in the e-wallet scheme by the Federal Ministry of Agriculture and rural Development (FMARD) in 2012 was aimed at correcting the age-long corrupt practices witnessed among middlemen in fertilizer and seed distribution among rural farmers. Studies have shown that input supply to rural farmers were bedevilled by poor market knowledge of farmers which if addressed through the use of Mobile Telephony System the strength of middlemen against these rural farmers will be weakened (Ifejika et al, 2015; Adebo 2014; Jato & Terna, 2015; Ayanda & Subair; 2015; Fadairo et al, 2015; Ifejika & Oladosu, 2011; Okunseinde, 2014).

Scholars also believe that the mechanism for the effectiveness of the Mobile Telephony System in the distribution of farm inputs among rural farmers depends on several factors which include: Timeliness (for both the farming system and delivery of its services), Cost of using the technology, Technical know-how (in terms of skill and language of communication known to farmers) as well as Constraints to adoption of such technology (Sunding & Zilberman, 2001; Anjum, 2015; Martin, 2010; Baumuller, 2015).

In the light of the above submissions, how has the use of Mobile Telephony System (MTS) equipped rural farmers with the necessary agricultural related information, which is believed to weaken the strength of the middlemen? Considering the educational level of these farmers and their socio-economic disposition to this technology, to what extent has the use of MTS addressed the age-long corrupt practice witnessed in fertilizer distribution among rural

farmers in Nigeria? How well have rural farmers utilized the MTS in accessing agro input in view of their ability to pay, their skills and competence to use the technology as well as the usefulness of its contents and functions?

1.3 Objectives of the Study

The broad aim of this study was to assess the utilization of mobile telephony in agricultural communication among rural farmers in South East Nigeria. The choice of mobile telephony utilization in agricultural communicationis underscored by the fact that the system is novel (i.e. first-of-its-kind in Nigeria).

In line with the purpose of the study, the following specific objectives are outlined:

(1) To establish the extent of mobile phone ownership and use among rural farmers in South East Nigeria.

(2) To ascertain the extent mobile telephony is utilized in agricultural service delivery in South East Nigeria.

(3) To determine whether rural farmers in South East Nigeria use mobile phones to access farm inputs and agricultural advisory services.

(4) To find out whether these farmers use the mobile phone platform to learn about fertilizer distribution.

(5) To determine the factors that motivates rural farmers' utilization of Mobile Telephony in Fertilizer distribution in South East Nigeria.

(6) To examine the constraints in the use of mobile telephony in fertilizer distribution among rural farmers in South-East Nigeria.

1.4 Research Questions

In order to explore the stated specific objectives for this study, the following research question wereformulated: -

(1) How many rural farmers in South East Nigeria own and use mobile phones?

(2) To what extent is mobile telephony utilized in agricultural service delivery among rural farmers in South East Nigeria?

(3) What number among rural farmers in South East Nigeria use mobile phones to access farm inputs and agricultural advisory services?

(4) Who among these farmers use the mobile telephone platform to learn about fertilizer distribution?

(5) What factors motivated the rural farmers in South East Nigeria to use the Mobile Telephony System in Fertilizer distribution?

(6) What are the constraints in the use of mobile telephony in fertilizer distribution among rural farmers in South-East Nigeria?

1.5 Scope of the Study

The study used the pilot phase of the e-wallet scheme where Mobile Telephony System was used for the first time as a basis for the investigation of MTS use in agricultural communication among rural farmers in south east Nigeria. This pilot phase lasted for one year (i.e. from July 2012 – June, 2013). Registered farmers who took part in this pilot phase of the scheme in South East Nigeria were the study unit as well as the ADP staff, GESS staff and other key stakeholders.

Another aspect of the scope of this study is on the content. This has to do with agricultural communication with particular emphasis on Agricultural Extension Services, Agricultural Advisory Services and Access to Fertilizer as well as learning more about farm inputs using the Mobile Telephony System.

More specifically, this study focused on fertilizer distribution (as one of the farm inputs) which rural farmers accessed using the Mobile Telephony System because the report of the pilot phase of the MTS use in the e-wallet scheme was on fertilizer alone.

1.6 Significance of the Study

The findings from this study are significant in agro-economy, which is the maximization of all economic advantages that are possible in achieving increased productivity in agriculture. They are also useful in agricultural communication as they provide the current status of MTS use among rural farmers in south east Nigeria. Any government that aims at achieving food security must promote agricultural technology through agricultural communication, which has the capacity of increasing both quality and quantity of farm produce at the rural level. This also underscores the significance of this study in revealing the current status of the use of mobile telephony (as a modern agricultural technology used in the e-wallet scheme for the first time) in the distribution of farm inputs in Nigeria.

The findings from this study also serve as an eye-opener to all stakeholders in the agricultural sector (especially in south east, Nigeria) to properly harness the various opportunities that abound in the use of mobile phone technology in agricultural development in the area of extension services among small holder farmers in rural areas.

Empirically, this study has added to the existing literature by filling the gap as regards the current status of mobile telephony system in agricultural extension services among rural farmers in south eastern Nigeria. The findings established the fact that the Mobile Telephony System can now be used with other devices other than mobile phones.

Theoretically, the findings in this study underscored the tenets of the Technology Acceptance Model as its findings agree with the fact established in the theoretical review that the "Ease of Use" and "Usefulness" of any technology (i.e. Mobile Telephony System) determines its adoption and continual use respectively.

1.7 Definition of Terms

The following terms were defined as they relate to this study:-

- **Adoption**: This means the tendency to use or the acceptance of a given technology which the individual shows a favourable disposition towards its use in the future based on some perceived benefits or advantages.
- **Agricultural Communication:** In the context of this study, "Agricultural Communication" means all forms of communication that uses Mobile Telephony to share agricultural related messages to rural farmers using different techniques involving one-to-one or one-to-many communication.
- **Agricultural Services**: These include all the services that enable farmers have access to farm inputs like fertilizer and other agriculture-related information, which also involves the activities of other stakeholders in the procurement and distribution of these farm inputs.
- **Competence**: This has to do with being able to use a given technology well so as to fully maximize its usefulness.
- **Compliance:** In the context of this study, it means using a given technology as specified based on previous training and achieving the anticipated result.
- **Distribution**: In the context of this study "distribution" means "sale" of farm inputs.

- **E-wallet**: This is an agricultural program where farmers use their mobile phones to receive agriculture-related information on the availability of farm inputs and can also serve as a means of payment for such farm inputs.
- **Fertilizer:** This is a chemical substance used to make the ground suitable for growing crops. In this study the following types of fertilizers were investigated: NPK, Teractive, SSP, Urea and Agrolizer
- **Knowledge**: It is a state of gaining information on how to use o given technology which is well understood to the extent of putting such information into productive use in order to achieve a given result as anticipated.
- **Mobile Phone:** A device with access to a cellular radio system so it can be used over a wide area, without a physical connection to a network.
- **Mobile Telephony**: This is the provision of telephone services to mobile phones, which may move around freely, rather than stay fixed in one location. Here the mobile phones connect to the terrestrial cellular network of the base stations.
- **Rural Farmer**: This is a farmer who does not reside in the town and who engages in subsistence farming with a land mass area of less than 10 hectares.
- **Skill**: This has to do with the ability to use a given technology based on continuous exposure to the technology and training.
- **Utilization:** This has to do with the use of Information Communication Technology (i.e. Mobile Phone) in various forms suitable to the characteristic disposition of its users (i.e. rural farmers).

CHAPTER TWO

LITERATURE REVIEW

This chapter reviews all the relevant related literature that covers the different aspects of this study as they relate to the objectives of the study. Hence, this study explored the following broad sections: conceptual review of related literature (i.e. The Concept of Agricultural Communication, The Concept of Rural Farmer, The Concept of Mobile Telephony, The Concept of Utilization, The Concept of Adoption and The Concept of E-wallet); review of empirical studies on: Level of Knowledge and skill on Mobile Telephony Utilization, Factors that enhance Mobile Telephony Utilization as well as studies on the Mobile Phone Technology Adoption in Africa and Nigeria; Current Trends in Mobile Telephony Adoption and its Constraints. There is also a section on Theoretical Review which examines related theories to explain the key variables in the study. Lastly, this chapter contains the Summary of Literature Review and Research Gaps.

2.1 Conceptual Review of Related Literature

This section contains review of literature on:The Concept of Agricultural Communication, Rural Farmer, Mobile Telephony, Utilization, Adoption and E-wallet.

2.1.1 Agricultural Communication

The concept of Agricultural Communication emerged out of the relevance of communication in the agricultural sector which enables farmers and other agricultural stakeholders to share information, ideas or messages through identifiable channels for increased productivity.

Lack of key agricultural information that can help increase productivity using modern technology among rural farmers have been identified by Scholars as the major setback to agricultural development. This underscores the place of agricultural communication where

there are established levels of communication ranging from one-to-one (i.e. Inter-personal) to one-to-many (i.e. group or mass) communication between farmers and agricultural extension agents.

Scholars have also argued that the different forms of agricultural communication are of great importance because the knowledge they will provide will aid understanding of the operations of agricultural activities among farmers as well as enable them predict outcomes based on knowledge gained from the communication process (Howell and Hebron, 2004; Boz and Ozca, 2010; Okwu and Daudu, 2011). These forms of agricultural communication within the context of this study include: E-payment, Agricultural Services, Learning about Fertilizer, Agricultural Advisory Services, Agronomic Practices and Market Information.

They further explained that exposure to and use of various communication channels within the agricultural communication framework is a pre-condition for any effect of agricultural information content on the people to occur. Adding that, the influence of any medium in a communication situation or on the message depends not merely on the type of media used but on how it is used or the use to which it is put. Here, emphasis is on the suitability of the agricultural communication content as well as the means through which such content is communicated to the target group (i.e. Rural Farmers) in meeting their agricultural needs.

In explaining the relevance of agricultural communication in increasing agricultural productivity, Orata (2014) pointed out that lack of knowledge of the information needs of users constitutes formidable barriers to information communication. Adding that, information agents seem to be ignorant of users' information needs. He also argued that lack of cooperation among related information systems create barriers to information. What this implies is that appropriate agricultural information targeted at meeting farmers' needs for

increased productivity is largely hindered by either the inappropriate mechanism for disseminating such information or the inability of farmers to either access or understand the content of such information.

The design of agricultural communication contents must bear in mind the communication needs of the users (i.e. Rural Farmers). Such contents should also be made accessible to these rural farmers considering their location and the level of infrastructure available that can aid their use of modern technology.

Barne (1990) noted that access to modern communication media makes rural lives more productive and comfortable; adding that today's rural farmers now make use of audio-visual equipment's like radio, television, video, mobile phone and so on. In his understanding of the concept of agricultural communication in meeting the needs of the rural farmer, Ajakaiye (1978) suggested that agricultural shows and exhibitions should be used to educate farmers on improved methods of farming.

According to him, it offers opportunity to farmers to see and consider for adoption, results of materials used in research institutes and agro-allied concerns and it helps farmers in assessing the success of previous efforts and in formulating policies that would help farming population of rapid agricultural development.The use of modern technology in agricultural communication has been shown to be useful in bridging the information gap between the information providers and the information agents and rural farmers.

Studies reviewed have shown that inter-personal communication channels (like Mobile Phone) were found to be more accessible and used by rural farmers than the mass media to obtain information on improved farm technologies in Nigeria (Barne, 1990; Adebayo, 2015;

Aina, 1998; Ajakaiye, 1978).These Scholars also argued that extension agents were not readily available and used by the farmers as most of the rural farmers lack the skill and competence in the use of modern technology in agricultural communication.

Having considered how scholars examined the concept of agricultural communication as it relates to farmers' access and use of modern technology, the concept of agricultural communication within the context of this study emphasizes the use of mobile technology to share information, ideas and messages on agricultural services and activates among the stakeholders in the agricultural sector in Nigeria (i.e. Extension Agents, Information Providers and Farmers).

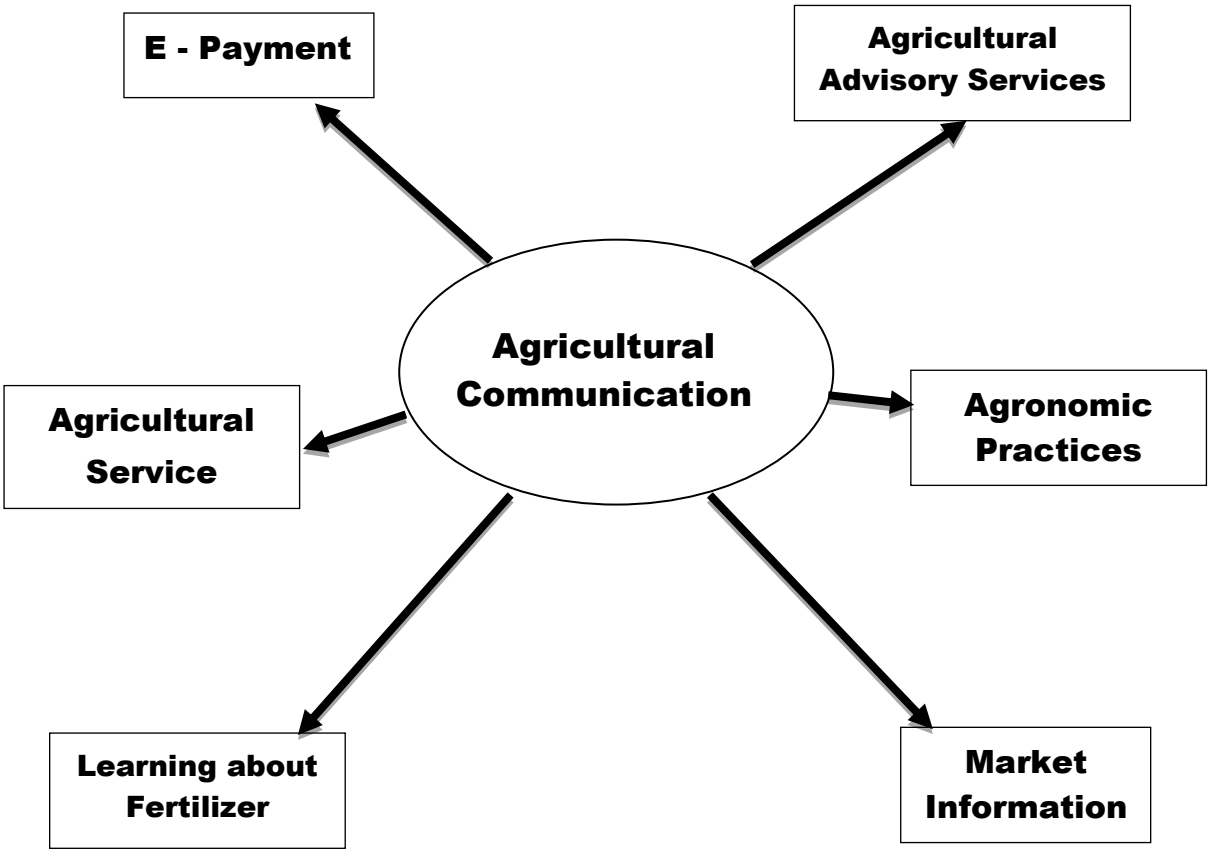


Figure 2.1:Conceptual Framework of different forms of Agricultural Communication (as designed from Howell and Hebron, 2004; Boz and Ozea, 2010)

2.1.2 Rural Farmer

The concept of "Rural" used in relation to Farmers has been shown in literature to be associated with the geographical location of farmers. This location is characterised by the absence of basic infrastructure like good road network, power supply and sometimes poor network connectivity for using mobile phone (Agboola, 2007; Okwu and Daudu, 2011; Adebayo, 2015).

From the report of the pilot phase of the GESS (2013), the average age of rural farmers in South East Nigeriais put between 40 – 50 years with an average household size of 5 – 10 persons. The major crops grown by these farmers include: Maize, Yam and Cassava. According to Agboola (2007) rural farmers are farmers who produce at subsistent level purely to keep themselves and members of their families going. Adding that they lack the inputs and implements, thereby making farming vary tasking and unattractive.

Thischaracteristic description of the rural farmer underscores the need for the introduction of modern agricultural technique and practice that can improve productivity. Agboola (2007) further asserted that despite the enlightenment campaigns on television, these rural farmers are yet to embrace the modern agricultural innovations that guarantee food sufficiency. He argued that apart from ignorance and adherence to old values, belief and norms, modern infrastructures are yet to be found in these rural areas. These challenges result in agricultural output being so poor to the detriment of the larger population in the towns and cities who depend on these rural farmers for food.

In the words of Soola (1988): “The Nigerian non-literate farmer lives in the rural areas where, incidentally, most Nigerians have their roots; he has access to about 80% of the total land resource and is responsible for over 95% of the nation’s agricultural production.” He sees the Nigerian non-literate farmer as being marginalized, adding that though he owns a considerable landmass but he suffers a great deal of deprivation occasioned by neglect from successive governments, researchers, extension agents, agricultural input suppliers, banks and other financial institutions.

He further stated that these farmers engage in subsistence farming with traditional methods of farming, which force them to engage in mixed cropping which inevitably reduces yields even when all necessary technological inputs have been added. According to Bello and Obinne (2012), the rural farmers in Nigerian context are suspicious of all new ideas, especially ideas from theoretical people such as scientists and extension officers. Adding that culture of the society where these farmers live is also another major factor that informs their suspicious disposition.

They further explained that most rural farmers do not understand the principles of scientific agriculture and have little interest in gaining information on these principles. They see their farms as ways of life and strive hard for incomes, whichare considered reasonable within their communities.

The above picture about the characteristics of rural farmers shows the relevance and need for the introduction of agricultural communication that addresses their basic needs with the aim of improving productivity. This can only be made possible if these farmers are carried along with up-to-date technologies in modern agricultural practice.

From the review of literature on the concept of rural farmer, it is evident that rural farmers are generally seen as a disadvantaged group in the society who incidentally occupy a key position in ensuring economic growth in the area of increased productivity and food security.

However, within the context of this study, a rural farmer is one who does not reside in the town or city and also engages in subsistence farming with a landmass area of less than 10 hectares, who also produces crops along identifiable value-chain.

2.1.3 Mobile Telephony

The concept of mobile telephony has been used in different context by different scholars within the scope of agricultural communication. These various approaches examined the concept of mobile telephony as a channel through which farmers gain access to or knowledge of information related to agriculture which will improve productivity.

In conceptual terms, Jagun, Heeks and Whalley (2008) in their study confirms the need to understand mobile telephony as relating to mobile phones which are devices for communicating of information. According to them, before anyone can build analysis on an informational foundation, he/she must first understand the role of information in the phenomenon under investigation. Adding that, it is only then that one can move into the study of mobile telephony.

Agricultural innovations, one of which is mobile telephony, were adopted to solve the information needs of farmers and the technology to facilitate this is found in mobile telephony. According to Agbamu (2006), farmers' decision making usually involves

choosing a course of action from a number of alternatives that will enable the farmer achieve his or her objectives. In most developing countries, the typical farmer often makes decision based on inadequate information and conflicting interest and his ability to analyse complex environment in which decisions are made is limited. Most Scholars share the thought that mobile telephony as a concept in agricultural communication deals with the channel through which farmers gain access to information especially as it concerns agricultural services that will improve productivity (Levi, 2015; Kwadwo and Ayalew, 2011; Jensen, 2007; Mittal and Mehar, 2012; Aker, 2010; Aker and Mbiti, 2010; Donner, 2006; Nyamba and Mlozi, 2012; Harker and Akkeren, 2002; Donner, 2008).

Mobile phones are without doubt the most ubiquitous communication technology in rural areas in developing countries. Studies have also shown that the widely used Information and Communication Technology (ICT) gadget in rural areas in developing nations is the mobile phone (Dire, Onu, Jungur, Ndaghu and Giroh, 2016; Mabe and Oladele, 2012; Ndaghu, 2011; Omotesho, Ogundele and Muhammad, 2012).

Mobile phone penetration stood at 10% in Africa in 1999 but later rose to 62% in 2002. From the current Pew Research reports (July, 2017) the current status of mobile phone penetration in Africa is about 80% of its population (i.e. about 2.16 billion) while that of Nigeria stood at 84% which is estimated to be about 162 million people who now own mobile phones. Nigeria and South Africa ranked highest in mobile phone penetration in Africa. Today, nine out of every ten Nigerians own a mobile phone and it is found mostly among the educated ones (Pew Research Centre, 2017). This rapid acceptance and use of mobile phones has brought new economic and social development possibilities to the continent, generating a great deal

of speculation and optimism regarding their effect on economic development in Africa (Mutunga and Waema, 2016).

Scholars believe that the spread of the concept of Mobile Telephony in Africa has the tendency of boosting the Gross Domestic Product (GDP) growth of the continent (Mutunga and Waema, 2016; Vodafone_Accenture, 2011; Waema and Okinda, 2010). According to Mutunga and Waema (2016), due to the wide spread of mobile phones in Africa, policy makers, mobile network operators and media have touted the poverty eradicating potential of mobile phone communication. For instance, Vodafone_Accenture (2011) reported that in a typical developing country, an increase of 10 mobile phones per 100 people boost GDP growth by 6 per cent. Also, Ashraf (2008) cited in Mutunga and Waema (2016) notes that it is with this in mind that developing countries have been rushing to implement ambitious mobile phone for development projects in rural areas through direct and indirect supervision of institutions such as the World Bank, the United Nations (UN) and other donor/local agencies.

Other researches carried out in Ethiopia, Uganda, Tanzania and China have shown that mobile telephony can be used to provide information to the farmers and rural residents through Short Message Service (SMS) and multimedia-supported systems (Martins and Abbott, 2008; Wei and Zhang, 2008; Nyamba and Mlozi, 2012; Chhachhar, Qureshi, Khushk and Maher, 2014; Tadesse and Bahiigwa, 2015). This agrees with the previous studies mentioned earlier in this study that relates the concept of mobile telephony to the mobile phone device which is used to access information especially as it relates to agricultural services.

But amid all these, little has been shown in literature on how mobile telephony is utilised in agricultural communication among rural farmers especially in South East Nigeria. Hence, in this study the concept of Mobile Telephony has to do with telephone services provided through mobile phones and used by rural farmers to access fertilizer and other agricultural services for their farming activities. The agricultural-related information contained in the mobile phones is aimed at improving productivity for the rural farmer. Based on the foregoing, the concept of "Mobile Telephony" is used interchangeably with the concept of "Mobile Phone" in this study based on the established relationship between the former and the latter from the conceptual review of literature in this study.

2.1.4 Utilization

According to the *English Oxford Dictionary* (2018), the term "Utilization" means "the action of making practical and effective use of something." It is a deliberate activity that involves conscious decision making. The word "Utilization" has been used by Scholars to mean the act of using materials, products technologies and services to make things function, extend the lifespan of machineries; improve durability of materials and other things that can lead to better performance and less risk of damage (Wei and Zhang, 2008; Oyeyinka and Bello, 2013; Olaniyi, 2016).

This was explained in relation to what rural farmers do with technologies and other innovations to enable them have access to agricultural information that can increase productivity based on the expanding nature of agricultural communication which is established in mobile technology.

Most of the studies reviewed on the concept of "Utilization" used it in relation to mobile phones to mean "Use" (Dire, et al. 2016; Nyamba and Mlozi, 2012; Masuka, Matenda, Chipomho, Mapope, Mupeti, Tatsvrei and Ngezimana, 2015; Wei and Zhang, 2008; Waema and Okinda, 2010; Gordon, 2007; MacNamara, 2003; Duncombe, 2012; Hellstrom, 2010). The concept of utilization in mobile telephony presupposes that the user of the mobile phone must have had knowledge and developed skill in dialling numbers or sending SMS. Wicander (2010) pointed out that educated mobile phone users prefer SMS to calls while the uneducated ones prefer calls to SMS due to their low literacy level.

On the category of those who use mobile phones most (based on income level), studies have shown that countries classified by World Bank as "low-income" and "lower-middle income" constitute 75% of the world population and they own 44% of mobile phones spread across the world (ITU, 2007; World Bank, 2007; Donner, 2008). In the near future, it is believed that more than half the number of mobile phones in the world will be in the developing world (Donner, 2008).

Usage patterns of mobile phones can be seen as an everyday affair but it depends on the context of its use. Traxler (2006) believes that in developing countries, mobile, nomadic and handheld technologies have the capacity to gather, store, deliver and enhance information in ways that are completely different from countries where mains electricity, computer hardware and internet connectivity are stable, reliable, cheap and abundant. Studies have also shown that the use of mobile phones among rural farmers has enhanced their ability to access timely market information (Sife, Kiondo and Lyimo-Macha, 2010; Nyamba and Mlozi, 2012; Dire, et al. 2016). It has also enabled farmers to extract useful and up-to-date information from social and business networks (Overa, 2006).

Furthermore, the use of mobile phones had helped farmers make tentative decisions much more easily than when they had none (Ilahiane, 2007). Studies have shown that the use of mobile phones among rural farmers has increased the rate of flow of information which provides early warning on potential threats or potential opportunities to farmers leading to positive livelihood outcomes (Macnamara, 2003; Duncombe, 2012; Sife et al., 2010). Mobile phone use has been shown to save time and money by substituting for journeys. The cost of calls and time for journeys when compared will reveal this relative advantage (Jagun, Heeks and Whalley, 2008). Related studies also reveal that the concept of utilization of mobile phones is seen in helping farmers make choice of where and when to sell their products based on its competitive advantage (Nyamba and Mlozi, 2012). Farmers make decisions on the best time to sell crops and livestock because they could get instant information on prices at different market places. Also, Ashraf, et al., (2005) and De Silva (2008) assert that mobile phone use can facilitate a greater export orientation in agricultural practices and marketing.

In all the studies that employed the concept of "Utilization" to mean "use" in relation to mobile phone among rural farmers, there is a common basis for its application in each of these studies. This has to do with mobile phone utilization because of its relative advantage over other ICTs which include but not limited to the following: convenience of use, fast, cheap and ease of use.

Based on the foregoing, the concept of utilization in this study will mean both "use" and "adoption" (i.e. acceptance and willingness to use) as it relates to mobile phone technology (i.e. Mobile Telephony) in Agricultural Communication among rural farmers in South East Nigeria.

2.1.5 Adoption

The concept of adoption which suggests the predisposition to use a given technology based on its perceived usefulness and benefits to the user has been used in literature basically as it concerns mobile phone utilization.

Martin and Abbott (2010) in their study on mobile phone adoption among rural farmers have revealed that the concept of adoption hinges on the premise that farmers are predisposed to use the technology because of its perceived benefits. According to them, "rural farmers in developing countries have reported a number of benefits resulting from mobile phone use in agricultural businesses."

They further added that, "of these, elimination of travel cost, saving of time and market access rise to the top positions." Also, they maintained that mobile phone adoption and use lead to observable increases in 'contacts and opportunities,' 'market access' and increases in 'efficiency resulting in greater output.'

In another study, Chhacchar and Hassan (2013) examined the use of mobile phone among farmers and clearly noted that mobile phone adoption is made possible by the fact that it saves energy and time of farmers and ultimately improves their income. They added that, "it provides an opportunity to farmers to communicate directly with market brokers and consumers for selling their products at good prices.

Aker and Mbiti (2010) examined the expectations of mobile phone adoption in most African countries. They saw a rapid increase in mobile technology adoption among some poorest countries of the world. According to them, for instance, the Kenyan-based service provider (Safaricom) projected that the mobile phone market in Kenya would reach three (3) million subscribers by 2020 adding that the service provider currently has 14 million subscribers.

They further stated that mobile phone subscribers on the continent have risen from 16 million in 2000 to 376 million in 2008. According to them, the increase in mobile phone adoption is all the more surprising considering the prevalence of poverty in sub-Saharan Africa and the price of mobile phone handsets and services. They hinged their projection on the increasing perceived benefits which users derive from adopting mobile technology.

The concept of adoption of mobile phone as used by Etwire et al. (2017) in their study varies directly with access to agricultural extension. What this implies is that farmers will be predisposed to use mobile phones so long as they can find someone to assist them on how to access the perceived benefits accruing from the technology. They further added that farmer-to-farmer extension has a larger effect on the probability of patronizing mobile phone-based weather and market information.

Adoption of mobile phone among rural farmers is also seen to be fuelled by testimonies from those who have used the technology. According to Etwire et al. (2017), "the probability of farmers patronizing mobile phone-based weather and market information is higher if they are introduced to the information platform by fellow farmers." They added that trust and personal relationship are likely determining factors for mobile phone adoption among farmers.

Farmers who have used the technology tend to recommend it to their colleagues and such recommendations seem to be credible usually because they are based on real-life experiences. This makes mobile phone adoption among rural farmers possible because farmers are almost certain to get similar results as recommended by their colleagues (Etwire, et al., 2017).

From the above studies reviewed on the concept of adoption, it is obvious that the major determining factor for mobile phone adoption is its perceived benefit accruing to users. Also, studies in literature show similar meaning shared among scholars on the concept of adoption. Most studies reviewed used adoption to mean one's predisposition to use a given technology (i.e. Mobile Phone). This predisposition is fuelled by several factors which vary from one study to another. Hence, in the context of this study, adoption is used to mean Farmers' predisposition to use mobile phone based on certain predetermined factors conceived to have enhanced its usage among rural farmers.

2.1.6The Concept of E-wallet in Nigeria

According to the *Macquarie Concise Dictionary*, the term wallet is defined as 'a small, booklice folding case for carrying papers, paper money, etc. in the pocket'. From the above definition, the idea of mobile wallet or e-wallet may have changed the concept of wallet with respect to structure but its function still remains the same, through in software form (electronically driven).

The virtual world gives a new dimension to human mobility and humans now need the ability to identify themselves and access their items of value from any point of connection to the network. These access points include: personal computer, personal digital assistants, mobile phones, set-top boxes, games consoles and internet appliances (Brent, 2001).

According to GSMA (2012) in its non-confidential GSMA white paper defines 'mobile wallet' as 'a software application on a mobile handset that function as a digital container for payment cards, tickets, loyalty cards, receipts, vouchers and other items that might be found in a conventional wallet'. It further added that such application enables the user to manage a broad portfolio of mobile NFC (Near Field Communication) services from many different companies. The above definition captures the exact structure and operations of the e-wallet concept in Nigeria. In this study, the concept of mobile wallet is used interchangeably with e-wallet (electronic wallet) having established the sameness between them both structurally and functionally. As stated earlier in this study, the e-wallet scheme is a programme that uses mobile technology system (i.e. Mobile Telephony) adopted in the Growth Enhancement Support Scheme (GESS) of Nigeria's Agricultural Transformation Agenda (ATA) under the auspices of the honourable minister for Agriculture and rural development, Dr.AkinwunmiAdesina during the leadership of president GoodluckEbele Jonathan (of the Federal Republic of Nigeria).

Adesina (2012) noted that the e-wallet program was a strategy by the federal and state governments under the ATA to provide subsidised inputs to farmers and ensure that the financial burden is sharedbetween the two levels of government.

According to JatoandTerna (2015): The e-wallet program ensures that government pays a 50% subsidy (25% Federal and 25% state) while the farmer pays the remaining 50% for each bag of fertilizer.

The policy was based upon technological, institutional and financial support 'subsidies' that are needed to transform agriculture into a viable commercial enterprise in Nigeria. They

further added that ‘this government policy is to increase fertilizer procurement and usage by small holder farmers. The policy is consistent with the aims of the Abuja food security summit of African Heads of state on food security, which sought to increase the level of fertilizer nutrients wed from the current average of 5kg/ha to an average of 50kg/ha by 2015.

This idea was also aimed at eliminating the services of middlemen that had hampered the distribution of fertilizer and other farm inputs to rural farmers. The corrupt practices exhibited by these middlemen prompted the launch of the e-wallet program where farmers now deal directly with manufacturers of these farm inputs under the supervision of other stakeholders like the ADP staff, banks and helpline officer. Studies on the e-wallet program in Nigeria have focused on rice farmers (Nwalieji, UzuegbunamandOkeke, 2015), others on livelihood and productivity of rural farmers (Adebayo andOlagunju, 2015; Fadairo, et al, 2015, Ezeh, 2013; Adebo, 2014).

There have also been studies on the e-wallet program in Nigeria among ADP (AyandaandSubair 2015; Egbule, AgwuandUzokwe, 2013) and Aguapreneur farmers (Ifejika et al, 2015; IfejikaandOladosu 2011). However, a large proportion of studies on the e-wallet program in Nigeria focused on food security/availability (Ahmed, Yusuf andDunah, 2016; AdewuyiandAyatu, 2011; Ojoko, 2014; Idachaba, 2013; Tiri, OjokoandAruwayo, 2014; Chima, 2015).

This shows a growing concern in literature on increased productivity with a sustainable agricultural technology innovation like the e-wallet (using Mobile Telephony System) which will lead to a sustained food security/availability given the growing population of the country.

However, none of these studies have been able to carry out a holistic evaluation of the use of Mobile Telephony System (as a technological innovation in the e-wallet program) in agricultural communication as it concerns fertilizer distribution which is one of the farm inputs needed for increased productivity for a sustained food security/availability. This then underscores the need for this study.

The varieties of use to which a particular mobile phone can be applied depend on the need and the kind of technology driving it. Morroni (1992) defines technological change as a variation in the method of production and/or quality of goods and services produced. Tracing the history of mobile wallet, Doan (2014) pointed out that mobile wallet developed from a concept called 'Digital wallet'. According to him: 'it dated back in 1996 when the founder of Digital wallet, Sam Pitroda, who filed the patent in the United States'. He was said to have 'professed that a digital wallet would consist of a liquid crystal display (LCD) not much bigger than a regular plastic bank card, which preferably a touch-sensitive screen and simple user interface that lets the he/she flips through a leather wallet' (Pitroda and Desai 2010 cited in Doan, 2014).

The above description agrees with the kind of mobile phone technology (i.e. Mobile Telephony System) which this study seeks to evaluate its utilization (as a technology adopted in the e-wallet scheme) in agricultural communication among rural farmers in south east, Nigeria.

A Review of the GESS Monitoring Report on the Pilot Phase of the utilization of Mobile Telephony System (used in the E-wallet Scheme) in the Distribution of farm inputs to farmers in Nigeria (Between Sept – Oct, 2012)

The agro-economy in Nigeria has huge potentials and fertilizer plays a significant role in harnessing this opportunity in crop production. Research findings reveal that farmers in Nigeria apply less than 20kg fertilizer nutrient per hectare compared to world average of 100kg. It is also established that farmers in Nigeria use less than 5% improved seeds. All these indices led to the introduction of e-wallet system in the distribution of farm inputs among farmers in Nigeria (FEPSAN, 2012).

The Growth Enhancement Support Scheme (GESS) was designed as a component of the Agricultural Transformation Agenda (ATA) of the Federal Government of Nigeria. At inception, the broad objective of the GESS was to achieve food security for the nation at the macro level and increase household income for farmers at the micro level. The scheme was designed to encourage the stakeholders in the fertilizer value Chain to work together to improve productivity, household food security and raise the income of the farmer by providing direct subsidy through the supply of discounted fertilizer and seeds. This report (GESS report 2013)was presented with the following objectives in mind: -

(1) To establish whether the GESS program was effective in delivering subsidized inputs to farmers

(2) To find out if the use of e-wallet as mechanism for administering inputs subsidy was effective

The report covers twelve (12) states (i.e. 2 from each Geo-political zone) out of the 36 states in Nigeria that were believed to have implemented the GESS program. The data gathered was through face-to-face interview and telephone interview and the key respondents include:

(i) Agro Dealers = 36

(ii)	GESS Farmers	=	780
(iii)	Non-GESS Farmers	=	60
(iv)	Banks	=	3
(v)	Fertilizer Companies	=	6
(vi)	Seed companies	=	5
(vii)	Cellulant	=	1
(viii)	National Agricultural seed council	=	1
(ix)	State GESS Coordinators	=	10
	Total	**=**	**902**

The 12 states covered in the report were: -

(1)	Abia State	=	(South-East)
(2)	Ogun State	=	(South-West)
(3)	Ondo State	=	(South –West)
(4)	Taraba State	=	(North West)
(5)	Cross-River State	=	(South-South)
(6)	Imo State	=	(South-East)
(7)	Edo State	=	(South-South)
(8)	Gombe State	=	(North-East)
(9)	Jigawa State	=	(North-East)
(10)	Kuduna State	=	(North-West)
(11)	Kogi State	=	(North-Central)
(12)	Nassarawa State	=	(North-Central)

(Source: FEPSAN, 2012).

Characteristics of GESS Farmers

The farmers that participated in the scheme were mostly male (83%) while female respondents were (17%). The top three crops cultivated by the farmers were: maize, cassava and yam. Others include: rice, guinea corn, groundnuts, millet, beans, oil palm, green leaf vegetables, soya beans, ginger, sugar cane, cocoa, watermelon, beni-seed, plantain, Okra, cocoyam, tomatoes, onions, banana, rubber, mango, moringa and kolanut. Farmers in the northern states primarily cultivated grains (e.g. beans, millet, maize, guinea corn and groundnuts) and vegetables. About one-third of the farmers surveyed (36%) were cultivating lands which were less than two hectares; hence, they were regarded as smallholders who were the target beneficiaries of the scheme. However, what this report shows is that the remaining 64% of farmer were large scale farmers, who were not the intended beneficiaries of the scheme.

Knowledge of Activation of Numbers

In order to get fertilizer or seeds under the scheme through e-wallet, farmers first have to activate their mobile phone numbers. Almost half (47%) of the farmers surveyed did not know how to activate their numbers.

Also, to purchase fertilizer, farmers had to dial specific numbers for NPK and Urea, and then enter their voucher numbers. A similar procedure was required for redeeming seeds. The report revealed that 54% of the farmers interviewed did not know the numbers to dial for fertilizer and 58% did not know the number for seeds.

Purchase of Fertilizer using the Mobile Telephony System (MTS)

From the survey, 65% of farmers interviewed said they purchased fertilizer using the MTS. The percentage of farmers that could not purchase fertilizer via MTS were found to be more

in Kaduna (85%), followed by Jigawa (84%), Gombe (68%) and Abia (48%) as at the time of this survey.

Imo state ranked highest in the number of farmers that purchase fertilizer using the MTS (97%), followed by Nassarawa State (95%), Edo State 93%), Cross-River State (92%) and Ondo State (75%). Others are Ogun State (74%), Taraba State (72%) and Kogi State (67%).

Access to Fertilizer

Over 90% of the farmers surveyed, said the scheme makes purchasing of fertilizer easier. Similarly, 92% rate access to fertilizer under the scheme as easy and very easy. Most farmers said their access to fertilizer has improved with the introduction of Mobile Telephony System in the e-wallet scheme.

Presence of Middlemen

According to the report about 87% of the farmers surveyed said there were no middlemen between them and the appointed agro-dealers for purchasing fertilizer. More male farmers (12%) reported the presence of middlemen than the female farmers (8%). However, most of the farmers that reported the presence of middlemen, said their presence made it easier for them to access fertilizer. Some of the farmers said the middlemen were extension agent and local government officials, who were in essence facilitating access to fertilizer.

Ability to Purchase Required Fertilizer

The report revealed that about9 in 10 of the farmers surveyed said they were able to purchase the required type of fertilizer under the scheme. NPK and Urea were the main types of fertilizer the farmers required for their crops and soil types.

However, many farmers reported that they were not able to get one bag each of the two types from the agro-dealer. Many received either one bag of one type or two bags of the same type of fertilizer.

Also, about 68% of farmers said they were unable to purchase the quantity of fertilizer required for their farms under the scheme. This impediment cuts across farmers with different farm sizes, even those with 1 hectare and below.

Challenges in Accessing Fertilizer

Numerous challenges greeted this pilot phase of the Mobile Telephony System used in the e-wallet scheme as revealed in this report among selected 12 states representing the six geo-political zones in Nigeria. These challenges include: -

(1) Inability to receive e-wallet through their mobile phones

(2) Late supply of fertilizer

(3) Inadequate quantity of fertilizer to meet their farming needs

(4) Price of fertilizer perceived as still being too high

(5) Lack of fertilizers in some areas

(6) Lack of the required type of fertilizer in some areas

(7) Lack of commitment from some ADP staff

(8) Location of collection centres too far for some farmers

(9) Processing of redeeming fertilizer found to be cumbersome by some farmers

(10) Long queues and repeated visits to collection centres to get fertilizer were also noticed in some areas.

Proposed Recommendations

The following actions were proposed from the report in the light of the prevailing challenges:

(1) Establishment of clear alternative procedures for redeeming farm inputs where e-wallets are not received

(2) Replacement of the 10-digit activation numbers with a more user friendly 3-digit codes

(3) Increased sensitization of farmers on the operational procedures of the scheme in languages easily understood by farmers (e.g. local languages, pidgin, etc).

(4) Improvements in operational procedures to ensure inputs are delivered to agro-dealers by March/April of the year.

(5) Establishment of a monitoring framework to ensure farmers receive one bag each of NPK and Urea intended under the scheme.

(6) Establishment of more collection centres, especially in rural locations close to farms. (Source: FEPSAN, 2012).

2.2 Review of Related Empirical Studies

In this section, related empirical studies are reviewed such that the variables under investigations as contained in the objectives of the study are discussed as they appear in the findings. Here, findings of empirical studies on level of knowledge of mobile telephony utilization are discussed; skills and competences in the use of mobile phone among rural farmers as well as factors that enhance the use of mobile phones are also examined. It also looked at findings on constraints to the use of mobile phones among rural farmers in the studies reviewed. There is also a review of mobile phone adoption in Africa and Nigeria as well as the current trend of mobile telephony adoption in Nigeria. The findings from these empirical studies are discussed and thoroughly examined in the light of the research gap

which this study seeks to fill. Other methodological approaches used in these empirical studies are also discussed as a basis to validate the method(s) to be used in this study.

2.2.1 Level of Knowledge and Skill on Mobile Telephony Utilization

The level of knowledge possessed by any mobile phone user is informed by adequate awareness on such technology. Also, adequate awareness on any given innovation is a key to the success in adoption and utilization of the technology (Dire, et al., 2016). In view of this, Ekumankma and Nwankwo (2002) noted that poor awareness or exposure of farmers to appropriate agricultural information and channels of communicating this information is one of the major reasons for low yield recorded by many Nigerian farmers as well as performance of agricultural extension agents in their duties. According to them, for human performance to be effective and efficient some knowledge is needed on how, why and when certain things have to be done.

Similarly, Adesope, Asiabaka and Agumagu (2007) in their study found that about 98% of the extension agents in the Niger Delta region are aware and have gained requisite knowledge on how to use ICTs. This, according to Dire et. al. (2016) means that most of the agricultural extension agents in the south-east and south-south of Nigeria are aware of ICTs especially as they concern agricultural extension work.

The educational level of the users of mobile phone is also akin to enhancing its utilization. According to Bon (2012), many smallholder farmers are unable to read and write, live in isolated villages without access to mass media and other channels of communication and rely on verbal communication, mainly in their vernacular languages. This means that knowledge of the language of communication used in the channel (mobile phone) will enhance both

knowledge of its operation and its utilization. Bon further posits that any useful method of sharing information would have to leverage on verbal communication and according to Cheneau-Loquay (2010) mobile telephony is very much in tune with this prevailing oral tradition in rural areas.

Dire, et. al. (2016), conducted a study on awareness of the use of ICTs among agricultural extension agents in North East Nigeria. They found that all the extension agents (100%) were aware of the use of ICTs generally (mobile phone inclusive), but in more specific terms, they found that knowledge were limited in the use of some ICTs like computer (53%), CD-Rom (91%), Internet (68%) and so on. This, they also found was linked to the educational level of the extension agents (Primary Education = 3%, Secondary Education = 1.5%, Certificates = 10.5%, Diploma = 37.8%, Degree/HND = 45.7% and M.Sc. = 1.5%).

In another study, Chhachhar and Hassan (2013) found that lack of knowledge was also a big problem among rural communities and farmers in the use of ICTs. A similar study indicated in the context of Malaysia that the level of ICT usage among rural farmers was low due to lack of knowledge and skill on the part of the farmer on how to use the technology. Illiteracy was also found to be another major cause of not being able to use ICTs among farmers because farmers could not contact with related officers and department and get information about market price, weather or pesticides; even farmers were not knowledgeable about how to use mobile phones to contact their family and friends due to illiteracy (Samuel, Akinsola, Marlien and Jacob, 2005; Musa, 2008).

Hellstrom (2010) observed that many of the rural people in East Africa have access to mobile phones, however, due to lack of knowledge and skill (i.e. competence in its use) they are not

advanced users; they use the mobile phone mainly for voice calling and person-to-person SMS. This finding was corroborated by Ramburn and Van Belle (2011) who showed that even in Mauritius, which has one of the most sophisticated cellular markets in Africa, advanced mobile data services (apart from SMS) have still not entered the lives of most mobile subscribers.

Investigating the patterns and drivers of mobile telephony for sustainable livelihood among farming households in Kwara State, Nigeria, Animashaun, Fakayode, Idris and Adedokun (2014) found among other things that all the farmers (100%) have gained knowledge on how to use mobile phones to contact their family members but 67% could use it to source agricultural information; 63% could use it to facilitate access with agricultural extension officers; 56% could use it to source for agricultural credit while an abysmal 38% use it as a source of income generation (i.e. phone booth). All these variations in the usage patterns hinges on the individual farmer's level of knowledge of the various operations of mobile telephony as well as his/her level of education or exposure in terms of being literate.

It is undoubtedly true from literature that individuals with high educational level are likely to show increased knowledge and skill both in the operations of the mobile phone and the various patterns to which it can be put to use. Also, one with low educational level is likely to be selective in his/her choice of use of the mobile phone due to limited knowledge of its operations and lack of requisite skill needed for manipulating the device.

2.2.2 Factors that enhance Mobile Telephony utilization

The predominant use of mobile phone in rural areas as against other ICTs like computer, radio, television, etc., can be traced to the relative advantage it has over other ICTs.

According to Albu and Scott (2001), Mobile Telephony can be an asset for development by enabling the rural poor to respond more efficiently to external economic opportunities or threats. Also, mobile phones can empower the rural poor to lobby for and demand a higher priority for themselves through an increase in access to information which can assist in sound decision-making (McNamara, 2003).

According to Donner (2008), Mobile Telephony can serve as a development tool to the extent that it accelerates complicates and interacts with the process of economic development in general. Nyamba and Mlozi (2012) in their study on "factors influencing the use of mobile phones in communicating agricultural information in Tanzania," found that educational level determines both the level of access and use of mobile phones among farmers. According to them, people with tertiary level of education could have higher access and use of public telephones and cellular phones than those with lower level of education. Also, the income level of the individual influences the use of mobile phones, though ownership of mobile phones was also found to be common among those with low income. This shows that there is a positive correlation between income and mobile phone technology adoption.

Aker (2008) assessed the impact of mobile phones on grain market performance and found the introduction of mobile phones to be associated with a 20-percent reduction in grain price difference across markets, with a larger impact for markets that are farther apart and those linked by poor-quality roads. Another study in Uganda (Muto and Yamano, 2009) found that market participation rose with mobile phone access. Although better market access can be a powerful means of alleviating poverty, the study found that market participation still depended on what producers had to sell. Also, the flow of information improved among

banana farmers following expansion in mobile phone coverage, leading to greater market participation and a rise in profits by 10 per cent.

Aker (2011) also found that the use of mobile phones had positive effects on both traders and consumer welfare in Niger; mobile – use traders' profit increased by 29 per cent and average consumer grain prices fell by 3.5 per cent. He also reported that the use of mobile phones enabled traders to reach more markets and established wider contacts. Aker, in his findings revealed that mobile phones played a significant role in providing information on market, weather, transport and agricultural techniques through concerned agencies and departments who provide such information.

Katengeza*et. al*. (2013) in their study in Malawi reported that cell phone use is positively influenced by literacy, distance to local market, land size, current value of assets, crop income and region. They also found that intensity of use is conditioned by gender, participation in agricultural projects, mobile phone ownership, current asset value and distance to nearest public phone services. Also, asset endowment played a critical role in enhancing adoption of mobile phone technology. Gender disparity was found to significantly affect adoption, as most women have limited access to assets.

Furthermore, Scott *et. al*. (2004) investigated gender differences in mobile phone uses in rural Uganda and found that many women were not using mobile phones because of the cost of making a phone call and their lack of knowledge of how to use the device. It was reported that men were more likely to use mobile phones for business purposes than women, while women were more likely to use mobile phones for kinship maintenance.

Martin and Abbott (2013) examined the diffusion and perceived impact of agricultural based mobile phone use in Uganda. They found that 42% of the farm households had a mobile phone and more than half of the farmers used their mobile phone for farm purposes. They also found that men tended to adopt mobile phones earlier than women and those with high level of education were more likely to use SMS (Short Message Services) text features as women were less likely to use the calculator function, perhaps due to a lack of numerical literacy training.

In all, one can deduce from literature that educational level of farmers and the relative advantages of the channel of mobile telephony (i.e. mobile phone) are two key factors that enhance one's predisposition to use the mobile phone. And the use to which one puts the mobile phone is determined by one's perceived need and the knowledge as well as skill developed (via training).

2.2.3 Mobile Phone Technology Adoption in Africa and Nigeria

Agricultural productivity gap between developed and developing countries of the world has widened since after World War II and this has led to rapid development in agricultural technology in developed countries (Rahman, 1996).

This has prompted researchers to undertake studies on various agricultural technology adoption in Africa and Nigeria. Most of these studies have focused on mobile phone technology (as an agricultural technology) widely promoted in Africa and Nigeria (Egbule, AgwuandUzokwe, 2013; Akinbile, AkwiwuandAlade, 2014; BilijonandKotze, 2007; AdesinaandBaidu-Forson, 1995).

For instance, Ogbonna and Agwu (2013) carried out a study on 'Access and use of ICTs by rural farmers in Enugu'. They used survey research design and structured interview as instrument to collect data among 90 rural farmers in the area. Their finding revealed that mobile phone use ranked second with 96.7% (behind Radio = 98.9%) respondents. Adebo (2014) in her study on the effectiveness of e-wallet practice in Kwara State also found that 86% of farmers own mobile phones and all (100%) of them attended the E-wallet training on the use of mobile phone to access agricultural inputs like fertilizer. The concept of mobile phone technology has assumed different status at different epochs. The concept 'wallet' was one of the earliest descriptions given to mobile phone technology several centuries ago.

According to Brent (2001): Wallets have been used for thousands of years to protect and carry personal items of value. The earliest wallets or sachets were a piece of cloth tied with a piece of strong which enabled a range of items such as coins to be carried out market.

He further added that human beings have always been mobile and have needed a container to securely carry personal items of value while in transit. New modes of transportation have accelerated human mobility across the globe increasing this need. Doan (2014) also pointed out that 'when smart phones can function as leather wallets, it is called 'Digital wallet' or the widely known 'mobile wallet' Hence, the idea of mobility in relation to the concept of 'wallet' have been improved through the use of mobile phones.

2.2.4 Current Trends in Mobile Telephony System Adoption in Nigeria and its Constraints

Since the introduction of mobile phone technology in agricultural service delivery, scholars have made attempts at evaluating its use or adoption in different aspects of agricultural services and production activities. Despite the various perceived benefits or advantages

accruing to mobile telephony use among rural farmers, there are also some limitations related to its use. For instance, Matuha (2015) in his study found that mobile phone-based information services have not yet penetrated or become popular with the majority of farmers due to either the cost of purchase or dissatisfaction with the relevance of its content. Molony (2008) conducted a study on the effects of mobile phones on traders of perishable foodstuffs in Tanzania with a particular focus on the importance of credit in the relationship between potato and tomato farmers and their wholesale buyers. The study found that the ability to communicate using new ICTs did not significantly alter the trust relationship between the two groups.

Furthermore, IfejikaandOladosu (2011) examined the use of e-wallet in extension advisory services around Kainji Lake basin, Nigeria. Using the survey research design and questionnaire as instrument to elicit responses from some selected fisher-folk farmers in Kainji Lake Basin, the study found that oral communication (through voice call) was the easiest way of reaching this category of respondents than through SMS when it comes to providing agricultural services.

In another study by Egbule *et. al.* (2013) on the use of e-wallet for information dissemination by public extension Agents in Delta State, Nigeria, a survey research design was used among 64 randomly selected public extension agents. The findings reveal that Majority (98.4%) of the extension agents were not provided with institutional mobile phones to aid information dissemination. However, about 97% said they had their personal mobile phones which they (2%) used to disseminate information to farmers. Interaction with farmers was found to be mainly through phone calls (84:4%) and SMS (71.9%).

Similarly, Ifejika *et.al.* (2015) assessed the willingness of Aquapreneurs to pay for Mobile Phone Advising Services (MPAS) in Anambra State, Nigeria. The study adopted the survey research design and an interview schedule was administered to 100 respondents from three (3) zonal ADP centres in the state. The findings revealed that elites at tertiary levels dominated aquapreneurs. Also, about 94% of respondents were found to have obliged to pay for MPAS and the consensus mean amount willing to pay was N48.87. Among their highest gratifications to pay include: to receive timely information, linkage to customers, increase profitability, better market information and to adopt technologies. The socio-economic variables were also found to be contributory factor (31%) to variation towards willingness to pay for MPAS but age, education and experience were not found to be statistically significant.

Conversely, Oyediran, *et. al.* (2014) in their study examined the attitude of cocoa farmers to the e-wallet system in Ogun State. The study sampled the opinion of 150 farmers using survey design and the questionnaire as instrument for data collection. The findings reveal that the mean age of farmers that participated in the GESS program stood at 40.14years. Also, most respondents (80%) were found to be males and married. The mean years of farming experience were 7.77 years, and almost all (95%) of the respondents had one form of formal education or the other. The mean household size of respondents was 8 people. About 50% of the respondent had 3-5 ha while a negligible few (8%) cultivated more than 8 ha for cocoa; Majority (70.67%) of the respondent were found to display negative attitude towards the GESS scheme.

Lastly, the effective and efficient use of the Mobile Telephony Systemwas affected by poor telephone network (77.33%), low publicity and awareness (76.67%) and incomplete farmers'

database (74.67%). The researchers claim that the result correlation analysis showed inverse but significant relationship between the socio-economic characteristics of cocoa farmers in Ogun state and their attitude towards the e-wallet scheme at $P<0.05$. In another study, Adebo (2014) examined the effectiveness of e-wallet in grassroots agricultural services delivery in Nigeria with a focus on Kwara State.

The study adopted survey research design using structured interview schedule among 200 randomly selected farmers from four local government areas in the state. The study found that e-wallet was effective in improved seeds of maize (53.5%), rice (51%) and two bags of fertilizers each (87.2%). Other benefits of the program were found to include: quick accessibility of improved and subsidised farm inputs, increased production and resuscitation of farmers' confidence in government programs. Lastly, the study found that the e-wallet scheme failed in these areas: telephony network failure, low level of awareness among farmers, cumbersome procedure of getting approval from cellulites, low density coverage of agro-dealers and supply of fertilizer and maize seeds.

Similarly, Fadairo *et. al.* (2015) examined the attitude of crop farmers towards e-wallet platform in Oyo state. The study used the survey research design and sampled the opinion of 120 crop farmers across the study area using a well-structured interview schedule. The findings show that farmers mean age was 47years (most of who were males and married) with an average of 15 years farming experience. Maize and cassava were found to be the most grown crops. The findings from this study also show that majority of respondents indicated non-commitment of the ADP and long distance to redemption centres as major constraints to the use of e-wallet program.

More than half of the farmers were found to have favoured attitude towards the e-wallet scheme. There is also significant relationship between the years of farming and educational level with farmers' attitude towards the e-wallet scheme. Lastly, the constraints faced by the farmers were found to also have negative influence on their attitude towards the e-wallet scheme.

Another study carried out by Nwalieji *et. al.* (2015) looked at an assessment of the GESS among rice farmers in Anambra state, Nigeria. Survey research design was adopted and 100 rice farmers that participated in the GESS scheme in the area were purposively selected using multi-stage random sampling technique. Data were collected using interview schedule and the scheme's publication. The study found that the e-wallet program had very low performance indices in redemption of inputs (4.7% and 32.4% in 2012 and 2013 respectively) but made great changes in food productivity with mean scores of 2.70 and farmers' access to farm inputs with mean scores of 2.55. Also, farmers were found to have high level of satisfaction on the scheme's implementation processes in the areas of registration process and quantity of improved seed redeemed. The major challenges found in this study with the e-wallet system were: poverty (M=2.32), illiteracy (M-2./45), poor awareness (M=2.55) and poor mobile phone possession and usage (M=2.76).

AyandaandSubair (2015) in their study on the assessment of cell phone for extension service delivery focused on small scale farmers and its prospects to sustainable agricultural production in Kwara state, Nigeria. The survey research designed was adopted and a total of 240 farmers were sampled using interview schedule. Findings revealed that the average age of farmers were 43.16 years. In addition, 55.8% and 51.6% of farmers with cell phone could read and write in English language respectively. Most of the farmers (74.12%) with cell

phones were found to have increased level of digital literacy, accessed information through internet. Furthermore, 65.8% of the farmers said the information accessed through the cell phone was timely while 65.8% reported drastic reduction in dependency on extension agents for agricultural information. Lastly, about 76.7% of farmers were found to have recorded increases in farm yield as a result of timely application of agricultural practices via the e-wallet scheme.

Another study by NwaobialaandUbor (2016) assessed the effectiveness of e-wallet system of the GESS among arable crop farmers in Imo State, South-Eastern Nigeria. The researchers used survey research design and randomly sampled 120 registered GESS farmers with a structured questionnaire. There was a corroborative finding of more male farmers (60%) than female farmers (40%) with mean ages of 49.8 years. About 35.5% of the farmers were found to have acquired secondary education, mean farming experience of the farmers stood at 16.5 years. The findings also revealed mean farm size and household size to be 1.1 hectares and 9.5 persons respectively. Farmers, in this study said the e-wallet system was effective (M = 2.0) by enhancing timeliness of notification (M = 2.8); increase responsiveness of staff to disburse inputs (M = 2.5), effective in notifying clients through farmers' notification of inputs and helps in the management of clients and inputs at the redemption centres with mean ratings of 2.1 as stated in the study.

Leo and Nzeakor (2014) also carried out a study on improving agricultural extension delivery service through the use of ICT in Abia State, Nigeria. The study used survey research design and randomly sampled 220 respondents (which consist of 200 farmers and 20 extension agents) through structured questionnaire. The findings revealed that 80% of the farmers were within the age range of 18 – 65 years while 100% of the extension agents fall within the same

age range. There were more male farmers (60%) than female (40%). The same applies to extension agents 80:20 percent. The educational level of farmers showed that 30% had primary education, 50% had secondary education while 20% had tertiary education. But extension agents recorded 10% secondary education and 90% tertiary education. Also, 80% of the farmers were married. The findings further revealed that 50% of the farmers had farming as their primary occupation while the remaining 50% did not have farming as their primary occupation (i.e. 40% trading and 10% civil servants). There is low computer literacy level among farmers (80%) compared to extension agents with 40% lack of computer literacy. Farmers that owned mobile phones were 98% while 100% of the extension agents had mobile phones.

In their use of ICTs in agricultural extension delivery service, the study found that farmers use Radio sets more (80%) than mobile phones (calls = 10% and SMS = 2.5%) and most of printed materials (100%).

Another study by Ahmed et al (2016) examined the effect of GESS on food security status of rural farming households in Adamawa State, Nigeria. A total of 120 farmers were randomly selected and data were sourced through well-structured questionnaire and interview. The findings revealed that 70% and 71% beneficiaries from the e-wallet system had between 11-29 bags and earned between N30,000 – N49,999 per month respectively.

It also showed that 62.5% of the respondents are food secure (using the food security index). Among the challenges faced by farmers in the GESS program include: insufficient seed and fertilizer, poor communication and poor GSM network for proper operation of e-wallet.

Insecurity and distance from redemption centres were found to be the major challenge of the scheme.

Summary of Review on Current Trends in Mobile Telephony Adoption in Nigeria

Out of a total of eleven empirical studies reviewed, four (4) examined Mobile Telephony System in relation to agricultural extension services, two (2) looked at farmers' attitude towards the e-wallet scheme, four (4) assessed its effectiveness in increasing productivity and food security, while only one study assessed Aquapreneur willingness to pay for mobile phone services.

In their methodological approaches to the studies, all the studies used survey research design with most of the studies using in-depth interview and survey as research designs (Oyediran *et. al*., 2014; Adebo, 2014; Fadairo *et. al*., 2015; Nwaobiala and Ubor, 2016; Leo and Nzeakor, 2014; Ahmed *et. al*, 2016) as a few others used only interview schedule (Nwalieji *et. al*, 2015; Ifejika *et. al.*, 2015).

The study unit of focus found in nine (9) out of the eleven empirical studies reviewed were farmers only while two (2) of the studies focused on both farmers and extension agents. All the studies reviewed showed a preponderance of male farmers over female farmers. This corroborates the findings from the monitoring report for the pilot phase of the e-wallet system found among 12 selected states in Nigeria (FEPSAN, 2012).

The average age of farmers that participated in the e-wallet scheme from all the studies reviewed was between 40 – 50 years with an average household size of 5 – 10 persons. The

major crops grown by farmers were maize, yam and cassava. This also agrees with the findings of FEPSAN (2012) monitoring report.

Studies that examined the effectiveness of e-wallet in the review found favourable attitude of farmers towards the scheme as regards easy access to fertilizer and other farm inputs but with similar challenges of inadequate fertilizer and seeds as well as poor GSM network, late arrival of inputs, low publicity and awareness, long distance to redemption centres and relatively lack of commitment from ADP staff.

2.3 Theoretical Review

This study is anchored on two major theories namely: The Diffusion of Innovation Theory and the Technology Acceptance Model (TAM).

2.3.1 Diffusion of Innovation Theory

This theory explains the process of adopting (making use of) a particular technology based on either advertisement or publicity. Such adoption may be an unintended or intended exercise. According to Rogers (1962) and Shoemaker (1973), the diffusion of innovation envisages a model of information diffusion in four stages namely: Information, Persuasion, Decision or Adoption and Confirmation. The role of the media is concentrated on Information and Awareness after which personal contacts, organised expertise and advice and actual experience take over in the adoption process (McQuail, 2010, p. 406).

The Diffusion of Innovation (DOI) theory as one of the oldest social science theories originated in communication to explain how, over time, an idea or product gains momentum and diffuses (spreads) through a specific population or social system. The end result of this

diffusion is that: people, as part of a social system adopt a new idea, behaviour or product (McQuail, 2010).

The term "Adoption" here means that a person makes use of the idea by doing something differently than what they had previously. The key principle behind this theory is that the person must perceive the idea, behaviour or product as "new" or "innovative." It is through this that diffusion is possible (Rogers, 1962).

The perceived newness of an idea for an individual determines his or her reaction to it. If the idea seems new to the individual, it is an innovation. According to Rogers (1962, p. 11), newness in an innovation need not just involve new knowledge. Someone may have known about an innovation for sometime but not yet developed a favourable or unfavourable attitude towards it, not have adopted or rejected it. The "newness" aspect of an innovation may be expressed in terms of knowledge, persuasion or a decision to adopt.

From Roger's research, we see that not everyone will immediately adopt a disruptive idea despite obvious benefits. Over the years of research, Rogers identified some fascinating personality traits that help organize how people will accept a new innovation. These stages of adoption explain how individuals tend to accept a given innovation over time based on the experiences of others. It turns out we approach innovation in the following ways:

1. **Innovators (2.5%):** Innovators are the first individuals to adopt an innovation. Innovators are willing to take risks, youngest in age, have the highest social class, have great financial lucidity, very social and have closest contact to scientific sources and interaction with other innovations. Risk tolerance has them Adopting technologies which may ultimately fail. Financial resources help absorb these failures (Rogers, 1962, p.282).

2. **Early Adopters (13.5%):** This is the second fastest category of individuals who adopt an innovation. These individuals have the highest degree of opinion leadership among the other adopter categories. Early adopters are typically younger in age, have a higher social status, have more financial lucidity, advanced education and are more socially forward than late adopters, more discrete in adoption choices than innovators. Realise judicious choice of adoption will help them maintain central communication position (p. 283).
3. **Early Majority (34%):** Individuals in this category adopt an innovation after a varying degree of time. This time of adoption is significantly longer than the innovators and early adopters. Early majority tend to be slower in the adoption process, have above average social status, contact with early adopters, and seldom hold positions of opinion leadership in a system (p. 283).
4. **Late Majority (34%):** Individual in this category will adopt an innovation after the average member of the society. These individuals approach an innovation with a high degree of scepticism and after the majority of society has adopted the innovation. Late majority are typically sceptical about an innovation, have below average social status, very little financial lucidity, in contact with others in late majority and early majority, very little opinion leadership.
5. **Laggards (16%):** Individuals in this category are the last to adopt an innovation. Unlike some of the previous categories, individuals in this category show little to no opinion leadership. These individuals typically have an aversion to change-agents and tend to be advanced in age. Laggards typically tend to be focused on "traditions", likely to have lowest social status, lowest financial fluidity, be oldest of all other adopters, in contact with only family and close friends, very little to no opinion leadership.

Rogers (1962) believe that the characteristics of innovations as perceived by individuals help to explain their different rate of adoption. These characteristics include:

1. **Relative Advantage:** The degree to which an innovation is perceived better than the idea it supersedes. This can be measured in economic terms. However, social-prestige factors, convenience and satisfaction are also often important components. It does not matter so much whether an innovation has a great deal of "objective" advantage, but what matters is whether an individual perceives the innovation as advantageous.
2. **Compatibility:** This has to do with the extent to which an innovation is perceived as being consistent with the existing values, past experiences and needs of potential adopters. An idea that is not compatible with the prevalent values and norms of a social system will not be adopted as rapidly as an innovation that is compatible.
3. **Complexity:** The degree to which an innovation is perceivedas difficult to understand and use. Some innovations are readily understood by most members of a social system; others are more complicated and will be adopted more slowly.
4. **Triability:** The degree to which an innovation may be experimented with on a limited basis. New ideas that can be tried on the instalment plan will generally be adopted more quickly than innovations that are not divisible.

For instance, Ryan and Gross (1943) found that every one of their Towa farmer respondents adopted hybrid-seed corn by first trying it on a partial basis. If the new seed could not have been sampled experimentally, its rate of adoption would have been much slower.

Situating this theory within the context of this study, it explains how the "mobile telephony system" as a perceived "new" idea (innovation) diffuses among rural farmers through the process of information, awareness, knowledge, persuasion and decision (to use). The theory

explains how the perceived "ease of use" of the technology among rural farmers (i.e. relative advantage) in its pilot phase of the GESS can facilitate its continued adoption among rural farmers in the fertilizer distribution exercise to boost productivity over time. The favourable disposition of rural farmers to the mobile telephony system can be traced to the less complexity in the technology as well as the triability based on prevailing agricultural need.

2.3.2 Technology Acceptance Model (TAM)

It is an obvious fact that technology adoption is the decision of a group or individual to make use of an innovation. According to Beal and Bohlen (1956), people accept new ideas through a series of complex mental processes in which adoption is the final action. The above assertion agrees with that of Rogers (1960, 1995) where technology diffusion is shown in a global curve, which can be explained by the demographic and psychographic characteristics of the adopters.

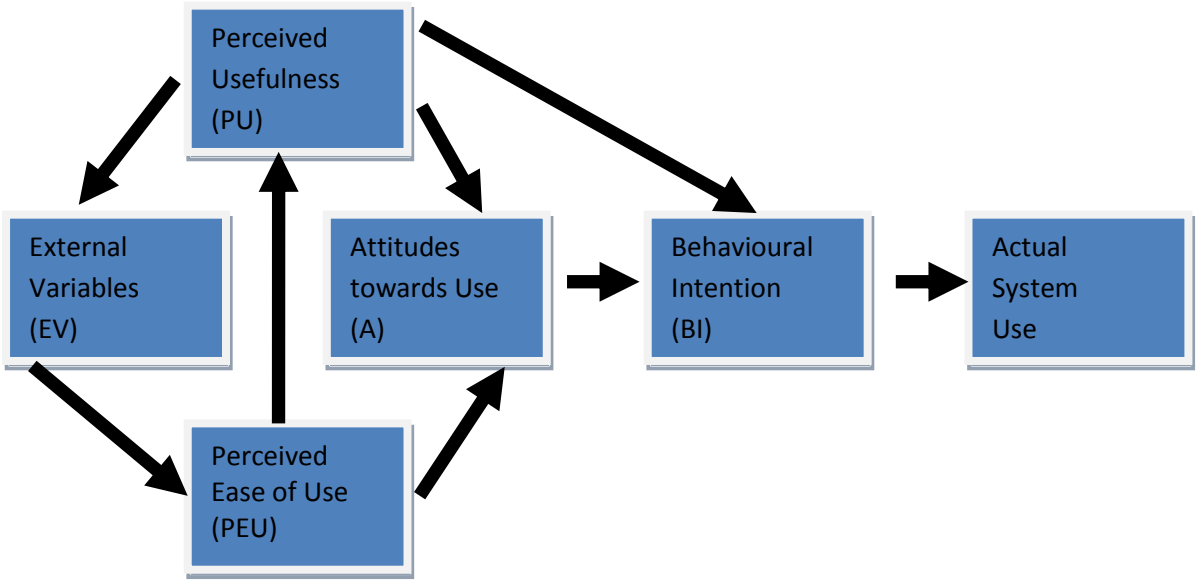


Figure 2.2: Technology Acceptance Model (TAM) (Davis, 1989)

Technology Acceptance Model (TAM) as one of the most influential models in the study of technology use (Gefen and Straub, 2000) was initially developed for new end-user of information systems for organisations. The theory explains the factors influencing the

behaviour of an individual regarding accepting and using new technology. One of the elements of TAM: "Perceived Usefulness" (PU) is the key determinant of acceptance, which implies the user's subjective probability that using a specific application system will increase his or her job performance within an organizational context (Davis et al, 1989, p.985).

On the other hand, "Perceived Ease of Use" (PEU) is "the degree to which the user expects the target system to be free of effort" (p.985). Combining PU and PEU determine the attitude (A) of a person towards using the technology. Lastly, the influence of PU and A behavioural intention (BI) influences the actual use of the technology. However, Malhotra and Galletta (1999) argue that TAM is incomplete as it does not account for social influence in the adoption of new information systems. Hence, they suggest considering the effect of social influence on the commitment of the information system user.

The above inclusion of social influences prompted recent modification of the TAM theory to what Islam (2011) called "Rural Technology Acceptance Model" (RuTAM) proposed by Venkatesh and Davis (2000). From the information system literature scholars have shown that the RuTAM is a combination of TAM, Theory of Planned behaviour and the Diffusion of Innovation Theory). Venkatesh et al (2003) argue that "given that the United Theory of Acceptance and Use of Technology (UTAUT) explains as much as 70% of the variance in intention, "it is possible that we may be approaching the practical limits of our ability to explain individual acceptance and usage decisions in organisation."

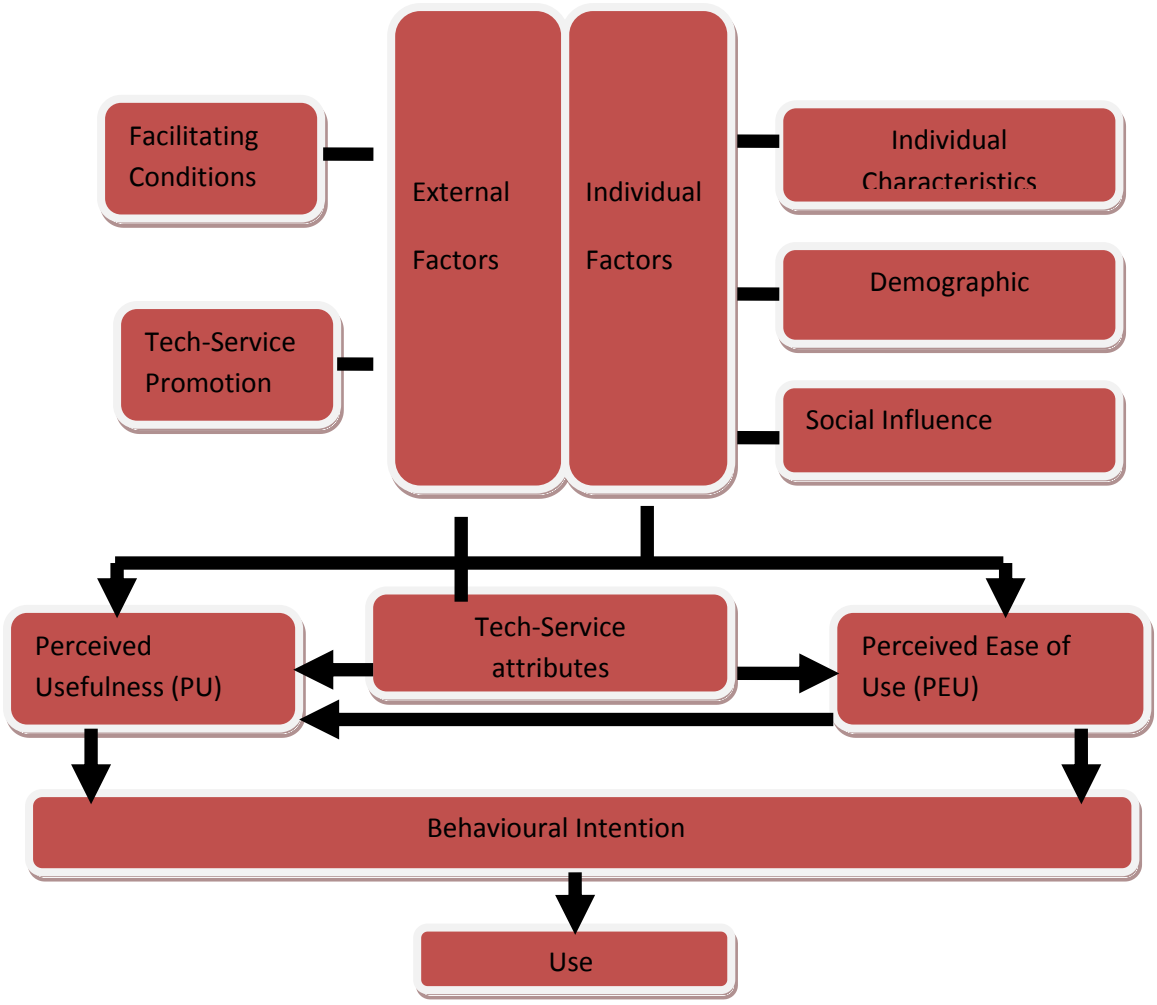


Figure 2.3: The Rural Technology Acceptance Model (RuTAM) (Source: Islam, 2011)

Having examined numerous literatures that explains the Technology Acceptance factors related to farmers in rural areas, scholars have come up with a conceptual model to explain how farmers in poor regions accept a particular technology based on influences from several factors as shown in figure. 2.2 above.

Facilitating Conditions

According to Venkatesh *et. al*. (2003, p.453) this is the degree to which an individual believes that an organizational and technical infrastructure exist to support the use of a system (i.e. e-wallet). Meanwhile, Jain and Hundal (2007) argue that choice of service provider is affected by the facilitating factors such as network coverage, service quality, easy availability of subscriptions and bill payment centres. The list of variables which are commonly found relevant to the mobile phone technology can broadly be categorized as the "facilitating conditions."

Tech-Service Attributes

This refers to the properties or characteristics of a certain technology, system or service that distinguish it from other technologies, systems or services.

Tech-Service Promotion

Kalish (1985) argue that "awareness" is one of the steps towards adoption and subsequently defines it as "the stage of being informed about the product search attributes" (p.1569).

Also, Doss (2003) finds that lack of awareness is one of the main reasons for farmers not adopting the new technology. Cook (2006) in view of this, suggest that suppliers must promote their initiatives in order to create awareness among the users.

Social Influence

From the point of view of the Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975; Qingfei *et. al*., 2008) behavioural intention of a person is influenced by subjective norms which in turn are influenced by the significance of referents' perceptions (or normative beliefs) and motivation to comply with those referents in rural context. Jain and Hundal

(2007) found that "the rural people are more influenced by their neighbour's usage of a given technology ... (p.25). In addition to neighbours, scholars have found some other sources of influence such as relatives, friends and senior or influential persons in the community (Wong and Hiew, 2005; Kargain and Basoglu, 2007; Biljon and Kotze, 2007).

Demographic Factors

Studies have shown the importance of demographic variables in the use and adoption of new technology (Kwon and Chidambaram, 2000; Hultberg, 2008; Islam, 2000; Dimaggio and Cohen, 2003). These variables include: age, gender, culture and ethnicity, income and household, occupation and education.

Individual Factors

Sultan and Chan (2000) argue that individual characteristics are more significant than technology properties in the technology adoption process in general. On the other hand, Wei and Zhang (2008) find that in rural context psychological factors in adopting new technology and mobile phone in particular are less significant than behavioural factors. Such a phenomenon in a rural setting is probably the social influence on the adoption process which is stronger than individual characteristics (Kargain and Basoglu, 2007).

Gatigam and Robertson (1989) suggest that information processing capability is afactor that separates the adopters from the non-adopters. This capability is framed by the individual's extent of observability or awareness (Huff and Munro, 1989; Vistiwanath and Goldhaber, 2003), innovativeness (Lu *et. al.*, 2005; Li *et. al.*, 2007) and past adoption or wages experience (Venkatesh, 2000).

Perceived Usefulness (PU) and Perceived Ease of Use (PEU)

These two factors are the most cited factors that influence the attitude and behavioural intentions of a person (Davis, 1989), especially in mobile service usages (Kargain and Basoglu, 2007).

Behavioural Intention and Use

Studies have shown that attitude is a significant factor in the process of adoption as found in the original studies of TRA (Fishbein and Ajzen, 1975) and TAM (Davis, 1989), but has been excluded from many other studies, even the later versions of TAM. In a situation where social norms and perceived usefulness are strong, a person's innate unfavourable attitude may disappear and behavioural intentions will become more consistent with the social trends in a certain time and context (Kargain and Basoglu, 2007; Stiff and Mongeau, 2013).

However, studies by Sarker (2003) finds continuity of use over time and resource commitment as the two outcomes, while some other studies describe these two as "actual use" (Renaud and Biljon, 2008; Lu *et. al*., 2007; Biljon and Kotze, 2007).

These technology acceptance factors in the RuTAM theory explains why rural farmers in south east Nigeria will adopt e-wallet system in fertilizer distribution under certain strong conditions as stated earlier that overrides the innate unfavourable attitude common among rural farmers exposed to new technology (like e-wallet). Hence, this study attempts to provide the basis for the acceptance or dismissal of this position.

2.4 Summary of Literature Review

The first section of this chapter looked at conceptual review of related literature under the sub-headings: The Concept of Mobile Telephony, The Concept of Utilization, Adoption and The Concept of E-wallet; the second section is a review of empirical studies on: Level of

Knowledge and skill on Mobile Telephony Utilization, Factors that enhance Mobile Telephony Utilization as well as studies on the Mobile Phone Technology Adoption in Africa and Nigeria; Current Trends in Mobile Telephony Adoption and its Constraints.

A preponderance of literature reviewed use the concept "Mobile Telephony" to mean "system of network using mobile phones" in relation to farmers. Also, the term "Utilization" was found to be used in literature to mean "Use" which is synonymous with "adoption" and this was also in relation to mobile phones among rural farmers. There is evidence in literature to accentuate the fact that level of knowledge and skill in using a given technology is determined by the educational level of the user as well as the continual exposure to the knowledge of the operations of the device with guided training. The extent of use which an individual makes of a given technology is also determined by the perceived needs of the individual as well as the various opportunities available in the operations of the technology.

On the concept of e-wallet, the study observed from literature that the earliest form of what is now called e-wallet originated from the concept of "digital wallet" which embodies all the structural and functional attributes of the physical wallet used to keep money and other valuable documents, though the current trend in mobile telephony use in agricultural services varied. From the empirical studies reviewed, it was obvious that mobile telephony adoption (in the e-wallet program) in the agricultural sector in Nigeria varied in research approach to it, though the objectives behind its introduction was linked to the Abuja Food Security Summit and the ADP objectives as outlined in the study.

Having reviewed the literature within the objectives of this study, the following research gaps were identified:

- Given the current trend in mobile telephony adoption in Nigeria, a good understanding of the current status of mobile telephony use in fertilizer distribution among rural farmers in the entire south eastern Nigeria.
- More understanding on what makes a farmer to adopt a new technology like the mobile telephony system.
- More understanding on the various patterns of mobile telephony utilization (use) among rural farmers in south eastern Nigeria.
- Given the nature of the GESS pilot phase project in Nigeria, a more understanding of the barriers to the use of mobile telephony utilization in fertilizer distribution among rural farmers and ADP staff in south eastern Nigeria.
- More understanding on the current status as regards level of awareness and extent of knowledge of mobile telephony system among rural farmers in south eastern Nigeria.

The points mentioned above are some of the gaps noticed in literature, this study intends to address most of them while others may be addressed by subsequent studies. The main gaps to be addressed in this study are: awareness and knowledge of mobile telephony among rural farmers in south east Nigeria; skill and competence in the use of mobile telephony among rural farmers in south east Nigeria; factors that enhance mobile telephony adoption among rural farmers in south east Nigeria as well as constraints to its utilization among rural farmers in South East Nigeria.

CHAPTER THREE

RESEARCH METHODOLOGY

The question of: how to measure in research is answered in this chapter of the study as it examines all the methodological approaches which can aid the actualization of the research objectives. In this chapter, the following sub-heads were considered: Research Design, Area of Study, Population of the Study, Sampling Frame, Sample and Sampling Procedures, Data Collection Instruments, Measurement of Variables, Pre-test and Validation of Research Instrument as well as Data Collection and Analysis Methods.

3.1 Research Design

The ease of measuring variables in a given research is determined by the choice of a suitable (appropriate) research design. The literature reviewed in the course of this study showed the viability of employing both qualitative and quantitative approaches in a study of this nature.

Hence, for the purpose of this study, a mixed method of research was used. This approach, according to Wimmer and Dominick (2014) is one in which the researcher collects, analyses and integrates both quantitative and qualitative data in a single study or multiple studies in a sustained program of inquiry.

Specifically, the mixed methods to be adopted in this study are descriptive survey and in-depth interview. According to Wimmer and Dominick (2011, p.185): "a descriptive survey attempts to describe or document current conditions or attitudes" – that is, to explain what exists at the moment. All the studies reviewed in literature employed the descriptive survey method.

On the In-depth Interview, they (p. 139) assert that it provides detailed background about the reasons respondents give specific answers. Here, the researcher produces elaborate data

concerning respondents' opinions, values, motivations, recollections, experiences and feelings about a given phenomenon. It is one, which allows for lengthy observation of respondents' non-verbal responses.

From the literature reviewed, studies that adopted the in-depth interview method include: Fadairo *et. al.* (2015); Adebo (2014); Ayanda and Subair (2015); Ahmed *et. al.* (2016) and Ifejika *et.al.* (2015). This, no doubt, underscores the appropriateness of this method for this study. It was used mainly for selected Key Informants from the GESS program across Nigeria.

3.2 Area of the Study

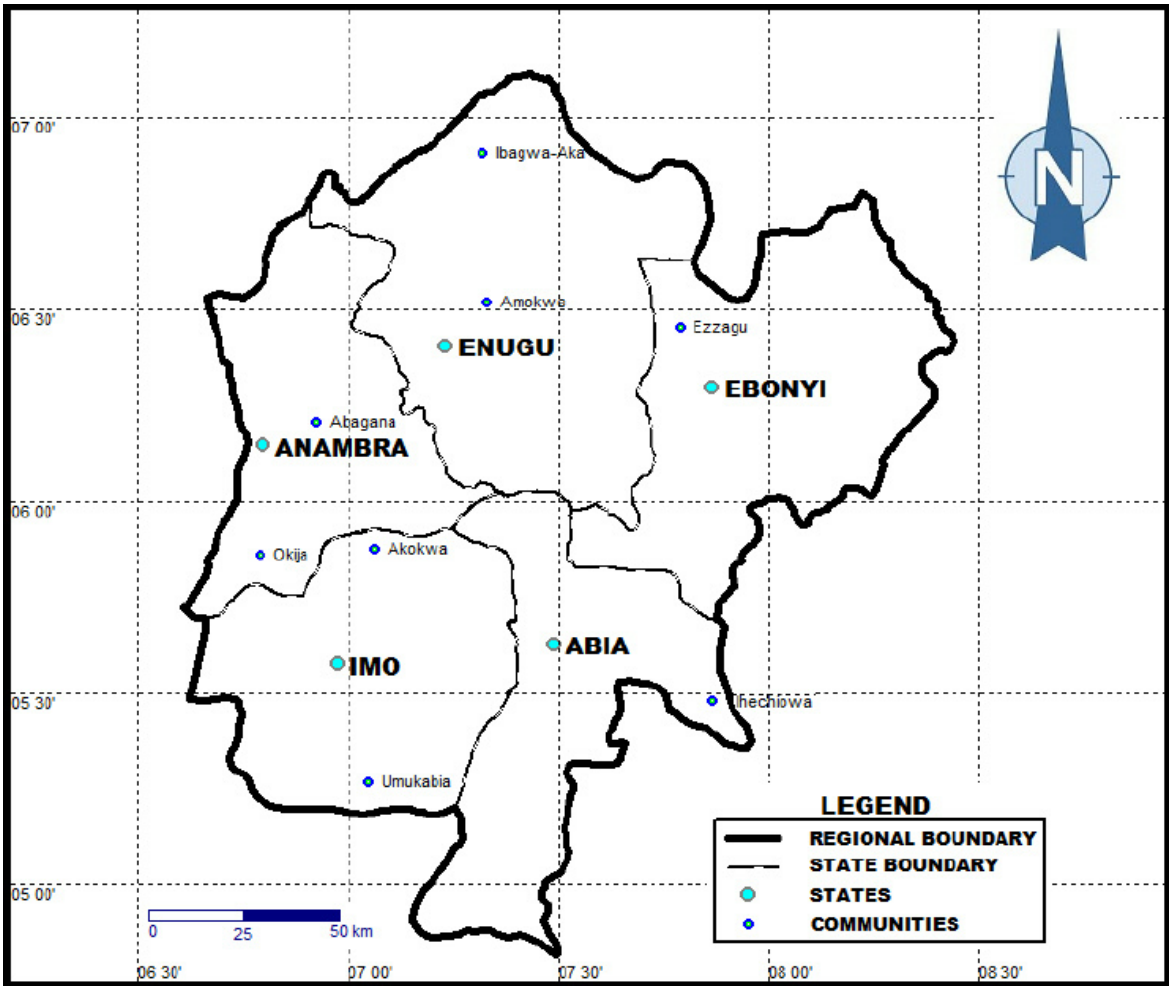
The area of the study, which is South-East Nigeria,is made up of five (5) states namely: (Abia, Anambra, Enugu, Ebonyi and Imo State). The region shares boundary with Benue and Kogi states from the north central end; Delta, Cross River and Rivers from the south-south end; the only boundary it shares with the south west region is intercepted by Edo state with Ondo state (precisely, Ore town). The south eastern region has a total population of 31,371,941 and an average population density of 416 persons per square kilometer (FOS, 2010).

This region was purposively chosen for this study due to the reported low participation of its farmers in the GESS program where the Mobile Telephony System (MTS) was introduced as a means through which farmers purchase fertilizer across Nigeria (FMARD, 2012).

South-East Nigeria is a diverse area and lies within the rain forest belt of Nigeria, which is characterized by high temperatures and humidity, with a substantial amount of rainfall during the rainy period of the year. The most common soils are Ultisols, which are acidic, with PH ranging from 4.0 in the highest rainfall areas to around 5.5 further north. Rural population

densities in South East Nigeria are amongst the highest in Africa and in many areas pressure on land has led to shortening fallow periods and declining soil fertility (Enete, 2010).

Agriculture in the region is predominantly based on bush fallow rotation, with cassava, yam and rice as the main crops/ palm tree plantation is the major cash crop in the area and land holdings are small and often fragmented.



<u>Figure 3.1</u>: Map of South East Nigeria

Figure 3.1 above shows the map of South East Nigeria with the five states that make-up the region. Three states were randomly selected as the primary study areas for this study. The states are: Anambra, Enugu and Ebonyi States, where copies of questionnaires were distributed to rural farmers that took part in the GESS program as well as the ADP staff that

supervised the program in the region. Interviews were also conducted with Key Informants of the program as a follow up to the findings from the questionnaire.

Anambra State

The state was carved out of the old Anambra State in 1991 and has a land area of 4,844 square kilometers and population of 4,055,048; about 70% of the land is rich for agricultural production (NPC, 2006).

The state has 21 local government areas (LGAs) consisting of 177 autonomous communities. The climate can generally be described as tropical with two identifiable seasons (i.e. rainy and dry seasons). Farming is the predominant occupation of the rural people, the majority of whom are small holder subsistence farmers (Chima, 2015).

Figure 3.2: Map of Anambra State(Source: Google Image)

Ebonyi State

Ebonyi state was created on 1st October, 1996 from Enugu and Abia states with a total landmass of 5,935 square kilometres of which 80% is rich in arable (Nwibo, 2012). The state has an estimated population of 1,739,136 people with a growth rate of 3.5% per annum (NPC, 2015). The population n the state is about 70% rural and the economy is primarily dependent on agriculture, which contributes about 90% of the GDP

Also, about 75% of its people are engaged in one form of farming or another and are mostly subsistence farmers (Ebonyi Agricultural Policy, 2010).

The state has a tropical climate with average rainfall ranges of 1,250 to 2,500 mm per year. Lowland areas popularly called FADAMA are scattered throughout and serve as good sites for rice and dry season vegetable farming; other major crops grown in the state are yam, cassava, cocoyam, groundnut, maize, vegetables and cowpea (Edeh *et. al*., 2011). It has an average annual temperature of about 27^0C with relative humidity of 85% (Nwakpu, 2013).

The vegetation of the state is a mixture of savannah and semi-tropical forest with underlying parent limestone. The soil is textually clay loam, fairly to poorly drained with gravely sub-soil in some locations, especially the upland adjacent to lowlands areas (Ekpe *et. al*., 2005).

Agricultural production in Ebonyi State is predominantly at subsistence level although some commercial farms are now springing up. About 90% of the farmers are small holders and land rotation with a fallow period of up to four years used to be the practice but with the increased pressure on land as a result of urbanization, the fallow periods are now becoming shorter (Ebonyi Agricultural Policy, 2010).

The state is made up of 13 Local Government Areas (LGAs) which are divided into three senatorial/agricultural zones namely: Ebonyi North, Ebonyi Central and Ebonyi South zones.

Figure 3.3:Map of Ebonyi State(Source: NBS, 2010)

Enugu State

The state was carved out of the old Anambra State on 27thAugust, 1991 by the then military head of state, General Ibrahim Babangida. The state is noted for its coal deposit, the largest in Africa. Other mineral resources found in the state include: Limestone, Iron-Ore and Bauxite Eastern region of Nigeria. In the 2006 population and housing census, the state had a total of 1,596,042 males and 1,671,795 females, which gives a total population of 3,267,837 people in the state.

The state has a land area of 7,161 square kilometres with an average population density of 460 persons per square kilometres. The average temperature in the state is cooler to mild (60^0F) in its cooler months and gets warmer to hot in its warmer months (upper 80^0F) and very good for outdoor activities with family and friends or just for personal leisure.

The state has good soil-land and climatic condition all year round, sitting at about 223 meters (732 ft) above sea level and the soil is well drained during its rainy seasons. Enugu state is predominantly rural and agrarian. The state has rich agricultural lands as a result of its location within the tropical rainforest and savannah belt. Over 70% of the population are farmers growing food crops such as rice, cassava, maize, yam, banana, plantain, etc., and a variety of fruits and vegetables. Cash crops grown include: oil palm, pineapple and cashew. They are also produced in large quantities (www.investmentsummit.en.gov.ng/agriculture/).

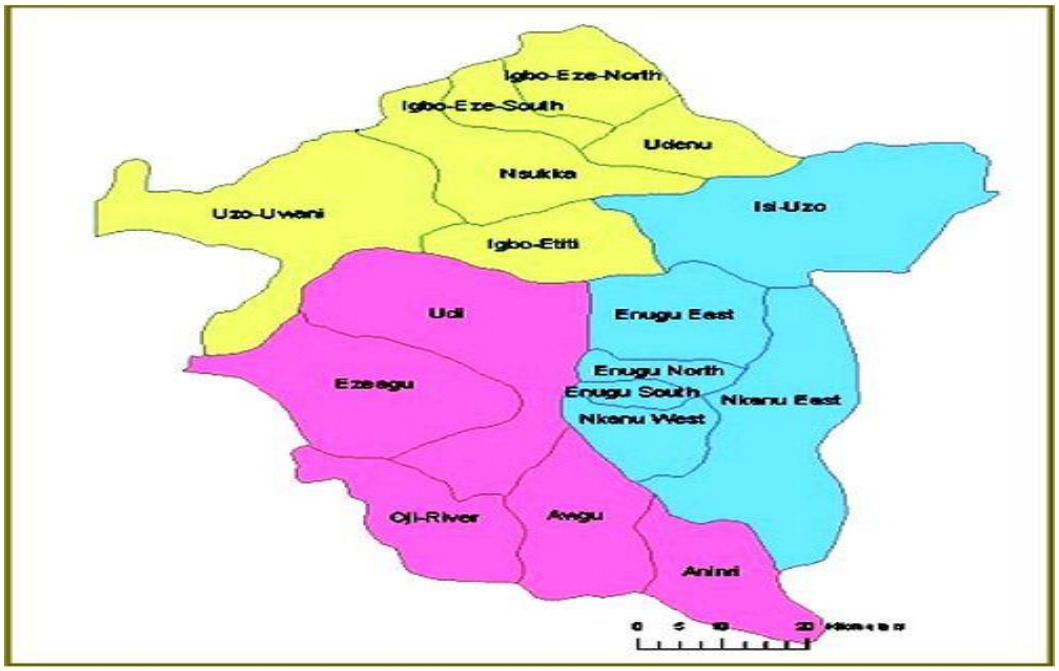


Figure 3.4: Map of Enugu State Source: (Google Image)

3.3 Population of the Study

The study unit consists of all registered farmers in south-east Nigeria. According to the report on the pilot phase of the GESS program in 2012, the total population of registered farmers in south east Nigeria is 31,175 (FEPSAN, 2012).

The target population for this study is the registered farmers and ADP staff in Anambra, Enugu and Ebonyi Sates. The population of rural farmers in these states include: Anambra =

9,056; Enugu = 7,248 and Ebonyi = 3,826 with 20 ADP Staff for each state. This gives a total of 20,130 rural farmers and 60 ADP Staff.

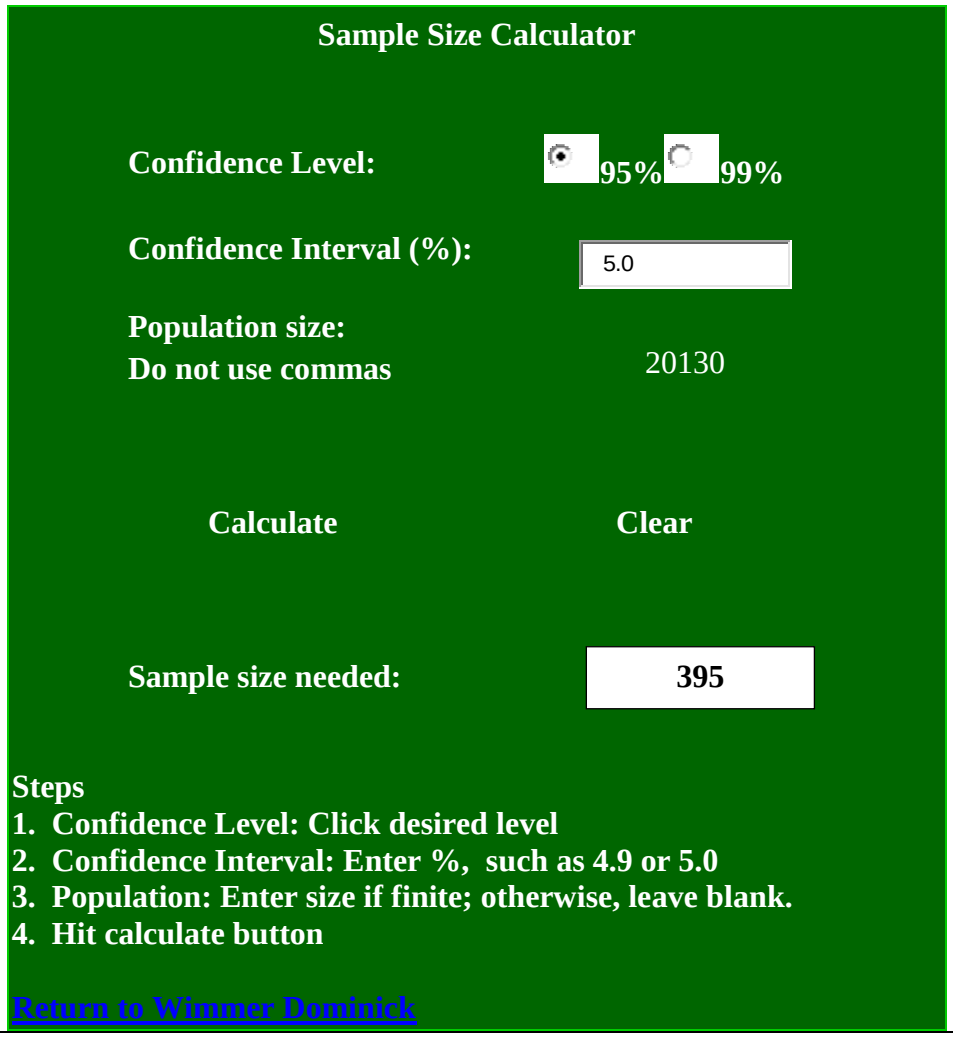
3.4 Sampling Frame

According to Wimmer and Dominick (2011), Sampling Frame is "the complete list of members in a given population." This has to do with the list of characteristics that is peculiar to the units of a given population. It is also, the list of all elements or other units containing the elements in a population. Hence, for this study, a list of all the registered farmers for the GESS program in south east Nigeria according to each state was used as the sampling frame for the study.

3.5 Sample and Sampling Procedures

A sample is "a smaller (but hopefully representative) collection of units from a population used to determine truths about that population (Field, 2005). The purpose of sampling is to get a representative number that can be used to make generalization about the total population.

The sample size for this study was determined using the online Australian Calculator. The result is given below:



http://www.rogerwimmer.com/mmr9e/samplesizecalculator.htm

The sample size for the study is 395

From literature reviewed, almost all the studies adopted the multi-stage sampling procedure. This shows that one sampling procedure is not suitable for a study of this nature. Based on that, this study adopts the multi-stage sampling procedure involving purposive sampling, simple random sampling and systematic random as well as proportionate sampling techniques.

Stage One: Three (3) States were purposively and randomly selected from the five (5) South Eastern States in Nigeria. They include: (Anambra and Enugu) purposively selected while (Ebonyi States) was randomly selected. The reason for the purposive selection was based on their performance from the GESS wet season report of 2013. Anambra and Enugu were chosen because they recorded the highest within South East, while Ebonyi was randomly chosen from states that do not have record in the report (i.e. Abia and Ebonyi). This was done so that there will be equal chance of selection for states that have record and those that don't have record.

Stage Two: Two (2) Agricultural Zones were randomly selected from each state using simple random sampling technique, which gives a total of six (6) Agricultural Zones namely: Enugu West & Enugu East (for Enugu State); Awka&Anambra (for Anambra State) and Ebonyi North &Ebonyi Central (for Ebonyi State).

Stage Three: Thereafter, two (2) Local Government Areas (LGAs) were randomly selected from each Agricultural Zone in each of the selected states using simple random sampling technique. This gives a total of twelve (12) LGAs for the study.

Stage Four: Also, five (5) Communities/Villages were randomly selected from each of the selected local government areas in the selected states using simple random sampling technique. This gives a total of 60 Communities/Villages.

Stage Five: In each of the communities or villages selected, systematic random sampling technique was used to select the nth farmer from the list of registered farmers in that community or village. The researcher went to the selected LGAs in each of the selected

Agricultural Zones and used the farmers' registers in each LGA to select the last farmer for the study.

Out of the total sample size of 395 (i.e. 335 farmers and 60 ADP staff) the nth farmer in each of the selected community or village was gotten by dividing the total number of registered farmers in the three states with 335 which is the sample size for farmers.

$$\text{nth farmer} = \frac{20{,}130}{335} = 60.08 \div 3 = 20$$

Hence, one farmer was selected from the list of registered farmers at intervals of 20 beginning from the 7th farmer. This continued until the total of 335 registered farmers were realized. Table 3.1 gives the picture of the various stages in the multi-stage sampling procedure.

Table 3.1: Distribution of Sample across the randomly selected area of study

States	**Agricultural Zones**	**L. G. As**	**Communities / Villages**	**Sample Size**
Anambra	Awka	Awka South	5	150
		Awka North	5	
	Anambra	Oyi	5	
		Anyamelum	5	
Enugu	Enugu West	Nkanu East	5	121
		Nkanu West	5	
	Enugu East	Aninri	5	
		Awgu	5	
Ebonyi	Ebonyi North	Izzi	5	64
		Abakaliki	5	
	Ebonyi Central	Ishielu	5	
		Ikwo	5	
TOTAL	**6 Agric. Zones**	**12 L. G. As**	**60 Communities**	**335**

Using Proportionate Sampling technique, the following sample size were arrived at for each state based on the strength of the population for each of the states:

Anambra State = $\frac{9,056}{20,130}$ x $\frac{100}{1}$ = 45%

Sample Size for Anambra State = $\frac{45}{100}$ x 20,130 = 150

Enugu State = $\frac{7,248}{20,130}$ x $\frac{100}{1}$ = 36%

Sample Size for Enugu State = $\frac{36}{100}$ x 20,130 = 121

Ebonyi State = $\frac{3,826}{20,130}$x $\frac{100}{1}$= 19%

Sample Size for Ebonyi State =$\frac{19}{100}$x 20,130 = 64

3.6 Data Collection Instruments

In order to elicit defined responses from the respondents, appropriate instrument for data collection was used. In this study, Structured Questionnaire and In-depth Interview Guide were the instrumentsused to collect data for the study.

The Questionnaire

The structured questionnaire that was administered to farmers and ADP staff in the study area wasarranged in sections. That of the farmers has (8) sections namely:
(A) = Demographic details of farmers

(B) = Socio-Economic Characteristics

(C) = Ownership & Use of the Mobile Telephony System

(D) = Extent of Utilization of Mobile Telephony in Agricultural Service Delivery

(E) = Utilization of Mobile Phone to Learn About Fertilizer

(F)= Factors that enhance Mobile Telephony Utilization

(G) = Constraints to the use of Mobile Telephony in Fertilizer Distribution

Meanwhile, that of the ADP staff had five (5) sections namely:

A= Demographic details of ADP staff

B= Level and extent of participation in the GESS

C= Benefits of the Mobile Telephony System in Fertilizer Distribution

D= Constraints to the use ofMobile Telephony System in Fertilizer Distribution

E = Ways to address the challenges in the Mobile Telephony System

The questionnaire for farmers consists of 86 items while that of ADP was made up of 34 items. The scales of measurement includes (VLE, LE, SE, Not At All) and (SA,A,D,SD, U) with some YES/NO questions.

In-depth Interview Guide

The population for the In-depth Interview is six (6) Key Informants (i.e. 2 from each of the selected South East States). The instrument for the In-depth Interview is the In-depth Interview Guide (i.e. IDI Guide). Open ended questions were used in the IDI Guide. These questions cover five main sections namely:

1) The Objectives of the Mobile Telephony System
2) The Utilization of the Mobile Telephony System
3) Knowledge and Skill of Mobile Telephony System Utilization
4) Factors that enhance Mobile Telephony System Utilization
5) The Constraints to the Utilization of the Mobile Telephony System

Those interviewed in each of the selected states include:

i. Programme Coordinator for ADP.
ii. Representatives from the Cellulants in Nigeria
iii. Coordinator of GESS in one of the states.

3.7 Measurement of Variables

Based on the objectives of this study, the following variables were measured:

i. Ownership and Use of Mobile Telephony: it means owning and using mobile telephone to purchase fertilizer. This was measured using polarised questions (i.e. questions having Yes/No responses).
ii. Extent of Utilization of Mobile Telephony: the term "Utilization" means "making use of" or "using" Mobile Telephony (mobile phone services) either through calls or short message services (SMS) to purchase and claim fertilizer from Agro-dealers (thiswas measured using Very Large Extent (VLE), Large Extent (LE), Some Extent (SE) and Not at all (NAA).
iii. Factors that enhance the use of Mobile Telephony: here we measured all perceived advantages that mobile telephony is said to have over other ICTs. This was measured using Strongly Agree (SA), Agree (A), Disagree (D), Strongly Disagree (SD) and Undecided (U) on some suggested perceived advantages with an open ended question for the respondent's opinion.
iv. Levels of compliance and skill in the utilization of Mobile Telephony System: the term "compliance" refers to "using as intended" while "skill" has to do with "ability in the use of" Mobile Telephony (mobile phone services). This was measured in the In-depth Interview with open ended questions.

v. Constraints to the use of Mobile Telephony: This implies certain factors or activities that make it difficult or impossible for farmers to use the Mobile Telephony System in Agricultural Communication. This was measured using a five (5) point Likert scale of (SA, A, D, SD and U) with 5,4,3,2 and 1 ratings respectively. This was also measure in the In-depth Interview.

3.8 Validity and Reliability of Research Instruments

The researcher adopted face-validity for the two instruments (i.e. Structured Questionnaire and In-depth Interview Guide). Here, the project supervisor undertook this to check if the instruments can truly measure what they were designed to measure.

On the other hand, a pilot study involving 20 copies of the two questionnaires (i.e. that of rural farmers and that of ADP staff) which was carried out in a particular location (village) among rural farmers as a pre-test for the instrument and the data gathered were then tested for internal consistency, using SPSS version 20.0 software, with Crombach Alpha co-efficient.Below is the result of the reliability test:

Reliability Test

Case Processing Summary

		N	%
Cases	Valid	20	100
	Total	20	100

Case Processing Summary

		N	%
Cases	Valid	20	100
	Total	20	100

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.909	84

From the above reliability result, it revealed that the instrument had a Cronbach's Alpha coefficient of 0.909 which implies that it is 90% reliable.

3.9 Method of Data Collection

The copies of questionnaire for both the rural farmers and ADP staff were self-administered with the help of five (5) research assistants. The data collection for each state lasted for a period of 30 days for the 5 selected communities in each selected LGA of the states. Hence, the entire data collection process took about 90 days (i.e. 3 months).

Meanwhile, the interview with Key Informants was also conducted within the same period by the researcher. The trained research assistants used the local language of the rural farmers to

interpret the content of the questionnaire and then enter the responses for each farmer in the questionnaire in areas where there are illiterate farmers.

3.10 Method of Data Analysis

The data collected in this study was coded in numerical values (as it is shown in the questionnaire) and analysed using SPSS version 20.0 software for statistical analysis. Descriptive analysis was carried out for objectives one, two and three while both descriptive and factor analysis were carried out for objectives four, five and six.

The result for the descriptive analysis was presented in tables showing frequencies and percentages as well as mean scores and standard deviation scores based on the objectives of the study concerned. The responses for the interview was also coded in themes based on relatedness in concepts and later interpreted alongside the findings from the questionnaire as they provide answers to the proposed research questions for the study.

The use of factor analysis in this study was to ascertain how the factors under investigation correlate with each other using the Rotated Component Matrix of Varimax Factor Analysis. In grouping the variable for naming the factors, only variables (i.e. factors) that had a factor loading value of 0.40 and above were used in naming the factors.

Also, variables that loaded in more than one component (factor) were dropped, while those that did not have up to factor loading value of 0.40 as stated earlier were also dropped. According to Chukwuone, Agwu and Ozor in Olaolu (2016) only variables with loadings of 0.40 and above (10% overlapping variance) were used in naming the factors.

CHAPTER FOUR

RESULTS AND DISCUSSION

This study is on the assessment of mobile telephony utilization in agricultural communication among rural farmers in South East Nigeria. This section deals with data presentation and analysis based on the objectives of the study. Data on objectives one and two were analysed using descriptive analysis showing frequencies and percentages. Data on objectives three were analysed using descriptive analysis showing frequencies, percentage, mean and standard deviation where findings were made based on decision rule within specified benchmarks.

Data on objectives four, five and six were analysed using descriptive analysis and factor analysis. The former showed results in frequencies, percentages, mean and standard deviation while the latter used factor loading value of 0.40 as benchmark which formed the basis for naming the factors as they correlate with each other in the study.

Data collected through the in-depth interview were analysed using thematic analysis where concepts emerging from the responses were grouped in themes based on their relatedness in meeting with the objectives of the study.

4.1 Data Presentation and Analysis for Survey

A total of 335 copies of the questionnaire were administered among the rural farmers and 60 copies were also administered among the ADP staff. From that of rural farmers, 331 copies were returned giving a return rate of 98.8% while 55 copies of questionnaire for the ADP staff were returned giving a return rate of 91.7%.

On the In-depth interview, 6 key informants were interviewed in all (i.e. 2 from each selected state – Anambra, Enugu and Ebonyi), five out of the six interviews were conducted face-to-face while one was conducted via the phone due to the researcher's inability to meet face-to-face with the interview.The results and the findings from the data collected are presented below:

Table 4.1: ***Distribution of responses showing socio-demographic data of respondents (Rural farmers)***

S/N	Variables		F	%
1.	Age	20-30years	93	28
		31-40years	133	40
		41-50years	54	16
		51years and above	51	16
2.	Sex:	Male	199	60
		Female	132	40
3.	Marital Status:	Single	68	21
		Married	237	72
		Divorced	3	1
		Widowed	13	4
		Separated	10	3
4	Number of children:	None	62	19
		1-3 children	84	25
		4-6 children	143	43
		7 children and above	42	13
5.	Educational Status:	No Education	17	5
		Primary School	83	25
		Secondary School	158	48
		First Degree	54	16
		Masters	11	3
		Doctorate	8	3
6.	Farming	Below 5yrs	67	20

Experience:	5-10yrs	74	22
	11-15years	92	28
	Above 15years	98	30
Total		**331**	**100**

The result (in Table 4.1) on the demographic data of respondents (i.e. farmers) shows that farmers between 31-40years ranked highest with 133 (representing 40%). This was followed by those between 20-30 years with 93(28%). At the bottom of that section of the table are farmers between 41-50years and 51years and above with 54 and 51 respectively but with equal percentage (16%).

Also, there is a preponderance of male farmers (199 representing 60%) when compared to their female counterpart (132) representing 40% of the total respondents.The section on marital status showed most of the farmer (237 out of 331) as married (representing 72%). This was followed by 68 (21%) of those who say they are single. At the bottom of that section of the table are farmers that claim to be "widowed" "separated" and divorced" with 1(4%), 10(3%) and 3(1%) respectively.

Similarly, farmers with 4-6 children ranked highest in the section of number of children with 143(43%), followed by those with 1-3 children (84 representing 25%). At the bottom of that section of the table are farmers with 7 children and above 42(13%), leaving those without children at 62(19%).

On the educational status, a greater number of the farmers (158 representing 48%) had secondary education; a total of 83(25%) had primary education while 54 had first degree, representing 16% of the 331 respondents. At the bottom of that section of the table are farmers with Doctorate degree 8(3%) leaving those without any form of education at 17(5%).

Lastly, most of the farmers have long experience (above 15years) in farming as attested to by 98(30%) of the respondents. Also, 92(28%) of the respondents say they have been farming for about 11-15years now while 74(22%) say they have been farming for about 5-10years. At the bottom of that section of the table are farmers with less than 5years of farming experience (67) representing 20% of the entire respondents (331).

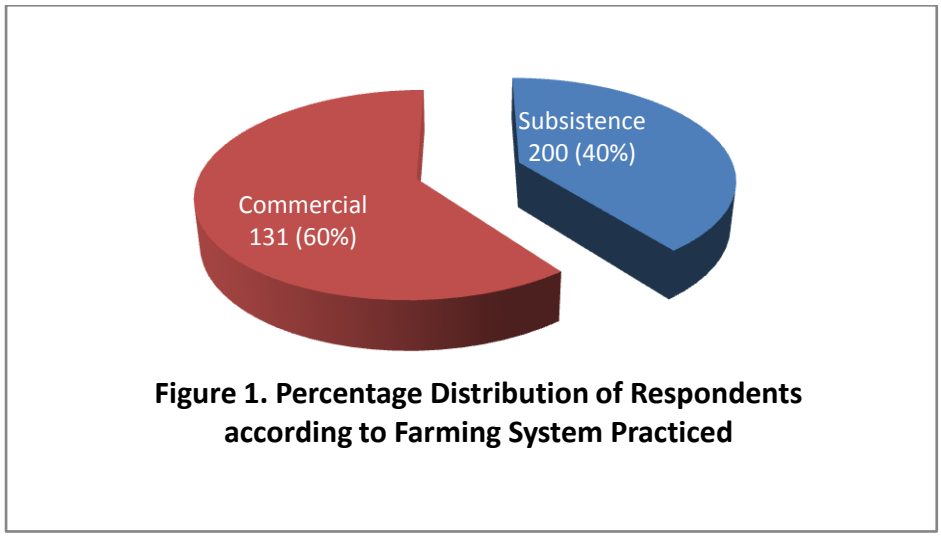


Figure 1. Percentage Distribution of Respondents according to Farming System Practiced

Figure 4.1: *Types of farming system practiced*

The result in Figure 4.1 shows that most of the respondents (farmers) 200 (60%) practiced commercial farming while the remaining 131 (40%) practiced subsistence farming.

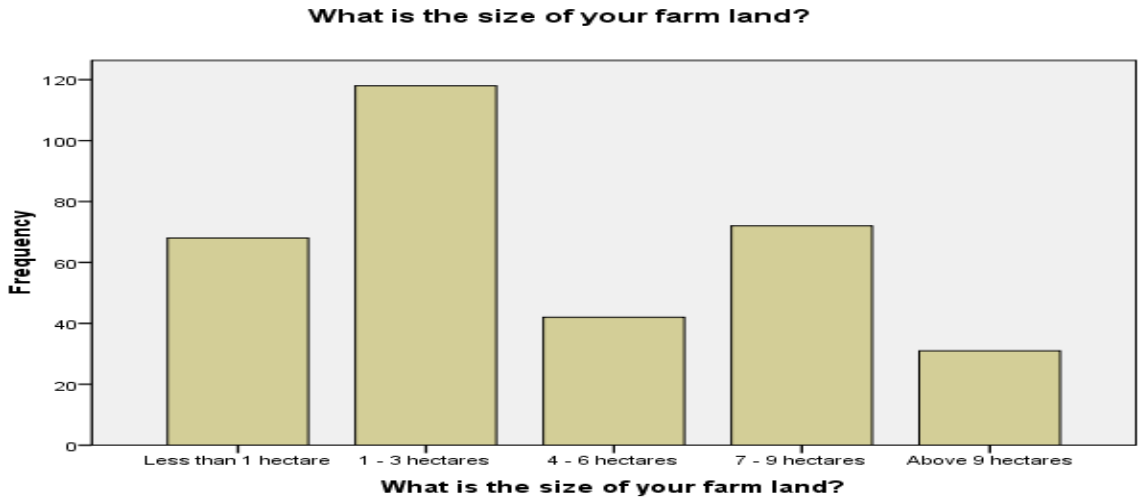


Figure 4.2: *Size of farmland used by farmers*

The result in figure 4.2 corroborates that of figure 1 as more respondents (farmers) used 1-3 hectares of land 118 (36%) and 7-9 hectares of land 72(22%). This affirms the fact that commercial agriculture requires larger farm land sizes than subsistence agriculture. At the bottom of this chart are respondents with above 9 hectares and those with 4-6 hectares recording 31(9%) and 42(13%) respectively, leaving respondents that used less than 1 hectare with 68(20%).

Table 4.2:*Distribution of responses according to nature of crop grown by rural farmers in South East Nigeria*

S/N	Variables*	Frequency	Percentage
1.	Yam	202	60
2.	Maize	248	74
3.	Plantain	80	24
4.	Cassava	274	81
5.	Rice	239	71
6.	Oil Palm	71	21
7.	Vegetable (Pumpkin)	14	4
8.	Beans	6	2
9.	Cucumber	3	1
10.	Ground Nut	4	1
11.	Okra	6	2
12.	Tomato	5	2
13.	Millet	1	0.3
14.	Guinea Corn	7	2

*Multiple Response

From the result in table 4.2 there is a preponderance of cassava production among rural farmers in South East Nigeria as affirmed by 274 (81%) respondents. This is followed by respondents that grow maize (248 representing 74%) as well as those that grow Yam (202 representing 60%). Each of the respondents grows one or more of the listed crops as there were room for multiple responses in the questionnaire. At the bottom of the table are respondents that grow millet and cucumber which recorded 1 (0.3%) and 3(1%) respectively.

This shows that majority of rural farmers on South East Nigeria practice subsistence farming and dominantly produces cassava, which is recognised as one of the major crop grown in South East Nigeria.

Table 4.3:*Distribution of responses according to type of fertilizer used by rural farmers in South east Nigeria*

S/N	Variables*	Frequency	Percentage
1.	NPK	322	96
2.	Urea	168	50
3.	SSP	3	1
4.	Agrolizer	42	13
5.	Teractive	3	1

*Multiple Response

The use of NPK fertilizer ranked highest from the list of type of fertilizer used by rural farmers in South east Nigeria as indicated in Table 4.3 above. This was affirmed by 322 (96%) respondents. Urea ranked second on the type of fertilizer used as affirmed by 168(50%) respondents.

Also, in this section, there were multiple responsesalso which means that each of the farmers used one or more of the types of fertilizer listed in the table. At the bottom of the table are SSP and Teractive fertilizer with 3 (1%) each from the responses of the farmers.

Table 4.4:*Distribution of Reponses showing ownership of Mobile phone by farmers*

Variable	**Response**	**F**	**%**
Do you own a mobile phone?	Yes	331	100
	No	-	-
Total		**331**	**100**

The result from Table 4.4 shows that all (331) of the respondents (farmers) own a mobile phone. This corroborates the criteria for participating in the e-wallet training stated earlier in this study where Mobile Telephony System (MTS) is used to access farm inputs like fertilizer by rural farmers in Nigeria. The result also gave further impetus to the Pew Research Findings (2017) on mobile phone penetration in Nigeria which was found to be 84% (i.e. 162 million people). The implication of this result is that agricultural communication using mobile phones have received a boost and the possibility of harnessing its potential in increasing agricultural productivity is not far-fetched.

Table 4.5: ***Distribution of responses showing farmers participation in the MTS training***

Variable	**Response**	**F**	**%**
Did you attend the training on how to use the Mobile Telephony System?	Yes	189	57
	No	142	43
Total		**331**	**100**

The level of participation in the training on how to use the MTS to access farm inputs among farmers is shown in Table 4.5 above. The result reveals that most of the respondents 189(57%) attended the training as against the remaining 142(43%) that did attend. The implication of this result to the study is that it is likely to suggest increased lack of competence in the use of Mobile Telephony among these rural farmers as regards agricultural communication in the area of fertilizer distribution.

Table 4.6: ***Distribution of responses showing ADP staff participation in the e-wallet scheme***

Variable	**Response**	**F**	**%**
Did you participate in the e-wallet scheme where MTS was used by farmers?	Yes	48	87
	No	7	13
Total		**55**	**100**

The result in Table 4.6 also shows a preponderance of ADP staff participation in the e-wallet scheme where farmers were trained on how to use the MTS to access farm inputs. This is affirmed by 48(87%) respondents as against 7(13%) who said they did not participate.

Table 4.7: Distribution of responses showing the roles of the ADP staff in the e-wallet scheme

Variable	**F**	**%**
Undecided	4	7
Supervise the process	9	16
Act as Extension Agent/facilitator	8	15
Assist Farmers	15	27
Coordinator to Scheme	19	35
Total	**55**	**100**

The result in Table 4.7 shows the level of participation of the ADP staff in the e-wallet program where farmers were trained on how to use the MTS to access farm inputs. Most of the ADP staff that participated 19(35%) acted as coordinators of the scheme at various locations. This is followed by those who assisted the farmers 15(27%) and those who supervised the process (i.e. either as Helpline Staff or Cellulants) 9(16%). At the bottom of the table are respondents who acted as Extension Agents/facilitators 8(15%) leaving those who were undecided recoding4(7%).

Table 4.8: ***Distribution of responses showing ADP staff participation in the training on how to use the MTS in fertilizer distribution***

Variable	**Response**	**F**	**%**
Did you take part in the training on the use of MTS in fertilizer distribution?	Yes	51	93
	No	4	7
Total		**55**	**100**

The level of participation of ADP staff in the MTS training as shown in Table 4.8 indicate that more respondents 51(93%) participated in the training as against the remaining 4(7%) that did not participate.

Table 4.9:***Distribution of responses showing the opinion of ADP staff on whether MTS had any benefit to farmers***

Variable	**Response**	**F**	**%**
Do you think the MTS had any benefit to farmers?	Yes	52	94
	No	3	6
Total		**55**	**100**

A total of 52 respondents (i.e. ADP staff) think the Mobile Telephone System (MTS) actually benefited the farmers; this represents 94% of the respondents. Conversely,3(6%) respondents say the MTS had no benefits to farmers

Table 4.10: ***Distribution of open-ended responses on outlined benefits of MTS to rural farmers***

S/N	Variables	F	%
1.	Easy access to fertilizer and other farm inputs	5	9
2.	e-payment	1	2
3.	Market Information dissemination	3	5
4.	Knowledge of where and how to get fertilizer	3	5
5.	Farmers get advisory services	5	9
6.	Farmers get fertilizer at reduced cost	6	11
7	Farmers know the actual price of farm inputs	1	2
8	Farmers know the quantity available and amount to pay	3	5
9	Farmers receive timely farmer input	1	2
10	Farmers get the right kind of fertilizer	2	4
11.	Undecided	7	13
12.	Genuine farmers are reached	10	18
13	Farmers communicate with other farmers	8	15
	Total	**55**	**100**

As a follow-up to the response in Table 4.9, the result in Table 4.10 indicates the outlined benefits that MTS has to the farmer. The responses: “Genuine farmers are reached” ranked highest with 10(18%) which is followed by the response: “Farmers communicate with each other” 8(15%) and “farmers get fertilizer at reduced cost” 6(11%). Other benefits include”

"Easy access to fertilizer and other farmer input"; and "farmers get advisory services" both with 5(9%).

Also, responses like "market information dissemination", "knowledge of where and how to get fertilizer" and "farmers know the quantity available and amount to pay" recorded 3(5%). At the bottom of the table are responses like: "E-payment", "farmers know the actual price of farm inputs" and "farmers receive timely farm inputs" with 1(2%) each.

Table 4.11:*Distribution of responses showing mobile telephony utilization among rural farmers in South-East Nigeria*

		RANK ORDER	
S/N	**Variables**	**F**	**%**
1.	Do you use mobile phone to access farm inputs like fertilizer?	225	12.9
2.	Do you use mobile phone to access seeds/seeding?	214	12.4
3	Did you get enough fertilizer required for your farming?	208	11.9
4	Did you get the right kind of fertilizer needed for your farming?	269	15.4
5.	Do you use mobile phone to access herbicides?	197	11.4
6.	Do you use mobile phone to access pesticides?	200	11.4
7.	Do you use mobile phone to access sack knap spray	168	9.7
8.	Do you use mobile phone to access Extension Agents' assistance?	259	14.9

The result in Table 4.11 shows a multiple affirmative response to the variables. Using the ranking order, the result shows that mobile phone use to get the right kind of fertilizer ranked highest with 269 (representing 15.4%). This is followed by the use of mobile phone to access Extension Agents' assistance as affirmed by 259 respondents (14.9%). The result also revealed that mobile phone use to access farm inputs like fertilizer ranked third with 225 (12.9%). Others were "the use of mobile phone to access seeds/seedlings (214 representing

12.4%) and using mobile phone to get enough fertilizer affirmed by 208 respondents (representing 11.9%).

Table 4.12: ***Distribution of responses showing extent of mobile telephony utilization among rural farmers in South East Nigeria***

S/N	Variables	VLE		LE		SE		N		AA	
		F	%	F	%	F	%	F	%	F	%
1	Advisory services	120	36	107	32	61	19	33	10	10	3
2.	Input information sourcing	36	11	98	30	112	34	67	20	18	5
3.	Market information sourcing	32	10	113	34	108	32	62	19	16	5
4.	Market price information	35	11	98	30	101	31	74	22	23	7
5.	Information on disease & pest control	40	12	124	37	52	16	70	21	45	14
6	Information on Home & Nutrition management	37	11	35	11	128	38	99	30	32	10
7.	Information on health management	62	19	98	30	97	29	66	20	8	2
8.	Farm produce storage information	51	15	72	22	123	37	60	18	25	8
9.	Agronomic training & practices	90	27	91	27	70	21	68	21	12	4
10.	Funding opportunities	30	9	67	20	130	39	83	25	21	7
11.	Information on farm training opportunities	55	17	116	35	104	32	52	16	4	1
12	Herbicide/chemical APP	36	11	78	24	120	36	89	27	8	2
13	Fertilizer application	67	20	112	34	85	26	34	10	33	10
14	Nature of fertilizer to use	70	21	53	16	122	37	67	20	19	6
15	Harvesting	64	19	79	24	94	28	69	21	25	8

The result in Table 4.12 shows that at least more than half of the respondents use the mobile telephony system to access all the listed items to some extent; “Agricultural advisory service” ranked highest in the list of items which the respondents say they access to a “Very Large Extent (VLE) with 120 (36%) and to a “Large Extent” (LE), 107 (32%), (Representing 5 and 4 points respectively). This is followed by access to “Agronomic practices and training” with 90(27%) to a “Very Large Extent” (VLE) and 91(27%) to a “Large Extent” (LE).

On the scale of “Large Extent” (LE), (representing 4 points), access to “Information on disease and pest control” ranked highest with 124 (37%), followed by access to “Information on farm training opportunities” which recorded 116 (35%) and access to “Market information sourcing” and “Fertilizer Application” with 113(34%) and 112(34%) respectively.

Also, on the scale of “Some Extent” (SE) (representing 3 points), access to “Funding opportunities” ranked highest with 130 (39%), followed by access to “Information on home and nutrition management” which recorded 128(38%) meanwhile, on the same scale (i.e. some extent”), access to “Farm produce storage information” and information on “Nature of fertilizer to use” both had 37% (represented by 123 and 122 responses respectively).

Lastly, respondents’ access to “Input information sourcing”; “Market information sourcing” and “Market price information” ranked 6^{th}, 7^{th} and 8^{th} respectively on the to “some extent” (SE) scale with responses as follows 112(34%), 108(32%) and 101(31%). This goes to show the importance of Agricultural Advisory services and Market Price Information on productivity and profit making to the farmer.

Table 4.13: ***Distribution of responses showing rural farmers utilization of mobile phone to learn about fertilizer***

Variables	SA	A	D	SD	U	Mean	St.D
I know the code to dial to find out whether fertilizer is available	112	93	48	58	20	3.66	1.272
I know the code to dial to request for fertilizer	66	123	78	52	12	3.54	1.087
I know the code to dial to access fertilizer	93	92	87	49	10	3.63	1.130
I know the code to redeem fertilizer	94	117	52	47	21	3.65	1.210
I know the code to confirm the redemption of fertilizer	81	80	104	43	23	3.46	1.191
I know the code for feedback (i.e. customer care & complaints)	89	86	96	44	16	3.57	1.159
I know the code to change the specification of input requested	100	57	100	62	12	3.52	1.204
I know the code for changing location of redemption centre	42	81	127	69	12	3.22	1.030
I know the code for rejecting unsolicited farm input	31	52	174	62	12	3.08	0.927
I know the code for cancelling request for fertilizer	54	102	106	55	14	3.38	1.073
I know the code to confirm payment for fertilizer	40	76	151	51	13	3.24	0.985
I know the code for seeking information on appropriate fertilizer to use	37	124	102	55	13	3.35	1.012

I know the code for updating my information	34	91	122	56	28	3.14	1.085
I know the code for rejecting unsolicited agricultural related information	22	113	109	68	19	3.15	1.011
I know the code to dial to pay for fertilizer received	74	59	125	50	23	3.34	1.180
I know the code for refund of payment made in error	20	135	86	57	33	3.16	1.095

The limit of real number is used as a basis to determine the cut-off point for each scale of measurement. Those responses that have mean scores within the range of the limits set for each scale of measurement are named by those scales of measurement. Here is a run-down of the limits set for real numbers that fall within each scale of measurement.

- For "Strongly Agree decisions = (5.00 – 4.45) = 5point
- For "Agree decision = (4.44 – 3.45) = 4point
- For "Disagree" decision = (3.44 – 2.45) = 3point
- For "strongly Disagree" decision = (2.44 – 1.45) = 2point
- For "undecided" decision = (1.44 – 0.45) = 1point

The result in Table 4.13 shows a preponderance of decisions tilting towards "Disagree" based on the above benchmark called "Limit of real numbers".

From the result, 9(out of the 16) responses fall within the "Disagree" decision as indicated in the figures under "D" column. The remaining 7 responses favoured the "Agree" decision going by the limit of real numbers. Hence, the areas where rural farmers learnt more about fertilizer using the mobile telephony system include: "Availability of fertilizer" (3.66), "how to request for fertilizer" (3.54), "Accessing fertilizer" (3.63), "how to redeem fertilizer"

(3.65), “how to confirm the redemption of fertilizer” (3.46), “how to use the customer care and complaints services” (3.57) and “how to change the specification of input requested” (3.52). All these responses had mean scores within the limit of the real number for “Agree” decision (i.e. 4.44 – 3.45).

On the other hand, the areas which farmers did not learn about fertilizer using the mobile telephony system include: “How to change location for redemption centre” (3.22), “How to reject unsolicited farm input” (3.08), “How to cancel request for fertilizer” (3.24), “How to seek information on appropriate fertilizer to use” (3.35), “How to update personal information” (3.14), “How to reject unsolicited agricultural related information” (3.15), “The code to dial to pay for fertilizer” (3.34) and “the code to dial for refund of payment made in error” (3.16). All the above responses had mean scores within the limit of real numbers for “Disagree” decision (i.e. 3.44 – 2.45).

The responses that rank highest in the “Agree” decision were: “I know the code to dial to find out whether fertilizer is available” (mean = 3.66 St.D = 1.272) and “I know the code to redeem fertilizer” (mean=3.65 St.D = 1.210); even though the former had a lower affirmative response shown by the addition of (SA + A) (i.e. 112 + 93 = 205) than the latter (94+117 = 211).Also, on the “Disagree” decision, “rejecting unsolicited farm input” ranked highest with (mean = 3.08, St.D = 0.927). This is followed by “knowing the code to confirm payment for fertilizer” with (mean = 3.24, St.D = 0.985). The former had on aggregate negative affirmation indicated by adding (D+SD) (i.e. 176+62 = 236), while the latter recorded (151 + 51 = 202).

Table 4.14:*Distribution of responses showing factors that enhance mobile telephony system utilization among rural farmers in South-East Nigeria*

Variables	SA	A	D	SD	U	Mean	St.D
I like the Mobile Telephony System because it is convenient	180	125	17	7	2	4.43	0.741
The use of mobile phone reduces corruption	72	164	58	28	9	3.79	0.967
Using mobile phone to access fertilizer is cheap	145	125	29	12	20	4.10	1.099
The Mobile Telephony System is fast	123	148	36	10	14	4.08	0.990
Using mobile phone to access fertilizer is simple	127	132	38	14	20	4.00	1.102
The codes used in the mobile phones are easy to understand	63	147	79	13	29	4.41	5.784
The fertilizers arrive on time	69	126	90	28	18	3.60	1.075
The network of the platform is not congested	32	124	126	16	33	3.32	1.053
There is no queue at the redemption centre in my area	88	162	38	28	15	3.85	1.052
The redemption centre is close to my area	70	90	119	36	16	3.49	1.088
The helpline staff attend to farmers on time	32	191	71	16	21	3.60	0.956
The process of registration is not cumbersome	59	112	121	17	22	3.51	1.054
The process of payment is quick and stress free	62	196	46	9	18	3.83	0.948
Farmers' complaints receive immediate attention	20	139	131	17	24	3.34	0.942
The language of communication through the Mobile Telephony System is easy to understand	50	182	58	11	30	3.64	1.071

There is a preponderance of affirmative response (87%) on the listed factors that enhance mobile telephony utilization among rural farmers in South-East Nigeria (13 out of 15

responses). From the result in Table4.14, a total of 5 responses ranked highest among the 13 affirmative responses with mean scores above (3.99). The limit of real numbers was used as a basis to determine the decisions on each of the responses. The affirmative responses are:

- "I like the mobile telephony system because it convenient (4.43)
- "The use of the mobile telephony system reduces corruption" (3.79)
- "Using mobile phone to access fertilizer is cheap" (4.10)
- "The mobile telephone system is fast" (4.08)
- "Using mobile phone to access fertilizer is simple" (4.00)
- "The codes used in the mobile telephony system are easy to understanding" (4.41)
- "The fertilizers arrive on time" (3.60)
- "There is no queue at the redemption centre in my area" (3.85)
- "The redemption centre is close to my house" (3.49)
- "The helpline staff attend to farmers on time" (3.60)
- "The process of registration is not cumbersome" (3.51)
- "The process of payment is quick and stress free" (3.83)
- "The language of communication through the mobile telephony system is easy to understanding"(3.64)

The responses above fall within the limit of real number for "Agree" decision (i.e. 4.44 – 3.45). Nevertheless, there were responses that ranked higher than others. The factor of "Convenience of use" ranked highest with (Mean = 4.43, St.D = 0.741) as affirmed by 305 (92%) of the respondents (i.e adding SA+A). This is followed by "The ease of understanding the codes to dial" with (mean = 4.41, St.D = 5.784) as affirmed by 210 respondents (representing 64% of the respondents) (i.e. adding SA+A). The other two factors on the top 5 are: the factor of "Reduced cost" (i.e. cheap) with (mean = 4.10, St.D = 0.990) and the factor of "Simple to use" (i.e. case of use (mean = 4.00, St. D = 1.102).

On the other hand, there were 2 factors that the respondents say did not enhance their use of the mobile telephony system. These are: "The network of the platform is not congested" (3.32) and "farmers' complaints receive immediate attention" (3.34). These responses fall within the limit of real number for "Disagree" decision (i.e. 3.44 – 2.45) which is an indication that indeed the network of the e-wallet platform have some level of network congestion, and that farmers' complaints did not receive immediate attention.

Table 4.15:*Factor Analysis on Motivation to Mobile Telephony Utilization among rural farmers in South-East Nigeria*

Rotated Component Matrix[a]

Variables	**Factors**		
	1	**2**	**3**
I like the Mobile Telephony System because it is convenient	0.564	-.188	0.478
The use of mobile phone reduces corruption	0.264	-.156	**0.707**
Using mobile phone to access fertilizer is cheap	**0.729**	0.274	0.326
The Mobile Telephony System is fast	0.327	0.360	**0.631**
Using mobile phone to access fertilizer is simple	**0.613**	0.340	0.337
The codes used in the mobile phones are easy to understand	-.031	0.123	**0.448**
The fertilizers arrive on time	**0.814**	0.267	-.075
The network of the platform is not congested	**0.683**	0.289	0.234
There is no queue at the redemption centre in my area	**0.675**	0.215	0.168
The redemption centre is close to my area	0.143	0.565	0.468
The helpline staff attend to farmers on time	0.558	0.552	-.279
The process of registration is not cumbersome	0.207	**0.778**	0.366

The process of payment is quick and stress free	0.396	**0.759**	0.043
Farmers' complaints receive immediate attention	0.108	**0.844**	0.110
The language of communication through the Mobile Telephony System is easy to understand	0.381	**0.690**	-.126

Factor 1 = Ease of Use & Usefulness of Mobile Telephony System Factor

Factor 2 = Timely & Ease of Fertilizer Delivery Factor

Factor 3 = Institutional factor

The use of factor analysis in this study was to ascertain how the factors under investigation correlate with each other using the Rotated Component Matrix of Varimax Factor Analysis. In grouping the variable for naming the factors, only variables (i.e. factors) that had a factor loading value of 0.40 and above were used in naming the factors.

Also, variables that loaded in more than one component (factor) were dropped, while those that did not have up to factor loading value of 0.40 as stated earlier were also dropped. According to Chukwuone, Agwu and Ozor in Olaolu (2016) only variables with loadings of 0.40 and above (10% overlapping variance) were used in naming the factors. From the result in table, variablesunder motivation to mobile telephony utilization among rural farmers in South-East Nigeria loaded under three (3) factors namely:

Factor 1 = Ease of use & usefulness factor

Factor 2 = Timely & ease of fertilizer delivery factor

Factor 3 = Institutional factor

The factor 1 variable had loading values of 0.729, 0.613, 0.814, 0.683 and 0.675. Also, factor 2 variables had loading values of 0.778, 0.759, 0.844 and 0.690 while factor 3 variables had loading values of 0.707, 0.631 and 0.448 respectively.

Table 4.16:*Distribution of responses showing constraints to farmers' utilization of mobile telephony system in accessing fertilizer in South-East Nigeria*

Variables	SA	A	D	SD	U	Mean	St.D
Cost of sending the code / text messages	113	138	61	11	8	4.02	0.937
Inability to compose and send text messages	31	146	141	9	4	3.58	0.748
Difficulty in understanding language of communication through the Mobile Telephony System	34	156	124	16	1	3.62	0.746
Failure in code response	72	102	114	18	25	3.54	1.118
Congestion on the network of the Mobile Telephony System	59	179	55	10	28	3.70	1.067
Receiving wrong text messages	25	88	181	17	20	3.24	0.896
Receiving unsolicited text messages	74	118	112	6	21	3.66	1.045
Poor training during the E-wallet program	58	100	153	4	16	3.54	0.957
Inadequate manpower for the training	76	151	75	6	23	3.76	1.048
Mix-up in responses to codes sent	52	125	118	5	31	3.49	1.077
Inconsistency of government policies and programmes	112	149	55	6	9	4.05	0.906
Poor monitoring of the process	56	122	120	12	21	3.54	1.021
Theft of mobile phone	90	130	84	11	16	3.81	1.029
Difficulty in repairing faulty mobile phone	48	142	117	22	2	3.64	0.832
Difficulty in recovering lost mobile phone	69	153	88	16	5	3.80	0.875
Poor knowledge of fertilizer request codes	73	132	90	8	28	3.65	1.109
Request of incentives at redemption centres	89	145	58	5	34	3.76	1.172

Here, the limit of real numbers was also used to determine the decisions for each of the responses. All but one of the listed responses in Table 4.16 had mean scores within the limit of real numbers for "Agree" decision (i.e. 4.44 – 3.45) which gives 94% affirmation to the listed constraints (i.e. 16 out of 17 responses).

For details, the responses that ranked highest (top 6 responses) are: "Cost of sending the code/text messages" (4.02); "Inconsistency of government policies and programmes"; (4.05); "Theft of mobile phone" (3.81); "Difficulty in recovering lost mobile phone" (3.80); "Inadequate manpower for the training" (3.76); "Request of incentives at redemption centres" (3.76)

Respondents affirm that "Inconsistency in government policies and programmes" is the greatest constraints to the use of MTS. This ranked highest as affirmed by 261 (79%) respondents (i.e. adding SA+A), followed by "Cost of sending the code/text messages" which was also affirmed 251 (76%) respondents (i.e. adding SA+A)

Conversely, the only response that was not perceived as a constraint was "Receiving wrong text messages" (mean = 3.24, St.D = 0.896). This response falls within the limit of real number for "Disagree" decision (i.e. 3.44 – 2.45) as shown in Table 17 above.

Table 4.17:*Distribution of responses (from ADP staff) on the constraints to mobile telephony system utilization among rural farmers in South-East Nigeria*

Variables	SA	A	D	SD	U	Mean	St.D
Lack of office facilities	3	23	26	3	-	3.47	0.690
Remuneration problem	9	37	6	3	-	3.89	0.875
Poor response from farmers	-	9	35	11	-	2.96	0.607
Poor response from cellular agents	8	6	30	11	-	3.20	0.931
Bureaucracy in the entire process	27	19	6	3	-	4.27	0.870
Mobility problem	38	11	6	-	-	4.58	0.686
Inconsistency in government policy	33	19	-	-	3	4.44	0.958
Poor response from national office (i.e. Abuja)	3	14	32	3	3	3.20	0.848
Too many farmers	15	-	28	12	-	3.33	1.106
Poor funding	18	18	13	3	3	3.82	1.124
Poor response from service providers	3	15	26	8	3	3.13	0.924
Delay / late payment by farmers	5	18	21	9	2	3.27	0.971
Duplication of responsibilities between state and federal desk officers	3	9	16	24	3	2.73	0.990
Change of government	43	6	-	-	6	4.45	1.259
Inability to initially disaggregate farmers into commodity of interest	12	11	23	9	-	3.47	1.016
Power supply	23	17	6	9	-	3.98	1.097
High cost of redeeming farm input	8	18	16	10	3	3.33	1.106
Wrong entries (especially during registration of farmers)	15	14	17	9	-	3.64	1.060

There is a greater affirmation from the ADP staff (10 out of 18) (representing 56%) from the list of constraints to mobile telephony system utilization among rural farmers in south –east Nigeria.

The limit of real numbers benchmark was also used here for the decisions on the responses within the scale of measurement they fall in: From the result in Table 4.17, two (2) out of the ten (10) affirmative responses to the constraints listed fall within the limit of real numbers for "Strongly Agree" decision (i.e. 5.00 – 4.45). They are:

- Mobility problem (Mean = 4.48, St.D = 0.686)
- Change of government (Mean = 4.45, St.D = 1.259)

The remaining 8 responses fall within the limit of real numbers for "Agree" decision (4.44 – 3.45). They include:

- Inconsistency in government policy = (Mean = 4.44, St.D = 0.958)
- Power supply (Mean = 3.98, St.D = 1.097)
- Remuneration problem (Mean =3.89, St.D = 0.875)
- Bureaucracy in the entire process (Mean = 4.27, St. D = 0.870)
- Poor funding (Mean = 3.82, St.D = 1.124)
- Wrong entries (especially during registration of farmers (Mean = 3.64, St.D = 1.060)
- Lack of office facilities (Mean = 3.47, St.D = 0.690)
- Inability to initially disaggregate farmers into commodity of interest (Mean = 3.47, St.D = 1.076)

On the other hand, there were 8 responses with negative affirmation which is an indication that the ADP staff did not consider them as constraints to mobile telephony system utilization among rural farmers in South-East Nigeria.

These responses fall within the limit of real numbers for "Disagree" decision (i.e. 3.44 – 2.45). They include:

- Poor response from farmers (Mean = 2.96, St. D = 0.607)
- Poor responses from cellular agents (Mean = 3.20, St. D = 0.934)
- Poor response from service providers (Mean = 3.13, St. D = 0.924)
- Delay/late payment by farmers (Mean = 3.27, St. D = 0.970)
- Duplication of responsibilities between state and federal desk officers (Mean = 2.73, St. D = 0.990)
- High cost of redeeming farm input (Mean = 3.33, St.D = 1.100)

From the list of responses from the ADP staff, top among the list of responses that were found not to have constituted any constraint is "poor responses from farmers" as confirmed by 46 (84%) respondents (i.e. adding D+SD).

Table 4.18:*Distribution of responses showing the extent to which constraints to mobile telephony system utilization affected farmers' participation in the program*

S/N	VARIABLE	VLE		LE		SE		N AA	
		F	%	F	%	F	%	F	%
1	To what extent do you think these challenges affected farmer's participation in the program?	24	44	20	36	8	14	3	6

From the result in table 4.18, the ADPstaff think that the challenges encountered in farmers' utilization of the mobile telephony system affected their participation. This is affirmed by 52 (out of 55) respondents (representing 94%) (i.e. adding VLE + LE + SE).

More specifically, 24 (44%) respondents say it affected farmers' participation to a "Very Large Extent" (VLE), 20(36%) respondents say it affected their participation to a "Large

Extent" (LE) while 8(14%) respondents say it affected their participation to "Some Extent" (SE).

At the bottom of the table are respondents (3 representing 6%), that say it did not affect farmers" participation in the program.

Table 4.19: ***Distribution of responses showing the extent to which constraints to MTS utilization among rural farmers affected ADP staffs' commitment to the program***

S/N	VARIABLE	VLE		LE		SE		N AA	
		F	%	F	%	F	%	F	%
1	To what extent do you think the challenges affected your commitment to the program negatively?	9	17	23	42	17	31	6	11

A total of 49 respondents (out of 55) (representing 89%) said the constraints or challenges encountered during farmers' use of the mobile telephony system to access fertilizer in South-East Nigeria affected their commitment to the program one way or the other (i.e. adding VLE, LE and SE).

In more specific terms, 9(17%) respondents said it affected their commitment to the program to a "Very Large Extent" (VLE), 23 (42%) respondents to a "Large Extent" (LE) and 17 (31%) respondents to "Some Extent" (SE) respectively.

Table 4.20: ***Factor Analysis on constraints to mobile telephony system utilization among rural farmers in South East Nigeria***

Rotated Component Matrix[a]				
Variables	**Factors**			
	1	**2**	**3**	**4**
Cost of sending the code / text messages	0.248	**0.619**	0.189	-0.080
Inability to compose and send text messages	0.099	**0.725**	-0.104	0.099
Difficulty in understanding language of communication through the Mobile Telephony System	0.078	0.109	0.117	**0.899**
Failure in code response	0.313	**0.736**	0.314	0.075
Congestion on the network of the Mobile Telephony System	0.505	0.385	0.409	0.208
Receiving wrong text messages	**0.830**	0.175	-0.089	0.180
Receiving unsolicited text messages	0.199	**0.743**	0.229	0.220
Poor training during the E-wallet program	**0.709**	0.286	0.173	-0.129
Inadequate manpower for the training	0.555	0.157	0.470	-0.010
Mix-up in responses to codes sent	0.225	**0.704**	-0.063	-0.008
Inconsistency of government policies and programmes	**0.585**	0.262	0.226	0.246
Poor monitoring of the process	**0.807**	0.217	0.216	-0.014
Theft of mobile phone	0.278	0.349	**0.625**	0.015
Difficulty in repairing faulty mobile phone	0.139	-0.065	**0.667**	-0.011
Difficulty in recovering lost mobile phone	0.003	0.044	**0.823**	0.185
Poor knowledge of fertilizer request codes	0.510	0.501	0.162	-0.238
Request of incentives at redemption centres	0.445	0.361	0.470	-0.255

Factor 1 = Implementation and Process related problems

Factor 2 = Technical and Cost related Constraints

Factor 3 = Mobile Phone Maintenance related Problems

Factor 4 = Communication Problems

Using the Rotated Component Matrix under Varimax Factor Analysis, the constraints to the use of MTS among rural farmers in South East Nigeria loaded under 4 components (factors). These include:

Factor 1: Implementation and process related problems (0.830, 0.709, 0.585 and 0.807)

Factor 2: Technical and cost related constraint (0.619, 0.725, 0.736, 0.743 and 0.704)

Factor 3: Mobile phone maintenance related problems (0.625, 0.667 and 0823)

Factor 4: Communication problem (0.899)

All the variable that were used to name the above factors based on their relatedness (i.e. how to correlate) loaded with values above 0.400 which was stated earlier in this study as the benchmark for using variable to name factors.

Table 4.21: ***Factor Analysis on constants to mobile telephony system utilization among rural farmers in South East Nigeria (response from ADP staff)***

Rotated Component Matrix[a]			
Variables	**Factors**		
	1	**2**	**3**
Lack of office facilities	0.373	**0.650**	0.077
Remuneration problem	0.390	-0.282	-0.210
Poor response from farmers	-0.120	-0.054	**0.920**
Poor response from cellular agents	0.162	0.196	**0.688**
Bureaucracy in the entire process	**0.526**	-0.059	0.153
Mobility problem	0.479	0.254	-0.756
Inconsistency in government policy	-0.093	**0.692**	-0.364
Poor response from national office (i.e. Abuja)	-0.068	**0.782**	0.059
Too many farmers	**0.799**	0.197	-0.128
Poor funding	**-0.707**	0.332	-0.273
Poor response from service providers	0.009	0.341	0.174
Delay / late payment by farmers	**-0.743**	-0.041	0.338
Duplication of responsibilities between state and federal desk officers	-0.063	**0.733**	-0.096
Change of government	-0.305	**0.690**	-0.333
Inability to initially disaggregate farmers into commodity of interest	0.238	0.600	0.425
Power supply	**-0.755**	0.049	0.158
High cost of redeeming farm input	-0.548	0.564	0.151
Wrong entries (especially during registration of farmers)	**0.812**	0.100	0.243

Factor 1 = Administrative and Technical related problems

Factor 2 = Policy making and Implementation problems

Factor 3 = Feedback related problems

Here, the Rotated Component Matrix under Varimax Factor Analysis was used and from the result, the variables loaded under 3 factors namely:

Factor 1: Administrative and technical related problems (0.526, 0.799, - 0.707, - 0.743, - 0.755 and 0.812)

Factor 2: Policy making and implementation related problems (0.650, 0.692, 0.782, 07.33 and 0.690)

Factor 3: Feedback related problems (0.920 and 0.688)

The variables that were used to name each of these factors loaded with values above 0.400 as shown in Table 19 and they are:

Factor 1 (Administrative and technical related Problems)

- Bureaucracy in the entire process (0.526)
- Too many farmers (0.799)
- Poor funding (-0.707)
- Delay/late payment by farmers (-0.743)
- Power supply (-0.755)

Factor 2 (Policy making and implementation related problems)

- Lack of office facilities (0.650)
- Inconsistency in government (0.692)
- Poor response from national office (i.e. Abuja) (0.782)
- Duplication of responsibilities between state and federal desk officers (0.733)
- Change of government (0.690)

Factor 3 (Feedback related problems)

- Poor response from farmers (0.920)
- Poor response from cellular agents (0.688)

4.2 Data Presentation and Analysis for In-depth Interview

A total of 6 key informants were interviewed (2 from each selected state) using the in-depth interview (IDI) Guide (see Appendix). They are:

(1) Mr.Ilukwe, Chukwuma**(Interviewee A)** (GESS Staff, one of the Cellulants) (Anambra State) Date: 12th March 2018 (10.00am)

(2) Mr.Okafor, Matthew **(Interviewee B)** (ADP Staff, Coordinator of GESS in Awka North (Anambra State) (Presently he is the Extension Officer for IFAD value-chain in Awka Zone) (Date: 12th March, 2018) (10:50am)

(3) Mrs. Chime Louisa **(Interviewee C)** (GESS Staff, one of the Helpline Cellulants in Awgu (Enugu State) Date: 9th October, 2017 (1.00pm)

(4) Mr.Nwobodo Luke **(Interviewee D)**GESS Desk Officer (Enugu State). NB: Interview was done via phone call (Date: 7th March, 2018) (10.00am)

(5) Mr.Eze Boniface **(Interviewee E)**(GESS Committee Secretary) Ebonyi State (Date: 26th February, 2018 (1:30pm)

(6) Mr.Udenwe Michael **(Interviewee F)** (Coordinator, Ezienyi farmer's multi-purpose cooperative society) Ebonyi State. (Date: 14th March, 2018 (2:13pm)

Table 4.22 (a): ***Distribution of responses from the In-depth interview showing emerging categories***

Question	Respondents	Categories
What was the objective of the mobile telephony system (MTS) adopted in the e-wallet program launched in 2012?	A	(i) Reducing price of fertilizer (ii) Delivering input on time (iii) Reaching real farmers
	B	Meeting genuine farmers
	C	(i) Getting fertilizer to real farmer (ii) Giving direct information to farmers (iii) Timely and useful information
	D	Getting input to real farmer
	E	(i) Enhancing transparency (ii) Timely delivery of farm inputs
	F	Helping real farmers with fertilizer

The response given to question 1 from the in-depth interview by the respondents as indicated in Table 22 (a) revealed emerging concepts from the relatedness of the response in each of the categories. The concepts of “timeliness”, “Real Farmers”and “usefulness” were deducedfrom the categories in their responses.

Table 4.22(b)

Question	Respondents	Categories
Do you think farmers have knowledge on how to use the MTS to access fertilizer in the state?	A	- Affirming - Messaging newly introduce - Making progress in knowledge
Probe: To what extent do you think they have such knowledge?	B	- Affirming - 80% knowledge - Needing assistance - Messaging interpreted
	C	- Affirming - Messaging interrupted
	D	- Affirming - Training given on how to use MTS - 60% knowledge
	E	- Affirming reasonably - Owning a mobile phone
	F	- Affirming - Training given to them - 60% knowledge

The responses given in Table 22(b) show a preponderance of affirmative response to the question on farmers' knowledge on how to use the MTS in accessing fertilizer. In each of the selected states, from the categories in the table the concepts of "Affirmation on knowledge", novelty" and "training" can be deduced.

Also, on the extent of knowledge on MTS utilization among farmers, the categories that emerged led to the concept of "Reasonability" in knowledge assessment

Table 4.22(c)

Question	Respondents	Categories
Do you think farmers have the requisite skill and competence to use the MTS to access fertilizer in the state?	A	- Negating - Needing strong capacity building - Depending on others for skill - Leading to manipulation
Probe: How do you assess their level of skill in using MTS to access fertilizer?	B	- Affirming - Feedback confirmation of skill present
	C	- Affirming - Feedback as confirmation of skill present - Needing assistance
	D	- Affirming - 60% skill acquisition
	E	- Affirming reasonably - Understanding codes easily
	F	- Needing assistance for some - 60% skill acquisition

The findings in table 4.22 (c) revealed a preponderance of affirmative response to the question on whether rural farmers have the requisite skill and competence to use the MTS in accessing fertilizer. The emerging concepts from these responses are: "Affirmation on skill",

"Feedback as confirmation" and "Assistance".Meanwhile, on the assessment of their level of skills on the use the MTS, the emerging categories led to the concept of "Average skill".

Table 4.22(d)

Question	Respondents	Categories
Do you think farmers compiled in the use of MTS to access fertilizer?	A	- Affirming
Probe: How do you assess their level of compliance?	B	- Affirming - Inconsistent results on compliance
	C	- Affirming
	D	- Affirming - 60% knowledge
	E	- Affirming reasonably - Inconsistent results on compliance
	F	- Affirming - Confirming compliance using result

There was high level of compliance in the use of the MTS in accessing fertilizer as expressed in the opinions of the interviewees in Table 4.22(d) but with levels of inconsistency in compliance attributed to sharp practices. The concepts that emerged from the above categories are: "Affirmation to compliance", and "inconsistency of result". More so, on the assessment of farmers' level of compliance, the concept of "Average compliance" emerged.

Table 4.22(e)

Question	Respondents	Categories
What factors do you think enhanced farmers' use of the MTS in accessing fertilizer in the state?	A	- Development - Spreading innovation
	B	- Needing increase in productivity - Reduced cost
	C	- Needing Agricultural information - Needing fertilizer
	D	- Motivated by result - Exchanging information and ideas
	E	- Reducing corruption - Transparency in the process
	F	- Eliminating bureaucracy - Ease of use of the MTS

There are recurring similarities in what the key informants think motivated the rural farmers to use the MTS in accessing fertilizer in each of the selected states. The relatedness in the categories, as shown in Table 4.22(e), produced the concepts of: "Diffusion of ideas", "Ease of use", "Motivated by need" and "Reduced corruption.".

Table 4.22(f)

Question	Respondents	Categories
Do you think there were constraints to the use of MTS among rural farmers in the state? Pls., outline them if there are.	A	- Illiteracy among farmers - Lack of understanding of some codes
	B	- Inability to pay - Needing reduction of cost
	C	- Poor network of the platform - Lack of power supply - Inadequate call credit
	D	- Network failure - Failed transition - Inability to read some message - Deleting message unknowingly
	E	- Delivering input late - Giving delayed feedback
	F	- Poor network of the platform - Lacking needed fertilizer - Inconsistency in input supply

The findings in Table 4.22(f) reveal that there are numerous constraints to farmers' utilization of the MTS in accessing fertilizer in each of the selected states as opined by the key informants. Also, there is relatedness in the stated categories which lead to the following

concepts: “Poor knowledge”, “Poverty”, “Poor network”, “Poor power supply”, “Delayed feedback”, “Poor Input Supply” and “Failed transactions”.

Table 4.23: ***Distribution of emerging concepts under Themes based on their relatedness***

S/N	Themes	Related Concepts
1.	Genuine	Timeliness
		Real farmers
		Novelty
2.	Affirmation	Affirmation on skill
		Affirmation to compliance
		Affirmation on knowledge
		Feedback as confirmation
3	Help	Training
		Assistance
		Motivated by need
4	Value	Usefulness
		Ease of value
5	Moderation	Reasonability
		Average skill
		Average compliance
		Reduced corruption
6	Inconsistency	Inconsistency of results
		Poor knowledge
		Poverty
		Poor network
		Poor power supply
		Delayed feedback
		Poor input Supply

The theme that emerged from the relatedness in the concepts from the in-depth Interview data cuts across the various objectives of the study. The theme “Genuine” comes from the idea that anything that is ‘new’ should have some attributes of being ‘real’ and ‘early’. Hence, it is

drawn from the idea that MTS is new and the process seeks for transparency and hopes to deal with 'real' farmers and real-time delivery of farm inputs which suggest that theme of "Genuine".

On the theme of "Affirmation", the idea is that anything that works involves processes that are believed to 'work' to achieve the desired result. So, what farmers who use the MTS get as result confirms what the GESS and ADP Staffs say about farmers' knowledge and skill of the process which implies that they (the farmers) complied with the process.

The theme of "Help", presupposes that anything that is new needs some form of assistance when introduced to people who are also new to the idea and what is likely to motivate them to seek for such help or assistance is their need for it.

On the theme of "Value", it is no doubt that the "ease of use" of any technology has some form of usefulness it gives to the user. Hence, farmers attach value to the MTS because of its ease of use which is of some benefits or usefulness to them.

"Moderation" as a theme comes from the idea that what it takes for farmers to comply with the process of using the MTS to access fertilizer is not evenly distributed among them. Some farmers have the skill, knowledge, competence and even money while some others do not. This invariably suggests the idea of moderation. Also, since the introduction of the MTS did not totally eliminate the services of the middlemen in the process, the idea of moderation comes from the fact that farmers still need some form of assistance either from their colleagues or the ADP Staffs (i.e. Helpline Staff or Cellulants).

Lastly, the theme of "Inconsistency" borrows from the idea of moderation but tends to be negative in outlook. When what is expected to be given to farmers to aid their utilization of the MTS is being delayed or denied or even reduced, one can say there is inconsistency in the entire process.

4.3 Discussion of Findings

Here, the findings from the study are discussed in relation to how they either agree or disagree with findings in literature and how they also provide answers to the research questions formulated in this study.

Research question one sought to find out how many rural farmers in south east Nigeria own and use mobile phones. The answer was found in Tables 4.1, 4.4, 4.11 and 4.23 which contain information on the demographic details of the rural farmers, their ownership of mobile phones as well as their utilization of the MTS respectively.

The findings from the result in these tables reveal that all (100%) of the rural farmers in this study (331) own mobile phones. Also, the details of ownership patterns from the demographic data reveal that more Males 199 (60%) own Mobile Phones when compared to their Female counterparts 132 (40%). This finding is also corroborated by the findings from studies conducted by Bolarinwa and Oyeyinka (2011) (Male = 68.3%; Female = 31.7%); Animashaun, Fakayode, Idris and Adedokun (2014) (Male = 79.2%, Female = 20.8%).

Conversely, this finding did not agree with the findings from a study carried out by Asa and Uwem (2017) in Akwa-Ibom State where they found that more female farmers (59.3%) own Mobile Phones than male farmers (40.7%).

On the other hand, mobile phone utilization among rural farmers largely depends on their needs and knowledge level. In this study, it was found that rural farmers' use of mobile phones depends on their knowledge level (i.e. Knowledgeable = 95% and Not Knowledgeable = 5%).

Also, findings from the in-depth Interview agreed with this as can be seen in the extract below:

Interviewee A

"… although there are very few farmers who neither had telephone nor knew how to use the MTS because as at that time the MTS was still coming into the country, hence, that knowledge was not so much there. But now, I think the knowledge had since progressed. …"

(*Personal Interview*, 12th March, 2018, 10.03 a.m.)

Interviewee B

"I think to a large extent they do have knowledge"

(*Personal Interview*, 12th March, 2018, 10.50 a.m.)

Interviewee C

"Actually some of them operate their phones with the help of their children. …"

(*Personal Interview*, 9th October, 2017, 1.07 p.m.)

Interviewee D

"Yes, I think so, because these farmers, irrespective of their location, were trained on how to use the Mobile Telephony System."

(*Personal Interview*, 7th March, 2018, 10.06 a.m.)

Interviewee E

"Yes, to a reasonable extent, they have the knowledge because an average farmer in the country now has a mobile phone."

(*Personal Interview*, 26th February, 2018, 1.36 p.m.)

Interviewee F

"Yes, because they were trained. …"

(*Personal Interview*, 12th March, 2018, 10.03 a.m.)

Comparing the above responses with the theme of "Help" which has the concepts of "Training", "Assistance" and "Motivated need" emanating from this study, we found that there are some pre-determining factors to knowledge on how to use a technology (i.e. Mobile Telephony System). The growth and spread of an innovation has a tendency to improve knowledge of its use among a given group based on the usefulness of that technology to meet their needs when used.

Even, when there is no immediate knowledge or skill to use mobile phone among some of the respondents, they sought the assistance of either their children or that of the ADP Staff because they were motivated by the technology's ability to meet their need of getting fertilizer for increased productivity of their farm products.

This falls within the purview of one of the tenets of the Diffusion of Innovation theory which explains one's disposition to use a given innovation based on its perceived usefulness in meeting one's needs.

Also, as espoused by Scholars in their explanation of the Technology Acceptance Model (TAM), two factors (perceived usefulness and perceived ease of use) have been shown in literature to influence the attitude and behaviour of persons to learn or know how to use a given technology (Davis, 1989; Kargain and Basoglu, 2007). This underscores the predisposition of rural farmers in South East Nigeria to use (or seek for assistance to use) mobile phone, based on its usefulness in meeting their needs.

Findings from literature also agrees with the findings in this study on farmers use of mobile phones based on their perceived usefulness of the technology in meeting their needs (Martins and Abbott, 2010; Bolarinwa and Oyeyinka, 2011; Animashaun, et al.., 2014).

Research question two sought to ascertain the extent to which the Mobile TelephonySystem is utilized in agricultural service delivery among rural farmers in South East Nigeria.The answer was found in Tables 4.10, 4.11 and 4.12 which deals with patterns of Mobile Telephony utilization among rural farmers as well as the extent to which Mobile Telephony System is used among rural farmers.

This study found that most rural farmers (225 representing 12.9%) and (269 representing 15.4%) used MTS to access farm inputs and the right kind of fertilizer for their yields respectively. They (259 representing 14.9%) also used it to access extension agents' assistance. This finding agrees with the findings from the results in Table 4.13 where "Advisory Services" were found to rank highest with 120 (representing 36%) on "Very Large Extent" (VLE) scale indicating a preponderance of farmers' use of mobile phone for that purpose. Findings also reveal that "Advisory Services" ranked 5th with 107 responses (representing 32%) behind variables like: "Information on Disease & Pest Control" with 124 (representing 37%); "Information on Farm Training Opportunities" with 116 (representing 35%); "Market Sourcing Information" with 113 (representing 34%) and "Fertilizer Application" with 112 (34%) on the "Large Extent" (LE) scale. This goes to show the importance rural farmers attach to advisory services as it concerns agricultural related information.

Scholars (in their findings) have come to agree with this fact that advisory services (i.e. speaking with Extension Agents on phone) is widespread among rural farmers' utilization of mobile phones (Bolarinwa and Oyeyinka, 2011 with mean = 19.32; Martins and Abbott, 2010

= 82%; Jain, *et. al*. = 95%; Asa and Uwem, 2017 with mean = 1.24 and Chhachhar and Hassan, 2013).

On the other hand, using mobile phone to communicate among farmers along agricultural value-chain was found to be widespread from the results in Table 4.10 (i.e. responses from the ADP Staff) with 8 (representing 15%). Farmers from different value-chain (i.e. Rice Farmers, Yam Farmers, Cassava Farmers, Maize Farmers, etc.) share information related to their area of crop production to enhance their practice and lead to increased productivity.

Asa and Uwem (2017) also found something similar to this in their study on "Utilization of Mobile Phones for Agricultural Purposes by Farmers in Itu area, Nigeria." In their study, they found that "getting information from fellow farmers" ranked highest among what farmers do with their mobile phones with mean = 1.61 as stated in the result.

Similarly, Martins and Abbott (2010) found that farmers use mobile phones to coordinate meetings and agricultural trainings among members (82%). Animashaun, *et. al*. (2014) in their finding (86.4%) also corroborates this fact that communication among farmers' social group is widespread.

Research question three sought to establish the number of rural farmers in South East Nigeria that use the Mobile Telephony System in their mobile phones to access farm inputs and agricultural advisory services. The results in Tables 4.10, 4.11, 4.12 and 4.23 above provided the answer to the question. As part of the benefits that accrue to rural farmers' use of mobile phone, this study found (from the responses of the ADP Staff) that access to advisory services was quite high as indicated by 5 (9%) of the ADP Staff.

Also, findings (from the responses of rural farmers) reveal that 259 (14.9%) of them use mobile phone to access extension agents' assistance based on their agricultural needs. This was also corroborated by the findings from the In-depth Interview, where the theme of

"Help" emanated from the concepts of "Training" and "Assistance" derived from the extracts of the interview as a proof that farmers get assistance in form of advisory services either on how to operate the MTS to access fertilizer or how to use fertilizer for better yield. As stated earlier in this study, the level of assistance given to farmers is dependent on their perceived need and access to the extension agents via the mobile phone.

The findings from the study carried out by Bolarinwa and Oyeyinka (2011) agree with the above findings. In their study, they found that 71.2% of farmers who own Mobile Phones make contact with extension agents for advisory services with contact per annum mean score of 41.43 which is an indication of how frequent they their mobile phone for that purpose.

Animashaun, et. al. (2014) also found that 67% of farmers use mobile phone for agricultural information and 63.6% use it to facilitate access with Agricultural Extension Officers for advisory services.

Similar findings from the In-depth Interview in this study reveal that farmers received assistance from ADP Staffs on how to use the MTS to access advisory services as well as how to use it to get fertilizer and other farm inputs. This can be found in the extracts below:

Interviewee C:

"Then I was assisting many farmers with their phones, because of the information they are getting from their colleagues … *when you come there, there is a woman who takes the phone and operates it for you how it's been operated*…"

(*Personal Interview*, 9th October, 2017, 1.06 p.m.)

This further underscores the earlier finding that farmers use the mobile phone to communicate among themselves and share information as well as seek advisory services

either on how to operate the MTS or any other agricultural related information that can improve productivity for their yield.

Research question four wants to find out the number of rural farmers in South East Nigeria that use the Mobile Telephony System in their phones to learn about fertilizer distribution as a form of agricultural communication. Results in Tables 4.10, 4.11, 4.13 and 4.23 provided answers to the question. From the responses of the ADP Staff (See Table 11), this study found that MTS was of immense benefit to rural famers in these areas: "Easy access to fertilizer and other farm inputs" with 5 (9%); "Market information dissemination" with 3 (5%); Knowledge of where and how to get fertilizer" with 3 (5%), "Advisory Services" with 5 (9%); "Getting fertilizer at reduced cost" with 6 (11%); "Knowing the quantity of fertilizer available and amount to pay" with 3 (5%) and "Getting the right kind of fertilizer" with 2 (4%).

This is corroborated by the findings from the rural farmers (See Table 4.11) where 208 respondents (11.9%) said they "got enough fertilizer required for their farming" as well as 269 (15.4%) who also said they got the right kind of fertilizer required for their farming.

Since the MTS uses codes, learning about fertilizer in the context of this study implies knowing the codes to dial to access whatever services one wanted via the e-wallet platform. Findings from the In-depth Interview underscore this fact as revealed in the extracts below:

Interviewee C:

"In operating it (i.e. the Mobile Telephony System) certain alphabets are used. For example: "M" stands for Maize, "U" stands for Urea, "K" stands for Cassava and so on"

(*Personal Interview*, 9th October, 2017, 1.06 p.m.)

This finding is supported by the findings from the result in Table 4.13 which revealed that more of the farmers (205 representing 62%) (by adding SA and A) know the code to dial to find out whether fertilizer is available.

Similarly, the study also found that 211 (64%) of the rural farmers know the code to redeem fertilizer; 189 (57%) know the code to dial when requesting for fertilizer and 161 (47%) know the code to dial when seeking information on appropriate fertilizer to use. This underscores how well farmers use the mobile phone to learn about fertilizer. Further findings were revealed from the In-depth Interview under the theme of "Affirmation" and "Moderation". The former contains concepts emerging from the idea that farmers' skill, knowledge and compliance in the use of the MTS to learn about fertilizer were confirmed by the kind of results they got, hence, making the Key Informants affirm that farmers really learnt about fertilizer using their mobile phones.

Interviewee E:

"The 'Free' nature of the system, I think, was an inducement for farmers' participation"

(*Personal Interview*, 26th February, 2018, 1.36 p.m.)

Interviewee F:

"… the ease of use of the MTS motivated them."

(*Personal Interview*, 14th March, 2018, 2.19 p.m.)

Scholars also found a number of factors as motivation to rural farmers' use of mobile phone: Zhang and Yuan (2002) mentioned the cost associated with using mobile phone; Hooper and Zhou (2007) found the personal attribute of the user and the influence of others (i.e. early

users) as a motivating factor. Mehrtens*et. al*. (2001) revealed that the perceived benefits and organizational readiness (Hooper *et. al*. 2010) are major factors that enhance mobile phone usage among rural farmers.

Also, Aker and Mbiti (2010) found mobile phones to be more accessible to rural farmers than other alternatives in terms of cost, geographic coverage and ease of use. More so, Etwire, Buah, Ouedraogo, Zougmore, Partey, Martey, Dayamba and Bayala (2017) in their study found that the need for access to Agricultural Extension motivates farmers' use of mobile phone.

This explains why proponents of the Technology Acceptance Model (TAM) identified "Perceived usefulness" and "Perceived Ease of Use" as two important determining factors for any group to adopt a given technology. These two factors were found to be predominant in all the above findings which corroborated the findings in this study.

The findings from the factor analysis on motivation to rural farmers' use of mobile phone in south east Nigeria (See Table 4.15) revealed that the variables on factors that enhance MTS use among rural farmers loaded in three (3) groups based on the relatedness of the factors.

This study found that the group that had the highest number of variables loading above the 0.400 value was named "Ease of Use and Usefulness of MTS" (i.e. Factor 1). This further buttress the fact stated earlier in the Technology Acceptance Model that the two major factors that influence the attitude and behavioural intensions of a person to use a given technology are **Perceived Ease of Use** and **PerceivedUsefulness**.

Similarly, the second group of variables loading above 0.400 benchmark for factor loading (See Table 4.15) was found to be named "Timely and Ease of Fertilizer delivery" which ranked 2nd with variables perceived to be the motivations for farmers' use of the MTS in accessing fertilizer in south east Nigeria.

Lastly, variables that loaded in group three "Institutional Factors" where found to be dealing with the outcome of the process of using the MTS rather than the use of the MTS itself. This is also perceived to be among the factors that enhance farmers' utilization of the MTS in south east Nigeria.

Research question five sought to find out factors that motivated the use of the Mobile Telephony System among rural farmers in south east Nigeria. This study found from the results in Tables 4.14 and 4.15 that "convenience of use" and ease of understanding the codes were the major determining factors for the continued use of the MTS. Findings further revealed that the reduced cost of accessing fertilizer using MTS and the fact that it saves time also motivated more farmers to take part based on evidence from those that have used the system earlier.

More so, findings from the factor analysis showed that more factors loaded under the name: "Ease of Use and Usefulness of MTS factor" (i.e. 5 factors) which is an indication that the perceived advantage that accrue to the MTS as a new technology in agricultural communication gave impetus to its adoption and continued use among rural farmers in south east Nigeria. This agrees with the tenets of the Technology Acceptance Model (TAM) which stressed that "Perceived Usefulness" (PU) is a key determinant of acceptance which presupposes that a user is likely to adopt and use a technology if that technology increases his or her job performance (Davis *et. al.,* 1989).

On the other hand, the finding also underscores the influence of the "Perceived Ease of Use" of a given technology on user's continued use as well as recommending such technology for others. According to Davis (1989, p.985) the perceived ease of use is "the degree to which the user expects the target system to be free of effort," thereby enhancing efficiency in what it has been put to use.

Research question six sought to find out the constraints to the use of MTS in fertilizer distribution among rural farmers in south east Nigeria. The findings from the results in Tables 4.16, 4.17, 4.18, 4.19, 4.20, 4.21 and 4.22(f) provided answers to the question. This is because they contain responses on constraints to the use of the MTS from the point of view of the three groups of respondents in this study (i.e. farmers, ADP Staffs and Key Informants).

From the farmers' point of view, this study found that "Inconsistency of Government policies and programmes" ranked highest among the constraints as affirmed by 261 (79%) of rural farmers. Others were constraints related to "Cost" (both of maintaining the mobile phone and paying for the fertilizer) as affirmed by 251 (76%), 190 (57%), and 222 (67%) respondents respectively.

This study also found constraints relating to poor implementation of policies and processes of using the MTS as affecting the use of the MTS by rural farmers. This ranges from "farmers receiving unsolicited messages as affirmed by 192 (58%); Congestion on the network of the platform 238 (72%); Failure in code response 174 (53%); Inadequate manpower for the training 227 (69%); Mix-up in responses to codes sent 177 (54%); Poor monitoring of the process 178 (54%) and request of incentives at redemption centres 234 (71%). All the above constraints found in this study can be traced to failure on the part of the government to properly implement the e-wallet program which initial objective was to reduce corruption through eliminating the services of the middlemen as was the case in previous interventions.

Findings from the responses made by the ADP staff further corroborated that of the rural farmers but were more of institutional problems or lapses which posed serious threat to farmers' continuous use of the MTS in accessing fertilizer in the region.

This study found that "Inconsistency in government policies" ranked highest among the constraints. This was affirmed by 52 (95%) of the respondents (i.e. ADP Staffs). Other

constraints include: “Poor funding” 36 (66%); “Bureaucracy in the entire process” 46 (84%); “Change of government” 49 (89%); “Mobility problem” 49 (89%) and “Remuneration problem” 46 (84%) as well as “Power supply issues” 40 (73%) as contained in the results (See Table 4.17) above.

The multiplier effect of each of these constraints has the capacity to corrupt the innovation which scholars believe have been the envy of other African countries like Uganda and Kenya (Mtega and Msungu, 2013) who wants to replicate the MTS use for fertilizer distribution among rural farmers in their regions.

Further findings from the responses made by the ADP Staffs revealed that the above constraints affected farmers’ participation in the program to a “Very Large Extent” (VLE) as affirmed by 24 (44%) respondents and to a “Large Extent” as affirmed by 20 (37%) of the respondents.

On the part of the ADP Staffs commitment to the program, this study found that the listed constraints above were found to have affected their commitment to the e-wallet program negatively (See Table 19) to a “Large Extent” (LE) and to “Some Extent” (SE) as affirmed by 23 (42%) and 17 (31%) respondents respectively.

This was further confirmed by the responses from farmers (See Table 16) stating that incentives were requested from them at the redemption centres as affirmed by 234 (71%) of the respondents (adding SA + A).

The In-depth Interview had similar findings that agreed with the findings earlier stated on the constraints to MTS utilization among rural farmers in south east Nigeria (from the responses of the rural farmers and that of the ADP Staffs). Below are the extracts:

Interviewee B:

"Farmers' inability to pay that 50% easily was another constraint… they want government to reduce it to 10% ... Sometimes if they send the code to Abuja it will take up to 2 days to get reply; this tends to discourage some of the farmers"

(*Personal Interview*, 12th March, 2018, 10.50 a.m.)

Interviewee C:

"Sometimes no network on the e-wallet platform; at times their battery might below and no power supply to charge them …"

(*Personal Interview*, 9th October, 2017, 1.07 p.m.)

Interviewee D:

"Network failure, failed transactions and farmers deleting messages unintentionally were some of the constraints …"

(*Personal Interview*, 7th March, 2018, 10.06 a.m.)

Interviewee E:

"Some of the farm inputs do not arrive on time and there is delay in giving feedback to farmers' complaints …"

(*Personal Interview*, 26th February, 2018, 1.36 p.m.)

Interviewee F:

"Network of the platform is not always available; not all the time that Agro-dealers have the type of fertilizer that the farmers need and sometimes the Agro-dealers will supply fertilizer and withhold the seedlings or will supply the seedlings and withhold the fertilizer."

(*Personal Interview*, 14th March, 2018, 2.19 p.m.)

All the above responses from the Interview extracts points to "Inconsistency" in the implementation of the program and failure on the part of some government institutions involved in the e-wallet program.

Other studies on mobile phone utilization among rural farmers had similar findings that agree with the findings in this study. Asa (2015) found "High cost of mobile phone services by service providers" (108 which ranked 5th) as one of the major constraints to farmers' utilization of the mobile phone adding that "High repairs and maintenance cost (83 which ranked 8th) as well as "Poor network coverage (125 which ranked 4th) contributed to farmers not maximizing their use of the mobile phone in the Agricultural sector. He further found "intermittent and unreliable electric power supply" as a major constraint (with 138 responses ranking 1st).

This was corroborated by Mittal and Mehar (2012) in their study where they found "Poor extension facility" (46.87%) as a major constraint. Others are "Poor access to electricity" (10.18%) and "Shortage of labour" (5.58%).

Furthermore, Dare and Ojebuyi (2017) in their study found among others that "Epileptic power supply" ranked highest (29%) among the constraints, followed by "Poor network signal" with 23% as well as "Unfamiliarity with the phones' features (16%) as one of the constraints.

Similarly, Kwakwa (2012) in a related study conducted on "Mobile Phone usage among farmers" found "No reception" as ranking highest (94.6%) among the constraints to using mobile phone among rural farmers. This was followed by "Network failure" (i.e. voice breaking in-between discussions) (88%) as well as "abrupt end of calls" (82.6%). All these point to the fact that there are more administrative and institutional factors as constraints to rural farmers' use of mobile phones. Other constraints found were related to farmers' knowledge level of its operation.

This is further buttressed from the findings in the factor analysis on constraints to the use of MTS among rural farmers in this study (See Table 4.20). The rankings of the named variables based on their loading value revealed that "Technical and Cost related constraints" ranked highest with 5 variables loading above 0.400 benchmark. This is followed by "Implementation and process related problems" loading with 4 variables while "Mobile phone maintenance related problems" loaded with 3 variables leaving "Communication related problems" loading with 1 variable which has to do with farmers' limited knowledge on the operations of the MTS used in the e-wallet program.

Similarly, the findings from the factor analysis (from ADP Staff responses) on constraints to MTS utilization among rural farmers (See Table 4.21) agree with that of farmers' responses. Here, "Administrative and Technical related problems" ranked highest with 6 variables loading above the 0.400 benchmark. This is followed by "Policy making and implementation related problems" loading with 5 variables leaving "Feedback related problems" at the bottom of the table with 2 variables.

From the above findings, there is strong correlation between institutional failure and process failure in the use of the MTS among rural farmers. And when this happen the end users (i.e. farmers) are likely to be discouraged from using the technology.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Findings

This study interrogated the utilization of MobileTelephony Systemin agricultural communication among rural farmers in South East Nigeria. Specifically, it examined the extent and how the rural farmers in South East Nigeria used Mobile Telephony in accessing fertilizer and other farm inputs as well as agricultural service delivery and advisory services. This was to provide the basis for the NRAP (2013) Pilot Study report that rural farmers in South East Nigeria did not make use of the Mobile Telephony System in accessing fertilizer and other farm inputs.

This study found that all (100%) of the rural farmers in South East Nigeria own mobile phones and majority (95%)have the knowledge and requisite skill on how to operate these phones. (i.e. using assigned codes to access fertilizers and other farm inputs). This study also found that those who could not operate the mobile telephony system (5%) sought the assistance of either their children, colleagues or the ADP staff assigned to their area during the e-wallet program.

On the ownership pattern, more male (60%) own mobile phone when compared to their female counterpart (40%). Mobile Telephony System utilization among rural farmers in South East Nigeria was found to be largely dependent on the knowledge level of its operation as well as the utilitarian value of the technology in meeting the needs of these farmers for farm input.

On the extent of usage of the Mobile Telephony System (MTS), the ranking order of the multiple responses to the various types of agricultural communication was used to ascertain the type of agricultural communication used mostly by these rural farmers in South East Nigeria. This study found that the use of the MTS to get the right kind of fertilizer needed for their yield ranked highest with 15.4% while the use of the MTS to access Extension Agents' assistance ranked second with 14.9%. Others were the use of the MTS to access fertilizer and other farm inputs like seeds/seedlings ranked third and fourth with 12.9% and 12.4% respectively.

Similarly, using mobile phone to communicate among farmers along similar value-chain was also found to be widespread 8(15%) from the responses of the ADP staff. The ability to learn about the use of a given technology stems from the benefit or usefulness of that technology to the user. This was found to be true in this study as affirmed by 208 (63%) of the rural farmer and 269(81%) who got the right kind of fertilizer they needed.

The above findings prompted rural farmers to learn more about fertilizer using the mobile telephony system as affirmed by 205(64%) of rural farmers who learnt the code to dial to find out whether fertilizer is available and 211(62%) rural farmers who learnt the code to dial to redeem fertilizer as well as 161 (47%) who learnt the code to dial when seeking information on appropriate fertilizer to use. Meanwhile, this study also found that 189(57%) of rural farmers learnt the code to dial when requesting for fertilizer.

The motivation to either adopt a new technology or continue the use of an existing one was found in this study to be linked with the "ease of use" of that technology and its "perceived usefulness."

In this study, the benefits of mobile telephony utilization which include: “Easy access to fertilizer”, “E-payment” and “Reduced cost” were found to be the motivating factors for rural farmers’ continual use of the mobile telephony system. Moreso, “Accessing fertilizer at reduced cost”, “Mobile telephony system is fast”, “Ease of use of the technology” and “Easy understanding of its operations” were found to be the motivating factors for rural farmers’ utilization of the technology.

Lastly,on the constraints to the use of mobile telephony system among rural farmers in South East Nigeria, this study found that “Inconsistency in government policies and programmes” ranked highest 261(79%) as a result of “Change in government” as affirmed by 49(89%) of the ADP staff. However, “Poor power supply” was also found to be a major challenge from the key informants’ responses which is believed to have negatively affected rural farmers’ participation in the e-wallet program.

5.2 Conclusion

Based on the findings in this research work, the following inferences were drawn:

1. Ownership of mobile phone is not a determining factor for its utilization. Also, it usage is pre-determined by user’s knowledge level as well as the ability of the mobile phone use to meet the prevailing need of the user.
2. There is a strong correlation between ease of use of the MTS and the user’s capability to easily understanding its operation under minimal supervision.
3. When a technology is made user-friendly the widespread of its utilization is likely to focus mainly on the user’s area of prevailing needs.

4. The ease of use of the MTS is a motivating factor for its adoption while its usefulness is a pre-determining factor for its continual use.
5. Learning about fertilizer using the MTS is directly proportional to its ease of use as well as its perceived usefulness in meeting the user's prevailing need of the fertilizer.
6. The result emanating from the utilization of an innovation enhances the adoption of such innovation by new users.
7. The inconsistency in government policies and programmes is a major constraint to individual's participation in future programs by a new government.
8. Poor implementation of an innovation has the capacity to negatively affect the commitment of the work force involved in implementing the programme.
9. The positive result of a given technology in a program is a strong motivation of its implementation in other future programmes.
10. Poor maintenance culture weakens the growth of an innovation despite the positive results emanating from its utilization.

5.3 Recommendations

In view of the findings in this study and the conclusions drawn therefrom, the following recommendations are made:

1. Government's introduction of an innovation that aims at enhancing farmers' access to farm inputs like fertilizer must consider the knowledge level of these farmers.
2. Since farming is time bound, input supply via mobile telephony system must take into consideration the timely delivery of such input so that its benefits can be fully maximized by the farmers.
3. Government should see the need to introduce a mechanism for monitoring progress of the introduction of an innovation periodically to avoid giving room for corrupt

practices due to inconsistency of policies and programmes and poor implementation of such innovation especially in rural areas.

4. The introduction of mobile technology in any sector of the economy should make provision for alternative network switch-overon the platform by building multiple networks of such platform in case if anyone fails.
5. Multipleand flexible feedback mechanism is important to build user-confidence in mobile technology utilization. This can be achieved via independent offline feedback generation
6. The introduction of mobile telephony system in any sector of the economy of Nigeria should involve a proper evaluation of its use in previous sectionsso as to avoid having recurring constraints or challenges that could have been avoided as a result of poor planning.
7. The use of Point of Sale (POS) servicesshould be introduced alongside the mobile telephony system in areas where farmers find it difficult to access money from their bank account to pay for farm inputs.
8. Constant communication between rural farmers and other stakeholders in the mobile telephony system is important for continuous monitoring of successful input delivery, so that government will not only rely on the feedback from the ADP staff or Agro-dealers on ground.
9. Government should boost power supply in the country through the introduction of alternative power source (like solar power source) so as not to jeopardize the introduction of any mobile technology innovation that needs power supply for its sustainability.

5.4Suggestions for Further Studies

1. A content analysis version of this study should be carried out. The objective should be to assess the manifest content of the messages in the Mobile Telephony System used in Agricultural Communication as it concerns agricultural related information among rural farmers in South East Nigeria.
2. A replication of this study in other geo-political zones of the country is suggested so as to give a total outlook to its findings in agricultural communication in Nigeria.
3. Comparative studies could also be carried out. This is with a view to comparing the usage patterns of Mobile Telephony System in Agricultural Communication across states within a geo-political zoneand also among geo-political zones of the country.
4. A replication of this study is also germane in assessing Mobile Telephony System use in accessing farm inputs among rural farmers in a state, especially in the northern part of Nigeria.

5.5Contribution to Knowledge

The following were the contributions this study made to knowledge as regards Mobile Telephony utilization in Agricultural Communication:

1. The e-wallet scheme where the Mobile Telephony System was used is new and the study validated existing literature that Mobile Telephony System offers great opportunity for rural farmers in terms of access to agricultural related information and ideas that can increase productivity.
2. The findings in this study also debunked the findings from the pilot study of the e-wallet scheme where it stated that South East rural farmers did not make adequate use of the MTS in accessing fertilizer and other farm inputs.

3. The findings in this study also validated the tenets of the Technology Acceptance Model (TAM) where it stated that the "Ease of Use" of a technology determines its adoption while the "Perceived Usefulness" determines its continued usage.
4. This study also revealed the current status of Mobile Telephony System utilization among rural farmers as an application that is not just used in mobile phones but also used in Tablets and Ipads as experimented in the pilot phase of the programme launched by the International Fund for Agricultural Development (IFAD) currently in six states of Nigeria.
5. The findings in this study also validated the recent trend in digital technology where codes can be used by non-literate individuals via their phones to access different kinds of agricultural related information as it is in the banking sector with mobile banking.

References

Adebayo, A. A. (2010). Food security status in Nigeria: Pre and past Economic Deregulation Review: *International Journal of Economic Development Research and Investment* 3(1), 135 – 147

Adebayo, R. (2015). Communication channels that can sustain agricultural production in Nigeria. *Journal of Information and Communication*, 11 (3): 78 – 88

Adebayo, O. &Olagunju, K. (2015).Impact of Agricultural Innovation on improved livelihood and productivity outcomes among smallholder farmers in rural Nigeria.*A working paper for the 5th MSM Annual Research Conference.Managing African Agriculture: Markets, linkages and Rural Economic Development*, Maastricht, Netherlands.

Adebo, G. M. (2014). Effectiveness of e-wallet practice in grass-root Agricultural delivery in Nigeria – A case study of Kwara State Growth Enhancement Support Scheme (GESS).*Journal of Experimental Biology and Agricultural Science*, 2(4), 410 – 418

Adeniyi, O.R. (2012) 'Socio-Economics Analysis of Subsistence Farming Practices in South-Western Nigeria', *Sustainable Agriculture Research*, Vol. 2, No.1

Adereti, F. O., Fapojuwo, O. E. &Onasanya, A. S. (2006).Information utilization on cocoa production techniques by farmers in Oluyole Local Government Area of Oyo State, Nigeria. *European Journal of Social Science*, 3(1), 1 – 7

Adesina, A. (2009) 'African food crisis: conditioning trends and global development policy', *IAAE international conference China*.

Adesina, A. (2013, Jan. 15). "Nigeria, no going back on cell phones,"*Vanguard newspapers*. Retrieved from http://www.vanguardngr.com

Adesina, A. A &Baidu-Forson, J. (1995) 'Farmers perception and adoption of new agricultural technology: Evidence from analysis in Burkina Faso and Guinea, West Africa', *Agricultural Economics*, 13: 1 – 9

Adesina, A. A. (2013). Honourable Minister of Agriculture and Rural Development, Federal Republic of Nigeria, *Governor from Nigeria, at the 36th session of the IFAD Governing Council consultative group on international agricultural research (1997) Information needs of small scale farmers in Africa: The Nigerian example.* 4 (3).

Adesope, O, M., Asiabaka, C, C. &Agumagu, A, C., (2007). Effect of Personal Characteristics of Extension Managers and Supervisors on Information Technology Needs in the Niger Delta Area of Nigeria, International Journal of Education and Development using ICT, 3 (2), 11 – 19

Adewuyi, K. A. &Hayatu, Y. (2011).Effect of poverty on food security of rural households in Adamawa State, Nigeria.*Journal of Environmental Issues and Agriculture in Developing Countries* 3(1), 150 – 152

African Union (2003) *Maputo Declaration on Agriculture and Food Security: 10 percent national budget allocation to agriculture development.* Available at www.africa-union.org

African Union (2010) *Discussion paper on Maputo declaration and food security in Africa.* Available at www.africa-union.org

Agbamu, J. U. (2006). *Essentials of Agricultural Communication in Nigeria*. Lagos: Malthouse Press Limited.

Agboola, S. A. (2007). *An agricultural Atlas of Nigeria.* Oxford: Oxford University Press Ltd.

Ahmed, F. F., Yusuf, A. B. &Dunah, F. J. (2016).Effect of Growth Enhancement Scheme (GESS) on food security status of rural farming households in Adamawa State, Nigeria.*EPRA International Journal of Economic and Business Review*, 4(5) ISSN:2349-0187: 14 – 24

Ahmed, R. K. (2012). Fertilizer supply and distribution in Nigeria: repetition a case for public – private sector partnership. Available at http://www.fepsannigeria.com/indexphp?option=com_content&view=article&id=179&Itemid=228 (accessed on 29 April, 2014)

Aigbokhan, B. (2001) 'Resuscitating Agricultural Production (cocoa, cotton, groundnuts, palm oil, rubber e.t.c) for exports', *Paper presented at the 10th annual conference of zonal research units of the Central Bank of Nigeria*.

Aigbokhan, B. (2002) 'Poverty, growth and inequality in Nigeria: a case study. Nairobi, Kenya', *African Economic Research Consortium (AERC).*

Aina, L. O. (1988). Agricultural information provision in Nigeria. *Journal of Library Archival Information Special,* 2 (4): 214

Ajakaiye, P. (1978). Modern technology transfers in agriculture. *Agricultural Research Institute. Agricultural Newsletter*. 19 (3): 105

Aker, J. (2010). Dial "A" for agriculture: using information and communication technologies for agricultural extension in developing countries. *Paper presented at the Conference Agriculture for Development-Revisited, University of California at Berkeley, October*.

Aker, J. C. &Mbiti, I. B. (2010).Mobile phones and economic development in Africa.*Journal of Economic Perspective. 24 (3), 207 – 232*

Aker, J. C. (2008). Does digital divide or provide? The impact of cell phones on grain markets in Niger. *Centre for Global Development Working Paper, 154*.

Aker, J. C. (2011). Dial "A" for agriculture: A review of information and communication technologies for agricultural extension in developing countries. *Agricultural Economics, 42*(6), 631-647.

Akinbile, L. A. &Odebode, S. O. (2002). Determinants of farmers use of sustainable practices in Osun State, Nigeria, challenges of organic farming and sustainable land use in the tropics and sub-tropics. Available at http://www.troentag.de/2002/abstract/links/akinbile-nfaxzey7.pdf

Akinbile, L. A., Akwiwu, V. W. &Alade, O. O. (2016). Determinants of farmers' willingness to utilize e-wallet for accessing agricultural information in Osun State, Nigeria. Nigerian *Journal of Rural Sociology*, 15(1): 105 – 113

Albu, M. & Scott A. (2001). Understanding livelihoods that involve micro-enterprise: Markets and technological capabilities in the SL framework. *Intermediate Technology Group*. Retrieved on February 09, 2009, fromhttp://www.itdg.org.

Anambra State Agricultural Policy (2010) *Anambra State Agricultural Plan and Policy thrust document.*

Angba, A. O. (2000). *Determinant of sustained use of selected technologies recommended to farmers by Cross River State Agricultural Development Programme (ADP)*. (Unpublished Ph.D Thesis), University of Ibadan, Nigeria.

Animashaun, J. O., Fakayode, S. B., Idris, K. A. &Adedokun, K, (2014). Patterns and drivers of mobile telephony for sustainable livelihood among farming households in Kwara State, Nigeria.*Journal of Agricultural Informatics, 5 (2), 34 – 44*

Anjum, R. (2015). Design of mobile phone services to support farmers in developing countries.*An unpublished Master's Thesis submitted at School of Computing, Computer Science, Faculty of Science and Forestry, University of Eastern Finland.*

Apantaku, S. O., Awotunde, A. &Folorun, M. A. (2001).Target agencies, awareness and implementation of Universities Agricultural Based Research Recommendation.*Asset Series (2): 141 – 150*

Asa, U. A. &Uwem, C. A. (2017).Utilization of mobile phones for agricultural purposes by farmers in Itu area, Nigeria.*European Scientific Journal, 13 (19): 395 – 402*

Asa, U. A. (2015).Constraints to mobile phones utilization by rural dwellers in Akwa-Ibom State, Nigeria.*International Journal of Information and Communication Technology Research 5 (2), 28 – 34*

Ashraf, N., Gine, X. & Karlan, D. (2005) *Growing Export Oriented Crops in Kenya: An Evaluation of Drum Net Services*. Ottawa: IDRC.

Ayanda, I. F. &Subair, S. K. (2015). Assessment of cell phone for extension services delivery to small scale farmers and prospects to sustainable agricultural production in Kwara State, Nigeria. Available at http://uasb.in/yahoo_site_admin/assets/docs/026.35293311.pdf

Babatunde, R. O., Omotosho, O. A., Olorunsanya, E. O. &Owotoki, G. M. (2008). Gender differences in resources allocation among rural households in Nigeria: implication for food security and living standard. *European Journal of Social Sciences*, 5(4): 160 – 173

Banful, A. B., Nkonga, E. &Obah, V. (2009). *Constraints to fertilizer use in Nigeria: Perspective and insights from the agricultural extension services, Nigeria strategy support program.*Brief No. 6. IFPRI:6P

Banks, K. (2008). Mobile phones and the digital divide. PC World, IDG News service, July 29, 2008. Available: http://www.pcworld.com/article/149075/mobile_phones_and_the_digital_divide.html

Barne, K. N. (1990). Some strategies of effective use of research information in Africa: Some Ghanaian and other Africa experiences: *In Arnold, E. and Nitechki, A. Culture and Development in Africa.* New York: N.S. Africa World Press: 131 – 143

Baumuller, H. (2015). Agricultural innovation service delivery through mobile phones: Analyses in Kenya. *An unpublished Doctoral dissertation submitted at Centre for Development Research. The faculty of Agriculture University of Bonn, Kenya*

Bello, M. & Obinne, P. O. (2012). Problems and prospects of agricultural information sources utilization by small scale farmers: A case from Nasarawa State of Nigeria. *Journal of Communication,* 3 (2): 91 – 98

Bilijion, J. V. &Kotze, P. (2007).Modeling the factors that influence mobile phone adoption.*Proceedings of the 2007 annual research conference of the South African ICSIT on IT research in developing countries, South Africa*, 152 – 161

Bolarinwa, K. K., &Oyeyinka, R. A. (2011).Use of cell phone by farmers and its implication on farmers' production capacity in Oyo State, Nigeria.*International Journal of Agricultural and Biosystems Engineering 5 (3): 170 – 174*

Borlaug, N. (2000). "Ending world hunger: The promise of Biotechnology and the threat of antisicencezealotry" (eds) 124: 487 – 490. Available at http://www.agbioworld.org/biotech-info/topics/borlaug/endhunger.html (accessed October 17, 2011).

Boz, T. & Ozcatalbas, O. (2010). Determining information sources used by crop producers: A case study of Gazian province in Turkey. *African Journal of Agricultural Resources, 5 (10): 980 – 987*

Brent, C. (2001). Electronic wallet: Past, present and future. A means of authentication and payment for device – independent electronic payment instructions.*A white paper on VP Business strategy, G-Payment Ltd. Warriewood NSW 2102 Australia.*

Briney, A. (2010).History and overview of the Green Revolution. About.com (online) Available at http://www.grography.about.com/od/globalproblemsandissues/a/greenrevolution.html (accessed October 21, 2011).

Cameron, L. A. (1999) 'The importance of learning in the adoption of high yielding varieties seeds', *Am.* Journal of Agricultural Economics, 81: 83-94, Links.

Canning, D. & Bennathan, E. (2000) 'The social rate of return on infrastructure investments', *Policy research working paper 2390, Washington, DC: World Bank*

Central Bank of Nigeria (2002), Statistical Bulletin, 9 (20): 114-117. *CBN, Abuja*.

Cheneau-Loquay, A. (2010). *Innovative ways of appropriating Mobile Telephony in Africa,*International telecommunication Union

Chhachhar, A. R. & Hassan, H. J. (2013).The use of mobile phone among farmers for Agriculture Development.*International Journal of Scientific Research, 2 (6): 95 – 98*

Chhachhar, A.R., Querestic, B., Khushk, G.M. & Ahmed, S. (2014) Impact of ICTs in Agriculture Development. *Journal of Basic Applied Scientific Research, 4(1):281-288.*

Chima, C. D. (2015). *Socio-economic determinants of modern agricultural technology adoption in multiple food crops and its impact on productivity and food availability at the farm-level: A case study from South-Eastern Nigeria.* (An Unpublished Doctoral Thesis) Plymouth University, England.

Chukwuemeka, E. &Nzewi, H. N. (2011). "An empirical study of World Bank agricultural development programme in Nigeria*," American Journal of Social and management Sciences* 2(1): 176 – 187

Chukwuemeka, E. (2004) 'World Bank and Agricultural development in Enugu state', *ESUI Journal of Administration,* 1(2): 56-70. 290

Cleaver, H. (1972). "The contradictions of the Green Revolution," *American Economic Review,* 62(2): 177 – 86

Dare, M. &Ojebuyi, B. (2017).Mobile phone use for Agribusiness by farmers in South West, Nigeria.*Journal of Agricultural Extension*. ISSN 1119944X: 172 – 186

Datt, G. & Ravallion, M. (1998) 'Farm productivity and rural poverty in India' *Food consumption and Nutrition Division Discussion Paper No. 42.*Washington D.C. International Food Policy Research Institute.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology.*MIS Quarterly*, 13(3): 319 – 340

Delgado, C.L. (1995) 'African's changing agricultural development strategies: past and present paradigms as a guide to the future', *Food, Agriculture and the Environment discussion paper 3. IFPRI.*

Dhaliwal, R. K. & Joshi, V. (2010). Mobile phones – Boom to rural social system. *Literacy Information and Computer Education Journal (LICEJ),* 1(4): 291 – 2650

Diaz-Bonilla et al, (2002) 'WTO, Agriculture and Developing Countries: A survey of Issues'. *International Food Policy Research Institute. Washington, D.C. USA*

Dire, B., Onu., J. I., Jungur, A. A., Ndaghu, A. A. &Giroh, D. Y. (2016). Awareness on the use of information and communication technologies among agricultural extension agents in North Eastern Nigeria.*Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development* 16(1): 129-134

Doan, N. (2014). *Consumer adoption in mobile wallet: A study of consumers in Finland*. (An Unpublished Bachelors' thesis) Bachelor of Business Administration (BBA), International Business, Turku University of Applied Sciences.

Donner, J. (2006). The use of mobile phones by microentrepreneurs in Kigali,Rwanda: Changes to social and business networks. *InformationTechnologies and International Development, 3*, 3-19.

Donner, J. (2008). Research approaches to mobile use in the developing world: A review of the literature. *The Information Society*, 24(3), 140-159.

Doss, C. R. (2003). Understanding farm level technology adoption: Lessons learned from CIMMYT's micro surveys in Eastern Africa. *CIMMYT Economics Working Paper, 03-07. Mexico, D. F. CIMMYT.*

Duncombe, R.A. (2012). Understanding Mobile Phone Impact on Livelihoods in Developing Countries:A New Research Framework. www.http://www.sed.manchester.ac.uk/idpm/research/publications/wp/di/index.htm

Ebonyi State Agricultural Policy (2010) *Ebonyi state government plan and policy thrust document.* A policy document of Ebonyi state government Nigeria

Egbule, C. L., Agwu, A. E. &Uzokwe, U. N. (2013).Availability and use of mobile phones for information dissemination by public extension agents in Delta State, Nigeria.*Journal of Agricultural extension,* 17(2): 23 – 30

Ekpe, I. I, Okporie, E.O., Ogbodo, E. N & Nwite, J. N. (2005) 'Physico-Chemical Properties of Four Ultisols Under Different Vegetation Cover in South-Eastern Nigeria', *Journal of Science. Agriculture, Food Technology, Environment*, 5: 74-78.

Ekumankama, O. O. &Nwankwo, G., (2002). Radio Farm Broadcast: A Study of Adoption of Agricultural Innovations in Umuahia Zone, Abia State. Journal of Agricultural Extension 6 (1), 17 – 23.

Enete (2010) 'Indigenous Agricultural Adaptations to Climate Change: study of Imo and Enugu state in South Eastern Nigeria', *African Technology Policy Studies Network, working paper series No. 53.* 292

English Oxford Dictionary (2018). *Dictionary of meanings*. Oxford: Oxford University Press

Etwire, P. M., Buah, S., Ouedraogo, M., Zougmore, R., Partey, S., Martey, E., Dayamba, S. &Bayala, J. (2017). An assessment of mobile phone-based dissemination of weather and market information in the Upper West region of Ghana.*Journal of Agriculture and Food Security 6 (8), 1 – 9*

Ezeh, A. N. (2013). Access and application of information and communication technology (ICT) among farming households of south east Nigeria.*Agriculture and Biology Journal of North America.*DOI:10.5251/abjna.2013.4.6.605.616

Fadairo, O. S., Nathaniel, S., Olutegbe, Adewale, M. &Tijani (2015). Attitude of crop farmers towards e-wallet platform of the growth enhancement support scheme for

input delivery in Oke-Ogun area of Oyo State.*Journal of Agriculture Informatics (ISSN 2061-862X)* 2015 6 (2): 62 – 71

FAO (2010) *World Summit on Food Security*, Report on 2009 WFS, *FAO*, Rome Italy.

FAO, (2002).*Independent Evaluation of the Special Programme for Food Security*. FAO report Rome Italy.

FAO, (2005a) *Special event on green revolution in Africa, Committee on world food security*. A report prepared by *SDR of FAO.*

FAO, (2005b).*The state of food insecurity in the world, Eradication of world hunger; key to achieving the MDGs. FAO document Rome Italy*.

Federal Ministry of Agricultural and Rural Development (FMARD) (2014, June 30). 10m farmers captured in agriculture e-wallet scheme.New Telegraph. Retrieved on March 15, 2015 from http://www.newtelegraphonline.com

Federal Republic of Nigeria (FRN) (2013). FG intensifies efforts at guaranteeing farmers' access to inputs, *flags-off 2nd phase of GESS in South West.*

Fertilizer Suppliers Association of Nigeria (FESPAN) (2012).Working together to improve fertilizer supply in Nigeria.*Newsletter,* 2(8).

FESPAN (2012). The Growth Enhancement Support Scheme: Monitoring Report. A report submitted to the Federal Minister of Agriculture and Rural Development: 8 – 12

Field, A. (2005). *Discovering statistics using SPSS* (2nd Edition) London: Sage Publications Ltd.

FMARD (2011) The Agricultural Extension Transformation Agenda Report, *Published by federal ministry of agriculture and rural development, Abuja, Nigeria*.

FMARD (2012). Nigeria's Agricultural Policy. Federal Republic of Nigeria, Federal Ministry of Agriculture and Rural Development, Agriculture in Nigeria: New Policy Trust.

Freebairn, D. (1995) 'Did the green revolution concentrate on income? A quantitative study of research reports', *World Development 23:265-279*

Fuglie, K. O. &Kascak, C. A. (2001).Adoption and diffusion of natural-resource-conserving agricultural technology.*Review of Agricultural Economics, 23*(2): 386 – 403

Google Image (2012) Map of sates in south-eastern Nigeria

GSMA (2012). The mobile wallet version 1.0 *GSM Association*

Gupta, D.K. (2005) *Modern encyclopaedia of media and mass communication*.Rajat Publications, New Delhi, India.

Hans, G. (2004). Towards a sociological theory of the mobile phone in: Sociology in Switzerland: Sociology of the Mobile Phone. Online Publication, Zurich, March 2004 (Release 3.0). Available at http://www.socio.ch/mobile/t_geser1.html

Harker, D. & Akkeren, J.A. (2002). "Mobile Data Technology for Small Business: Needs, Uses and Adoption. Agriculture*", Journal on Information System* 9, 17-30pp.

Hellstrom, J. (2010). The Innovative Use of Mobile Applications in East Africa, SIDA Review*Swedish International Development Cooperation Agency, Stockholm* http://upgraid.files.wordpress.com/2010/06/sr2010-12_sida_hellstrom.pdf

Holloway, G., Shankar, B. & Rahman, S. (2002). 'Bayesian spatial probit estimation: a primer and an application to HYV rice adoption', *Agricultural Economics*, 27: 383-402

Hooper, V. & Zhou, Y. (2007).Addictive, dependent, compulsive?A study of mobile phone usage. Conference proceedings of the 20th Bled e-Conference e-Mergence: Merging and Emerging Technologies, *Processes and Institutions held in Bled, Slovenia. June 4 – 6*

Hooper, V., Kew, J. & Herrington, M. (2010). The use of mobile phones by SMMEs in a developing economy: the case in South Africa. 18th*European Conference on Information System*. Accessed from http://.www.is2.Ise.ac.uk/asp/aspecis/20100132.pdf

Howell, J. L. & Hebron, G. B. (2004). Agricultural land owners lack of preference for internet extension. *Journal of Agricultural extension* 42 (6), retrieved April 1, 2011 from http://www.joe.org/joe/2004december/a7.php

http://www.m.ranker.com

Hultberg, L. (2008). Women empowerment in Bangladesh: A study of the village pay phone program Thesis: *Media and Communication Studies, School of Education and Communication (HLK)* Jonkoping University, Spring Term.

Ibrahim, H. I., Angara, A. U., Onuk, G. E. &Olatinwo, L. K. (2014). Is the e-wallet scheme working? evidence from a rural area of Northern Nigeria. *Proceedings of the 48th annual conference of the Agricultural society of Nigeria held at Abuja on 24th – 27thNovember, 2014*, pp 293 – 296

Idachaba (2013). Food security in Nigeria: challenges under democratic dispensation, 18th*ARMTI annual lecture, Ilorin.*

IFAD (2000).Rural poverty report 2000, An *IFAD Document on Poverty*, Rome Italy. 295

IFAD (2010).Rural poverty in Nigeria. Available at http://www.ruralpovertyportal.org/country/home/tags/nigeria

Ifejika, P. I. &Oladosu, I. O. (2011).Capability of Fisher-folk to use mobile phone facilities for effective extension advisory services around Kainji Lake Basin, Nigeria.*Journal of Rural Research & Information*, 6(2): 1 – 14

Ifejika, P. I., Oladosu, I. O., Asadu, A. N., Ayanwuyi, E., Sule, A. M. &Tanko, M. A. (2015). Assessment of Aquapreneur willingness to pay for mobile phone advisory services in

Anambra State, Nigeria. *International Journal of Agriculture and Forestry*, 5(6): 330 – 338

Ilahiane, H. (2007). Impacts of information and communication technologies in agriculture: Farmers and mobile phones in Morocco. *Paper presented at the Annual Meetings of the American Anthropological Association, December 1, Washington, DC.*

International Fertilizer Distribution Centre (2013). International fertilizer distribution centre projects in Nigeria. Available on http://www.ifdc.org/nations/Nigeria Access on April 30, 2014

International Food Policy Research Institute (2010). A review of fertilizer policy issues in Nigeria. Nigeria strategy support program (NSSP) *NSSP working paper No 0019* Available on http://www.ifpri.org/sites/default/files/publication/nsspwp19_1.pdf Access on March 25, 2014

Islam, M. S. (2011). *Adoption of mobile phones among the farmers: A case study from rural Bangladesh.*(Unpublished Master's Thesis), Oreboro University, Swedish Business School.

Iweriebor, E. E. G. (2004). *Nigerian technology development since independence.* Ibadan: Book Builders

Jagun, A., Heeks R., &Whalley J. (2007). Mobile telephony and developingcountry micro-enterprise: A Nigerian case study. *Journal of Information Technology and International Development 4(4): 47-65*

Jain, A. &Hundal, B. S. (2007).Factors influencing mobile services adoption in rural India.*Asia pacific Journal of Rural Development*, 17(1): 17 – 28

Jato&Terna (2015). Electronic wallet (e-wallet) as an Agricultural Policy of the Federal Government: A critical assessment. Available at http://www.globalacademicgroup.com/journals/teacher%20perspective/Ianna6.pdf

Jensen, R. (2007). The digital provide: Information (technology), marketperformance, and welfare in the South Indian fisheries sector. *TheQuarterly Journal of Economics*, *122*(3), 879-924.

Jhamtani H. (2010).The Green Revolution in Asia: Lessons for Africa. *FAO Paper*

Jhamtani, H. (2008) *Putting Food First: Towards community based food security system.* Insist press policy paper series, Yogyakarta.

Kalba, K. (2008). The adoption of mobile phones in emerging markets: Global diffusion and the rural challenge. *International Journal of Communication*, 2: 631 – 661

Kargin, B. &Basoglu, N. (2007).Factors affecting the adoption of mobile services.*PICMET proceedings, Portland, USA*, 5 – 9 August, 2007.

Katengeza, S. P., Juma, Okello, J., & Jambo, N. (2013). Use of mobile phone technology in agricultural marketing: The case of smallholder farmers in Malawi. *International Journal of ICT Research and Development in Africa* 2(2): 14-25.

Kerr, B. R. (2012). "Lessons from the old Green Revolution for the new: Social, Environmental and Nutritional issues for Agricultural change in Africa." *Progress in Developmental Studies*, 12(2): 213 – 29

Kim, S. & Garrison, G. (2008).Investigating mobile wireless technology adoption: An extension of the technology acceptance model. *Information Systems Frontier* 11(3): 323 – 333

Kwakwa, P. A. (2012). Mobile phone usage by micro and small scale enterprises in semi-rural Ghana. *International Review of Management and Marketing 2 (3): 156 – 164*

Kwon, H. S. & Chidambaram, L. A. (2000). Test of the technology acceptance model, the case of cellular telephone adoption. *Proceedings of the 33rd Hawaii International Conference on System Science, USA.*

Lanjouw, J. O. &Lanjouw, P. (2001). The rural non-farm sector: Issues and evidence from developing countries. *Agricultural Economics*, 26 (1): 1 – 23

Lele, U. J. & Mellor, J. W. (2013). "Jobs, poverty and the Green Revolution," International Affairs (Royal Institute of International Affairs 1944 – 48, 1972): 20 – 32. Available at http://www.jstor.org/stable/26136248

Levi, C. (2015). Effectiveness of Information Communication Technologies in dissemination of Agricultural Information to Smallholder Farmers in Kilosa District, Tanzania.*An Unpublished Bachelors' Thesis Submitted to Makerere University*

Li, Y., Fu, Z. T. & Li, H. (2007).Evaluating factors affecting the adoption of mobile commerce in agriculture: An empirical study.*New Zealand Journal of Agricultural Research*, 50(5): 1213 – 1218

Liverpool-Tasie, et al (2010). A review of fertilizer policy issues in Nigeria. *International Food Policy Research Institute, Policy Note, 28*

Mabe, L. K., &Oladele, O. I., (2012).Awareness Level of Use of Information Communication Technologies Tools among Extension Officers in the North- West Province, South Africa.Life Science Journal. 9(3): 440 - 444

Martin, B. L. (2010). Mobile phones and rural livelihoods: An exploration of mobile phone diffusion, uses and perceived impacts of uses among small-to-medium-size farm holders in Kamuli District, Uganda. *An unpublished Graduate Thesis of Iowa State, University.*

Martins, B. & Abbott, E. (2010). Development calling: The use of Mobile Phones in Agricultural Development in Uganda. *Greenlee School of Journalism and Communication, Iowa State University.*

Martins, B. & Abbott, E. (2011). Mobile phones and rural livelihood: Diffusion, uses and perceived impacts among farmers in rural Uganda. *Journal of Information Technologies and International Development, 7: 17 – 34*

Masuka, B., Matenda, T., Chipomho, J., Mapope, N., Mupeti, S., Tatsvarei, S. &Ngezimana, W. (2016). Mobile phone use by small farmers: A potential to transform production and marketing in Zimbabwe. *South Africa Journal of Agricultural extension*, 44(2): 121-135

Matuha, M. (2015). Mobile phone use in Uganda Aquaculture: Farmer experiences and aspirations. *An Unpublished Master's Thesis submitted to the Graduate faculty of Auburn University, Alabama.*

McClain-Nhlapo, C. (2004). 'Implementing a Human Rights approach to Food Security', *IFPRI Publication*

McGranaham, G. et al (1999) 'Environmental changes and human health in countries of Africa, the Caribbean and pacific', *Stockholm Environmental Institute, Stockholm, pp.214.*

McNamara, K. (2003). Information and communication technologies, poverty and development:Learning from experience. Retrieved on March 10, 2009, from http://www.infodev.org/en/Document.17.PDF

McQuail, D. (2010). *McQuails Mass Communication Theory*, 6th Edition. London: SAGE Publications.

Mehrtens, J., Cragg, P. B. & Mill, A. M. (2001).A model of internet adoption by SMEs.*Information and Management, 39 (3): 165 – 176*

Meijerink,G. & Roza, P. (2007) 'The role of agriculture in economic development', *Market, chains and sustainable development strategy and policy paper 4, available at http://www.boci.wur.nI/UK/Publications*

Mellor, J. (1976).*The new economics of growth*. Ithaca, New York: Cornel University Press.

Mendola, M. (2007) 'Agricultural technology adoption and poverty reduction: A propensity – score matching analysis in rural Bangladesh', *Food policy (science direct) 32 (3): 372-393.*

Mittal, S. &Mehar, M. (2012). How mobile phones contribute to growth of small farmers? Evidence from India.*Quarterly Journal of International Agriculture 51 (3): 227 – 244*

Molony, T. (2008).Running out of credit: the limitations of mobile telephony in a Tanzanian agricultural marketing system.*Journal of Modern African Studies.* 46(4): 637–658.

Morris, M. L., Kelly, V., Kopicki, R. J. &Byerlee, D. (2007). Fertilizer use in African agriculture: Lessons learned and good practice guidelines. *World Bank, Washington D. C.*

Morroni, M. (1992).*Production process and technical change.*Cambridge University press, London

Mtega, W.P.& Msungu, A.C. (2013) Using Information and Communication Technologies for enhancing the accessibility of agricultural information for improved agricultural production in Tanzania.*The Electronic Journal on Information Systems in Developing Countries 56 (1):1-14.*

Musa, A.H. (2008). *Benefiting ICT for all.Inaugural Lecture Series.*Serdang: UPM Publisher.

Mutunga, I. M., &Waema, T. M. (2016).Context of mobile phone use and itas effects on smallholder farmer's livelihood outcomes in Kenya.*International Journal of Scientific Research and Innovative Technology*, 3(4): 121-136

Nagy &Edun (2002).“Assessment of Nigerian Government Policy and suggested alternative market friendly policies,” *Washington D. C. International Fertilizer Development Centre*.

National Association of Nigerian Traders (NANTS) (2013). Opportunities for improving the growth enhancement support scheme (GESS). Agriculture News. Retrieved on December 2, 2014 from http://www.nants.org/

National Bureau of Statistics (2016). Review of the Nigerian economy in 2015 and economic outlook for 2011 – 2015, *National Bureau of Statistics.*

National Population Commission (2006).'Enumerators manual', March, 2006.

NBS (2010).*Nigeria National Bureau of Statistics Brief: Sources of Income for Households in Nigeria LSMS-ISA, Integrated Surveys on Agriculture*. Available at www.nigerianstat.gov.ng

NBS (2012). Yam consumption and production in Nigeria, *National Bureau of Statistic www.nigerianstat.gov.ng* accessed January 2014

Ndaghu, A. A., (2011).Use of Information and Communication Technologies (ICTs) among Women Farmers in North-Eastern Nigeria.An unpublished doctoral thesis, University of Ibadan, Nigeria.

Niazi, T. (2004).“Rural poverty and the Green Revolution: The lessons from Pakistan,” *Journal of Peasant Studies*.31(2): 242 – 260 (19) London: Routledge

Ninsiima, D. (2015). Factors affecting adoption of an Information Communication Technology (ICT) System for Agriculture in Uganda.*An Unpublished Masters' Thesis submitted to Michigan State University.*

Nkonya, E. *et al.* (2010a) 'Options for enhancing agricultural productivity in Nigeria', *NSSP background paper, No. 011, IFPRI, Abuja*

Nkonya, E., Pender, J., Kato, E., Omobowale, O., Phillip, D. & Ehui, S. (2010b). 'Enhancing agricultural productivity and profitability in Nigeria. Nigeria Strategy Support Program', *Brief 19, International food policy research institute, Washington, D.C.*

NPC, (2015).Transforming Rehabilitation: The voluntary sector perspective. Available at: www.thinknpc.org/publication/transformation-rehabilitation-the-voluntary-sector-perspective. Accessed 23 February, 2016

Nwalieji, H. U., Uzuegbunam, C. O. &Okeke, M. N. (2015).Assessment of Growth Enhancement Support Scheme among rice farmers in Anambra State, Nigeria.*Journal of Agricultural Extension*, 19(2): 71 – 81

Nwaobiala, C. U. &Ubor, V. U. (2016).Effectiveness of electronic wallet system of Growth Enhancement Support Scheme among arable crop farmers in Imo State South Eastern Nigeria.*Scientific papers series management, economic engineering in Agriculture and Rural Development* 16(1): 355 – 360

Nyamba, S. Y. &Mlozi, M. R. (2012). Factors influencing the use of mobile phones in communicating Agricultural Information: A case of Kilolo District, Iringa, Tanzania. *International Journal of Information and Communication Technology Research*, 2(7): 558-563

Ofuotu, A. U., Isife, B. I. &Emah, G. N. (2007).Adoption of mobile phone among Poultry Farmers in Delta State, Nigeria.*Journal of Engineering and Applied Science, 2 (1): 10 – 16*

Ogbonna, O. I. &Agwu, A. E. (2013). Access and use of Information Communication Technologies by rural farmers in Enugu North Senatorial zone, Enugu State, Scholarly *Journal of Agricultural Science*, 3(7): 264 – 270

Ojoko, E. (2014). Growth Enhancement Support Scheme (GESS) and the challenges of food security in Nigeria: A review. *Asian Research Publishing Network (ARPN) Journal of Agricultural and Biological Science* 9(7): ISSN 1990-6145

Okunseinde, M. (2014). The electronic wallet system: how Nigeria is dialling into its Agricultural sector. www.e-agriculture.org/.../electronicwallet

Okwu, O. J. & Daudu, S. (2011). Extension communication channels' usage and preference by farmers in Benue State, Nigeria. *Journal of Agricultural Extension and Rural Development 3(5): 88 – 94*

Olaniyi, O.A. (2013) Assessment of utilization of Information and Communication Technologies (ICTs) among poultry farmers in Nigeria: an Emerging Challenge. *Journal of Animal Science Advances, 3(7):361-369.*

Olaolu, M. (2016).Impact of the second National Fadama Development Critical Ecosystem Management Project on Behaviour Livelihood in Kwara and Kogi State, Nigeria.*An Unpublished Ph.D Dissertation submitted to the Department of Agricultural Extension, faculty of Agriculture, University of Nigeria, Nsukka.*

Olwande, J. *et al.* (2009) 'Agricultural technology adoption: Panel analysis of smallholder farmers' fertilizer use in Kenya', *Centre of evaluation for global action (CEGA)*

Omotesho, K. F., Ogunlade, I. O., Muhammad, L., (2012).Assessment of Access to Information and Communication Technology among Agricultural Extension Officers in Kwara State, Nigeria, Asian Journal Agriculture and Rural Development. 2 (2): 220 – 225

Oni, O. *et al.* (2009). Trends and drivers of agricultural productivity in Nigeria, *NSSP report No. 001, IFPRI-Abuja.*

Onuchego (1998).*Political decisions in the Nigerian agricultural industry*, Zaria: Tamaza Publishing Co. Ltd.

Orata, P. (2014). Relevance of communication channels in increasing agricultural production in Nigeria. *International Journal of Agriculture and Agribusiness*, 4 (4): 87 – 107

Overa, R. (2006). Networks, distance, and trust: telecommunications development and changing trading practices in Ghana. *World Development* 34 (7): 1301-1315. Retrieved March 10, 2015, from: http://dx.doi.org/10.1016/j.worlddev.2005.11.015.

Oyeyinka, R.A. & Bello, R.O. (2013) Farmers Use of ICTs for Marketing Information Outlets in Oyo State, Nigeria. *Journal of Agricultural Science,* 5 (11):150-158.

Pitroda, S. & Desai, M. (2010). The march mobile money – the future of lifestyle management. *The mobile wallet*, 127 – 155

Powledge, F. (2010). "Food, hunger and insecurity," Bioscience, 60(4): 260 – 265. DOI:10.1525/bio.2010.60.4.3 *Ebscohost.*

Pulitzer (2012).Transforming traditional agriculture in Africa.*Paper at joint session in Yale*: Yale University Press.

RebekkaSyiem, Saravanan Raj, (2015). Access and Usage of ICTs for Agriculture and Rural Development by the tribal farmers in Meghalaya State of North-East India

Ricker-Gilbert, J. & Jayne, T. S. (2009). Do fertilizer subsidies affect the demand of commercial fertilizer? An example from Malawi.*International Association of Agricultural Economists, Beijing.*

Roderiquez, D. (2011). How can CHOGM start a Green Revolution in sub-Saharan Africa? A theme paper presented at the CHOGM meeting on food security in Africa. Available at http://www.theconversation.com/html

Rogers, E. (1962). *Diffusion of innovations, 3rd edition*. New York: Free Press

Ryan, B. & Gross, N. C. (1943)."The Diffusion of Hybrid-seed Corn in Two Iowa Communities," *Rural Sociology*, 8: 15 – 24, RS (E).

Salimonu, K. K. (2008). Access to fertilizer subsidy among food crop farmers in Ogun State, Nigeria. *International Journal of Agricultural Economics & Rural Development*, 1(2): 58 – 62

Sanaz, Z. K. (2015). *Developing consumer adoption model on mobile wallet in Canada*. (An Unpublished Masters' Thesis) submitted to the Department of Electronic Business Technologies, Faculty of Graduate and Postdoctoral Studies, University of Ottawa, Canada.

Sangotegbe, N. S., Odebode, S. O. &Onikoyi, M. P. (2012). Adaptation strategies to climate change by food crop farmers in Oke-Ogun area of south western Nigeria. *Journal of Agricultural Extension* 16(1): 119 – 131

Sarker, S. & Wells, J. D. (2003).Understanding mobile handheld device use and adoption.*Communications of the ACM* 46(12): 35 – 40

Shiva, V. (1991).*The violence of the green revolution: Third World Agriculture Ecology and Politics.* London: Zed Books.

Sife, A.S., Kiondo, E. & Lyimo-Macha, J.G. (2010).Contribution of mobile phones to rural livelihoods and poverty reduction in Morogoro region, Tanzania.*The Electronic Journal of Information Systems in Developing Countries* 42(3): 1-15.

Signal Alliance (2014). ERP FOR THE AGRICULTURE SECTOR IN NIGERIA.Transforming Big Data into Big Value in Agricultural Industry. Retrieved from http://www.slideshore.net/signalalliance/erp-fortheagrculture-in-Nigeria Accessed on April 23, 2014.

Sinha, C. (2005). Effect of mobile telephony on empowering rural communities in developing countries.*IRFD Conference on Digital Divide, 2005, Tunisia*

Smale, M., Heisey, P. W. & Leathers, H. D (2001) 'Land allocation in HYV adoption model: an investigation of alternative explanations', *Journal of Agricultural Economics, 76: 535-546*

Soola, E. O. (1988). Agricultural communication and the African non-literate Farmer: The Nigerian experience. *African Media Review*, 2 (3): 75 – 91

Sunding, D. &Zilberman, D. (2001). The agricultural innovation process: Research and Technology adoption in a changing agricultural sector in: *B. L., Gardner & G. C., Rausser (Eds), Handbook of Agricultural Economics. Elsevier, Oxford, pp 207 – 261*

Tiri, G. D., Ojoko, E. A. &Aruwayo, A. (2014). Growth Enhancement Support Scheme (GESS) and the challenges of food security in Nigeria: A review. *ARPN Journal of Agricultural and Biological Science* 9(7): 226 – 228

Tsado, J. H. (2004). *Women's involvement in farming activities and household food security in Dako Local Government Area of Nigeria State.* (An Unpublished Masters' Thesis), Faculty of Agriculture, University of Ilorin, Ilorin, Kwara State, Nigeria

USAID, (2009). Improving food security in Africa: Highlight of 25 years of Research, Capacity-Building and Outreach, *MSU Food Security Group.*

Venkatesh, N., Morris, M. G., Davis, G. B. & Davis, F. D. (2003). User acceptance of information technology: Towards a unified view. *MIS Quarterly*, 27(3): 425 – 478

Vodafone Group, Accenture, (2011). *Mobile communication to transform small-holding farmers' livelihoods in emerging markets.* Vodafone Group and Accenture, London

Waema, T. & Okinda, O. (2010). Policy Implications of the Relationship between ICTAccess and Usage and Well-being: A Case Study of Kenya. *University of Nairobi*

Wei, L. & Zhang, M. (2008). The adaptation and use of mobile phone in rural China: A case study of Hubei, China. *Science Direct, Telematics and Informatics 25,* 169-186.

Wicander, G. (2010). M4D Overview 1.0 – the 2009 Introduction of mobile for development. *A working paper submitted to the Department of Information Systems, Faculty of Economics, Communication and IT, Karlstad University.*

Wimmer, R. D., & Dominick, J. R. (2003).*Mass media research: an introduction*, (7th edition). Belmont, CA: Wadsworth Publishing Company. Mass Media Research

Wimmer, R. D., & Dominick, J. R. (2011).*Mass media research: an introduction*, (9th edition). Belmont, CA: Wadsworth Publishing Company

World Bank (1986) Poverty and Hunger: Issues and options for food security in developing countries. *Document by World Bank,* Washington D.C

World Bank (2010). Bangladesh: Priorities for Agriculture and Rural Development. Available at http://www.go.worldbank.org/770VR4D1UO

World Bank Development Report (2008).*Agriculture for Development.* Washington, DC: The World Bank

World Bank. (2007). Agriculture for Development. *World Development Report 2007*. World Bank: Washington, DC.

World Food Summit (1996) *Rome Declaration on World Food Security, available at www.world-gazettee.com* (2010)

www.tradingeconomics.com

Zhang, J. & Yuan, Y. (2002). M-commerce vs Internet-based e-commerce: The key differences. *Proceedings of the American Conference on Information Systems, August.*Dalla, Texas.

APPENDIX I

QUESTIONNAIRE FOR FARMERS

SURVEY QUESTIONNAIRE ON

ASSESSMENT OF THE UTILIZATION OF MOBILE TELEPHONY IN AGRICULTURAL COMMUNICATION AMONG RURAL FARMERS IN SOUTH-EAST, NIGERIA

QUESTIONNAIRE NO: ☐ **STATE:** ☐

Good day Sir/Madam

I am ANI Moses Chukwubuikem, a postgraduate student in the Department of Mass Communication, NnamdiAzikiwe University, Awka. I am conducting a study on the recent Growth Enhancement Support Scheme program launched in 2012. The questions revolve around how the use of mobile telephony (mobile phone service system) in the distribution of fertilizer and other farm inputs has helped to improve the farming activity within the period.

You are humbly requested to provide objective answers to enable me obtain data for the study. I promise that information provided in the questionnaire will be used only for academic purposes.

Many thanks for your co-operation.

Yours faithfully,

Ani, Moses Chukwubuikem

INSTRUCTION:

Read the following questions and indicate your agreement with each item (1-86) by ticking (√) in the box as in or supplying the answer as appropriate.

SECTION A (Demographic Details)

1. Age: (a) 20 – 30 years ☐ (b) 31 – 40 years ☐ (c) 41 – 50 years ☐
   (d) 51 years and above ☐
2. Sex: (a) Male ☐ (b) Female ☐
3. Marital Status: (a) Single ☐ (b) Married ☐ (c) Divorced ☐
   (d) Widowed ☐ (e) Separated ☐
4. Number of Children: (a) 1 – 3 ☐ (b) 4 – 6 ☐ (c) 7 and above ☐
   (d) None ☐
5. Educational Qualification: (a) No Education ☐ (b) Primary School ☐
   (c) Secondary School ☐ (d) First Degree ☐ (e) Masters ☐ (f) Doctorate ☐

SECTION B (Socio-Economic Characteristics)

6. How long have you been a farmer? (a) Below 5 years ☐ (b) 5 – 10 years ☐
   (c) 10 – 15 years ☐ (d) Above 15 years ☐
7. What type of farming system do you practice? (a) Subsistence ☐ (b) Commercial ☐
8. What is the size of your farm land? (a) Less than 1 hectare ☐ (b) 1 – 3 hectares ☐
   (c) 4 – 6 hectares ☐ (d) 7 – 9 hectares ☐ (e) Above 9 hectares ☐
9. What nature of crop(s) do you grow in your farm?

NB: Here you can tick more than one item

(a) Yam ☐ (b) Maize ☐ (c) Plantain ☐ (d) Cassava ☐ (e) Rice ☐
(f) Oil Palm ☐ (g) Others _____

10. What type of fertilizer do you use in your farm?

(a) NPK ☐ (b) Urea ☐ (c) SSP ☐ (d) Agrolizer ☐ (e) Teractive ☐

11. What is your average Farm Income?

(a) Less than ₦50,000 ☐

(b) Between ₦ 50,001 and ₦ 150,000 ☐

(c) Between ₦ 150,001 and ₦ 200,000 ☐

(d) Between ₦ 200,001 and ₦ 300,000 ☐

(e) Above ₦300,000 ☐

12. What is your average Non-Farm Income?

(a) Less than ₦50,000 ☐

(b) Between ₦ 50,001 and ₦ 150,000 ☐

(c) Between ₦ 150,001 and ₦ 200,000 ☐

(d) Between ₦ 200,001 and ₦ 300,000 ☐

(e) Above ₦300,000 ☐

13. What is your total Income?

(a) Less than ₦100,000 ☐

(b) Between ₦100,000 and ₦300,000 ☐

(c) Between ₦300,001 and ₦500,000 ☐

(d) Between ₦500,001 and ₦700,000 ☐

(e) Above ₦700,000 ☐

SECTION C (Ownership and Use of Mobile Phones)

S/N	Variables	Yes	No
14.	Do you own a mobile phone?		
15.	Did you attend any training on how to use the Mobile Telephony System?		
16.	Do you use mobile phone to access farm inputs like Fertilizer?		
17.	Do you use mobile phone to access seeds / seedlings?		
18.	Did you get enough fertilizer required for your farming?		
19.	Did you get the right kind of fertilizer needed for your farming?		
20.	Do you use mobile phone to access herbicides?		
21.	Do you use mobile phone to access pesticides?		
22.	Do you use mobile phone to access knap sack sprayers?		
23.	Do you use mobile phone to access extension agents' assistance?		

SECTION D (Extent of Utilization of Mobile Telephony System in Agricultural Service Delivery)

Question: To what extent do you use Mobile Phone in Agricultural Service Delivery?

Key: Very Large Extent (VLE), Large Extent (LE), Some Extent (SE), Not At All (NAA), Undecided (U)

S/N	Variables	VLE	LE	SE	NAA	U
24.	Advisory Services					
25.	Input Information Sourcing					
26.	Market Information Sourcing					
27.	Market Price Information					
28.	Information on Disease & Pest Control					
29.	Information on Home & Nutrition Management					
30.	Information on Health Management					
31.	Farm Produce Storage Information Service					
32.	Agronomic Practices					
33.	Funding Opportunities					
34.	Information on Farm Training Opportunities					
35.	Herbicides / Chemical Application					

36.	Fertilizer Application					
37.	Nature of Fertilizer Use					
38.	Harvesting					

SECTION E (Utilization of Mobile Phone to Learn About Fertilizer)

Instruction: Please read the items carefully and tick **(√)** where appropriate

Key: Strongly Agree (SA), Agree (A), Disagree (D), Strongly Disagree (SD), Undecided (U)

S/N	Variables	SA	A	D	SD	U
39.	I know the code to dial to find out whether fertilizer is available					
40.	I know the code to dial to request for fertilizer					
41.	I know the code to dial to access fertilizer					
42.	I know the code to redeem fertilizer					
43.	I know the code to confirm the redemption of fertilizer					
44.	I know the code for feedback (i.e. customer are & complaints)					
45.	I know the code to change the specification of input requested					
46.	I know the code for changing location of redemption centre					
47.	I know the code for rejecting unsolicited farm input					
48.	I know the code for cancelling request for fertilizer					
49.	I know the code to confirm payment for fertilizer					
50.	I know the code for seeking information on appropriate fertilizer to use					
51.	I know the code for updating my information					
52.	I know the code for rejecting unsolicited agricultural related					

	information					
53.	I know the code to dial to pay for fertilizer received					
54.	I know the code for refund of payment made in error					

SECTION F (Factors that enhance Mobile Telephony Utilization)

Instruction: Please read the items carefully and tick **(√)** where appropriate

Key: Strongly Agree (SA), Agree (A), Disagree (D), Strongly Disagree (SD), Undecided (U)

S/N	Variables	SA	A	D	SD	U
55.	I like the Mobile Telephony System because it is convenient					
56.	The use of mobile phone reduces corruption					
57.	Using mobile phone to access fertilizer is cheap					
58.	The Mobile Telephony System is fast					
59.	Using mobile phone to access fertilizer is simple					
60.	The codes used in the mobile phones are easy to understand					
61.	The fertilizers arrive on time					
62.	The network of the platform is not congested					
63.	There is no queue at the redemption centre in my area					
64.	The redemption centre is close to my area					
65.	The helpline staff attend to farmers on time					
66.	The process of registration is not cumbersome					
67.	The process of payment is quick and stress free					
68.	Farmers' complaints receive immediate attention					
69.	The language of communication through the Mobile Telephony System is easy to understand					

SECTION G (Factors that hinder Mobile Telephony Utilization)

Instruction: Please read the items carefully and tick **(√)** where appropriate

Key: Strongly Agree (SA), Agree (A), Disagree (D), Strongly Disagree (SD), Undecided (U)

S/N	Variables	SA	A	D	SD	U
70.	Cost of sending the code / text messages					
71.	Inability to compose and send text messages					
72.	Difficulty in understanding language of communication through the Mobile Telephony System					
73.	Failure in code response					
74.	Congestion on the network of the Mobile Telephony System					
75.	Receiving wrong text messages					
76.	Receiving unsolicited text messages					
77.	Poor training during the E-wallet program					
78.	Inadequate manpower for the training					
79.	Mix-up in responses to codes sent					
80.	Inconsistency of government policies and programmes					
81.	Poor monitoring of the process					
82.	Theft of mobile phone					
83.	Difficulty in repairing faulty mobile phone					
84.	Difficulty in recovering lost mobile phone					
85.	Poor knowledge of fertilizer request codes					
86.	Request of incentives at redemption centres					

APPENDIX II

QUESTIONNAIRE FOR ADP STAFF

SURVEY QUESTIONNAIRE ON

ASSESSMENT OF THE UTILIZATION OF MOBILE TELEPHONY IN AGRICULTURAL COMMUNICATION AMONG RURAL FARMERS IN SOUTH-EAST, NIGERIA

QUESTIONNAIRE NO: ☐ **STATE:** ☐

Good day Sir/Madam

I am ANI Moses Chukwubuikem, a postgraduate student in the Department of Mass Communication, NnamdiAzikiwe University, Awka, Anambra State. I am conducting a study on the recent Growth Enhancement Support Scheme program launched in 2012 across the country. The questions revolve around how the use of Mobile Telephony (mobile phone service system) in the distribution of fertilizer and other farm inputs has helped to improve the farming activity within the period.

You are humbly requested to provide objective answers to enable me obtain data for the study. I promise that information provided in the questionnaire will be used only for academic purposes.

Many thanks for your co-operation.

Yours faithfully,

Ani, Moses Chukwubuikem

INSTRUCTION:

Read the following questions and indicate your agreement with each item (1-33) by ticking (√) in the box as in or supplying the answer as appropriate.

S/N	Question items	Variables	Tick (√)
	SECTION A: DEMOGRAPHICS		
1	Age	20-30 (1)	
		31-40 (2)	
		41 – 50 (3)	
		51 and above (4)	
2	**Sex**	Male (1)	
		Female (2)	
3	Marital status	Single (1)	
		Married (2)	
		Divorced (3)	
		Widowed (4)	
		Separated (5)	
4	Number of children	1-3 (1)	
		4-6 (2)	
		7 and above (3)	
		none (0)	
5	Educational qualification	No Education (0)	
		Primary school (1)	
		Secondary school (2)	
		First degree(3)	

		Masters (4)	
		Doctorate (5)	
6	How long have you been a Staff in Agricultural Development Program ?	Below 5 years(1)	
		5-10years (2)	
		10-15years (3)	
		Above 15 years(4)	
7.	What is your Discipline? Others (specify) _____	Agric Extension	
		General Agric	
		Mass Comm.	
Section B: To determine the level and extent of participation in the GESS program in Nigeria			
8	Did you participate in the e-wallet scheme which is one of the programs of GESS launched in May 2012?	Yes (1)	
		No (0)	
9	What is your role in the e-wallet scheme?	Supervise the process(1)	
		Coordinate the scheme(2)	
		Act as an extension agent (3)	
		Assist farmers in their use of the e-wallet system(4)	
		Others(0)	
	Please specify (others)		

10	Did you take part in the training for the use of mobile telephony in the distribution of farm inputs to farmers?	Yes (1) No (0)	
Section C: To ascertain the benefits of the mobile telephony system in fertilizer distribution in south east Nigeria			
11	Do you think the mobile telephony system had any benefit to farmers?	Yes (1) No (0)	
12	If "Yes" can you outline some of the benefits		
13	If "No" why not **Please state reasons**		

SECTION D (Factors that hinder Mobile Telephony Utilization)

Instruction: Please read the items carefully and tick **(√)** where appropriate

Key: Strongly Agree (SA), Agree (A), Disagree (D), Strongly Disagree (SD), Undecided (U)

S/N	Variables	SA	A	D	SD	U
14.	Lack of office facilities					
15.	Remuneration problem					
16.	Poor response from farmers					
17.	Poor response from cellular agents					
18.	Bureaucracy in the entire process					
19.	Mobility problem					
20.	Inconsistency in government policy					
21.	Poor response from national office (i.e. Abuja)					
22.	Too many farmers					
23.	Poor funding					
24.	Poor response from service providers					
25.	Delay / late payment by farmers					
26.	Duplication of responsibilities between state and federal desk officers					
27.	Change of government					
28.	Inability to initially disaggregate farmers into commodity of interest					
29.	Power supply					
30.	High cost of redeeming farm input					
31.	Wrong entries (especially during registration of farmers)					

32.	To what extent do you think these challenges affected farmers' participation in the program?	To a very large extent (VLE)	
		To a large extent (LE)	
		To some extent (SE)	
		Not at all (NAA)	
33.	To what extent do you think the challenges affected your commitment to the program negatively?	To a very large extent (VLE)	
		To a large extent (LE)	
		To some extent (SE)	
		Not at all (NAA)	

APPENDIX III

TEMPLATE (GUIDE) TO INDEPTH INTERVIEW

FOR KEY INFORMANT

TOPIC

ASSESSMENT OF THE UTILIZATION OF MOBILE TELEPHONY IN AGRICULTURAL COMMUNICATION AMONG RURAL FARMERS IN SOUTH-EAST, NIGERIA

1. What was the objective of the Mobile Telephony System (MTS) adopted in the e-wallet program in the Agricultural Sector?
2. Do you think farmers have knowledge on how to use Mobile Phones in accessing Fertilizer and other farm inputs in the state?
3. What is their extent of knowledge in using Mobile Phones to access fertilizer and other farm inputs?
4. Do you think farmers have the requisite skill and competence in using mobile phones to access other agricultural services in the state?
5. What is your assessment of their competence in using Mobile Phones to gain access to agricultural related information in the state?

6. What factors do you think enhance farmers' use of Mobile Phones in accessing agricultural services in the state?
7. Do you think farmers complied with the process of using Mobile Phones in accessing agro-input like fertilizer in the state?
8. To what extent do you think they complied in this regard?
9. Do you think there were constraints in the use of Mobile Phones in accessing agricultural services in the state?
10. If "Yes," what were the likely constraints faced by the farmers in this regard?

APPENDIX IV

INTERVIEW TRANSRIPT

(Interviewee A) (Anambra State)

Question: What was the objective of the mobile telephony system (MTS) adopted in the e-wallet program launched in 2012?

Response: Simply to remove drudgery, price reduction and to get fertilizer timely to real farmers

Question: Do you think farmers have the knowledge on how to use mobile phone to access fertilizer and other farm inputs in the state?

Response: I think "Yes" because it was just text messages that was sent across to them; although there are very few farmers who neither had telephone nor knew how to use the MTS because as at that time the mobile system was still coming into the country, hence, that knowledge was not so much there. But now, I think that knowledge had since progressed with the farmers.

Question: How do you assess farmer's extent of knowledge on mobile telephony utilization in the State?

Probe: Are they knowledgeable to a very large extent, to a large extent or to same extent?

Responses: On a scale of 1-5, I will give them4

Question: Do you think farmers have the requisite skill and competence in using mobile telephony system to access fertilizer in the state?

Probe: I learnt that they use code sent to them to dial in their phones based on their request. How well were they able to do this to request for fertilizer?

Response: No, I don't think so but there is need for more and strong capacity building in that direction. I know that today, elites are going into Agriculture because of the need that is obvious now. But, if it were the farmers that we know then especially during the e-wallet program, they don't have the requisite skill & competence to be able to operate the e-wallet program packaged in mobile telephony system (MTS). They will have to depend on one person or the other and that will make them prone to persons manipulating the code to access their fertilizer. Such things are highly possible

Probe: How do you assess their competence?

Response: On a scale of 1-5, 1will give them 3 or less

Question: What factors do you think enhanced farmers' use of the MTS in accessing agricultural related information?

Response: One is that, the nation developed and the issue of mobile phone started spreading and they began to see the need to use phones

Question: Do you think farmers complied with the process?

Response: Yes, I think they complied the degree of compliance also depends on how you understand the entire exercise because sometimes some farmers could be suspicious. I remember one farmer calling me and say: "should I pay, they said I should pay N10,000? This is so because the entire thing was new and they were beginning to hear stories of money here and there. I said, well, be sure before you make payment.

Probe: To what extent do you think farmers complied?

Response: On a scale of 1-5, I will give them 3-5 or 4.

Question: Do you think there were constraints to the use of MTS by farmers in the State?

Response: The constraints are there for example, an illiterate farmer does not understand some of the codes. There is still need for stronger capacity building in that direction.

Interviewee B (Anambra State)

Question: What was the objective of the mobile telephony system (MTS) adopted in the e-wallet program launched in 2012?

Response: The aim was to meet with genuine farmers, because if you come to be registered, you come with your phone number. They'll send the number to the cellulant, the cellulant will respond to us indicating that the farmer is registered with them.

Question: Do you think farmers have the knowledge on how to use mobile phone to access fertilizer and other farm inputs in the state?

Response: Yes

Probe: To what extent can you say they're knowledgeable about using the MTS to access fertilizer?

Response: I think to a large extent

Question: Do you think farmers have the requisite skill and competence in using mobile telephony system to access fertilizer in the state?

Response: Yes, I think so, if you give them the code, they'll put it in their phones and send to the network of the platform, then the cellulant will respond to us that they're received the code from the farmer for us to give them the fertilizer requested.

Question: What factors do you think enhanced farmers' use of the MTS in accessing agricultural related information?

Response: They were motivated by the need to increase productivity which the inputs will help them achieve. Also, the reduced cost (i.e. they were asked t pay 50% of the total cost) was another motivating factor

Question: Do you think farmers complied?

Responses: Yes, some got fertilizer at the right time but to some the Agro-dealers gave them low quality fertilizer, even the rice seedling they gave to farmers, some of them did not germinate.

Question: What constraints did rural farmers face in using the MTS to access fertilizer?

Response: Inability to pay that 50% easily. Example, rice farmers were asked to pay₦41,000 for 1 hectare and they complained it was too much for them because the total cost of production for 1 hectare is N82,000 so they were to pay 50% of it. They want government to reduce it to 10%

Interviewee C (Enugu State)

Question: What was the objective of the mobile telephony system (MTS) adopted in the e-wallet program launched in 2012?

Response: The objective as we were told was to make sure that real farmers get fertilizer and other farm inputs. From what the then Minister of Agriculture (Mr.Adesina) said that most often fertilizers meant for farmers do not get to them because they are usually diverted. But through this GESS program, farmers now get information directly to

their phones, telling them where to go and get fertilizer. With this, it is real farmers that will get the fertilizer.

Question: Do you think farmers have the knowledge on how to use mobile phone to access fertilizer and other farm inputs in the state?

Response: Actually, some of them operate their phones with the help of their children. Each time they get a message on their phone, they will tell their children *nwa m ginikaozi a n'ekwu* (meaning = my son what is the content of this message) because some of them are not literate.

Question: Do you think farmers have the requisite skill and competence in using mobile telephony system to access fertilizer in the state?

Response: Well, skill is there; why I said it's there is because even if they don't know how to operate it they will now tell you; please *meeyaotuesiemeya* (meaning: do it the way it's been done) because that time, they will come and tell you: "take my phone *gimeeyaotuesiemeya* (meaning: you do it as it's always been done). Then I was assisting many farmers with their phones. Because of the information they're getting from their collegues: *I biakwa e nwenwanyinaewelufonemeeyaotuesiemeya* (meaning: when you come there you will seea women who takes the phone and operates it for you how it's been operated). In operating it certain alphabets are used. For example: "**M**" stands for Maize, "**U**" stands for urea, "**K**" stands for cassava and so on.

Question: What factors do you think enhanced farmers' utilization of the MTS in accessing fertilizer?

Responses: The likely factors that motivated their use of MTS were their need for agricultural related information. Also, because of their need for fertilizer

because from the GESS program, they can now acquire fertilizer using their mobile phones. Not that it is really cheap but their main motivation is their need for agricultural related information

Question: Do you think farmerscomplied in their use of the MTS to access fertilizer?

Response: Yes, they did, they actually did comply

Question: Are there challenges they encountered while using the MTS to access fertilizer?

Response: Sometimes no network on the e-wallet platform; at times their battery might be low and no power supply to change them. Also, sometimes the farmer may not have money because every register farmer needs at least balance of N10 in the phone to be able to use the platform.

Interviewee D (Enugu)

Question: What was the objective of the mobile telephony system (MTS) adopted in the e-wallet program launched in 2012?

Response: To make available farm inputs to real farmers in the state

Question: Do you think farmers have the knowledge on how to use mobile phone to access fertilizer and other farm inputs in the state?

Response: Yes, I think so, because these farmers, irrespective of their location were trained in how to use the MTS

Question: How do you assess farmer's extent of knowledge on mobile telephony utilization in the State?

Response: On a scale of 1-5, 1 will give them 3

Question: Do you think farmers have the requisite skill and competence in using mobile telephony system to access fertilizer in the state?

Response: Yes, to some extent (with the help of help line officers)

Question: How would you assess farmers' level of skill and competence in using the MTS to access fertilizer?

Response: The result they saw encouraged them they were able to interact with fellow farmers to exchange into 8 ideas

Question: Do you think farmers complied?

Response: Yes

Question: On a scale of 1-5, how would you assess compliance?

Question: Any constraint

Response: Network failure failed transaction can't read message

(Audio only) Interviewee E (Ebonyi State)

Question: What was the objective of the mobile telephony system (MTS) adopted in the e-wallet program launched in 2012?

Response: The main objective of the MTS was to enhance transparency in the system and ensure timely distribution of farm inputs across the farming population in the state.

Question: Do you think farmers have the knowledge on how to use mobile phone to access fertilizer and other farm inputs in the state?

Response: Yes, to a reasonable extent they have the knowledge because an average farmer in the country now has a mobile phone. It may not be a complicated one but one they can operate easily – for a few of them that

may not have the knowledge their colleagues help them to operate it, or they use their children's phone to redeem their input.

Question: Do you think farmers have the requisite skill and competence in using mobile telephony system to access fertilizer in the state?

Response: Yes, they don't need any special skill or competence to do that because the codes developed by the Cellulants are easy to understand. They have the codes for every input, which the farmers request for, and they send these codes to farmers directly to their phones, theirs is just to open it, know the codes and use them for what they want.

Question: How would you assess farmer's level of compliance in using the MTS to access fertilizer?

Responses: On their part they complied very well. The only issue is that at times they face some challenges. Some of them that could not redeem fertilizer, it may not be their fault because as you know, this technology thing is not so perfect. For instance a farmer in Izzi Local Government may see his name appear in Ohazara Local Government, it is a challenge for the person to actually redeem fertilizer in that area.

Probe: Were there training carried out for this purpose?

Response: Yes, the Agro-dealers were trained and each Agro-dealers has a redemption centre and as such stepped down the training in his own centre.

Question: What factors do you think enhanced farmers' use of the MTS in accessing agricultural related information?

Response: Well, the motivation was that the middlemen that corrupt the farmer approach were removed from the scene in this MTS and each farmers'

particular are with the Cellulants (those who serve as the service providers for the MTS). The "free" nature of the system, I think, was an inducement for farmers' participation.

Question: Are there constraints on your own part?

Response Not actually.

Interviewee F (Ebonyi State)

Question: What was the objective of the mobile telephony system (MTS) adopted in the e-wallet program launched in 2012?

Response: Well, the then minister for Agriculture (Mr.Adesina) introduced the e-wallet called GESS in 2012 to help real farmers with fertilizer and farm input for about 1 hectare of farmland.

Question: Do you think farmers have the knowledge on how to use mobile phone to access fertilizer and other farm inputs in the state?

Response: Yes, because they were trained; then extension agents also carried out grass root training for these farmers

Probe: How do you rate farmers' extent of knowledge on the use of MTS?

Response: On a scale of 1-5, I will give them 3

Question: Do you think farmers have the requisite skill and competence in using mobile telephony system to access fertilizer in the state?

Response: Not all rural farmers are literate. Em!, some of them who don't know how to operate their phone are helped by their colleagues who are literate using the card (i.e. farmers' registration form) given to each registered farmer.

Question:	How would you assess their skill and competence in using the MTS to access fertilizer?
Response:	On a scale of 8, 1-5, I will give them 3
Questions:	What factors do you think enhanced farmers' use of the MTS in accessing agricultural related information?
Response:	One is that the scheme brought it nearer to the farmers by eliminating middlemen. Also, the ease of use of the MTS motivated them
Question:	Do you think farmers complied?
Response:	Yes,
Probe:	Why do you think so?
Response:	Because the cost of using MTS is cheaper when compared to the former system
Question:	How would you rate their compliance?
Response:	On a scale of 1-4, I will give them 3 (75%)
Question:	Are their challenges?
Response:	(1) Network of the platform is not always available, (2) not all the time that Agro-dealer have the type of fertilizers that farmers needed (3) sometime the Agro-dealer will supply fertilizer and withhold the seedling or vice-versa.

APPENDIX V

ABBREVIATIONS

ACGS: Agricultural Credit Guarantee Scheme

ADP: Agricultural Development Project

ATA: Agricultural Transformation Agenda

CMDC: Commodity Marketing and Development Companies

DFRRI: Directorate of Food, Road and Rural Infrastructure

FAO: Food and Agricultural Organization

FESPAN: Fertilizer Suppliers Association of Nigeria

FMARD: Federal Ministry of Agriculture and Rural Development

FMSP: Fertilizer Market Stabilization Programme

FRN: Federal Republic of Nigeria

GDP: Gross Domestic Product

GESS: Growth Enhancement Support Scheme

IFAD: International Fund for Agricultural Development

IFDC: International Fertilizer Distribution Centre

IFPR: International Food Policy Research

MDGs: Millennium Development Goals

MT: Metric Tonnes

MTS: Mobile Telephony System

NACRDB: Nigerian Agricultural Cooperatives and Rural Development Bank

NADF: National Agricultural Development Fund

NAFPP: National Accelerated Food Production Programme

NALDA: National Agricultural Land Development Authority

NBS: National Bureau of Statistics

NFDP: National Fadama Development Project

NIBER: National Bureau of Economic Research

NPC: National Population Commission

NRAP: National Report of Agricultural Performance

NSS: National Seed Service

NSSP: Nigeria Strategy Support Program

OFN: Operation Feed the Nation

RBDA: River Basin Development Authorities

APPENDIX VI

PICTURES FROM THE DATA COLLECTED

Plate I: Researcher with Rural Farmers in Anyamelum (ANAMBRA STATE)

Plate II: Researcher with a Cross-section of ADP Staff in Awgu (ENUGU STATE)

Plate III:A Cross-Section of Rural Farmers in Izzi (Ebonyi State)

Plate IV: Interview Session with Representative of GESS in Abakaliki (Ebonyi State)

Plate V: Interview Session with a Cellulant in Awgu (ENUGU STATE)

Plate VI: Researcher with Rural Farmers in Anyamelum (ANAMBRA STATE)

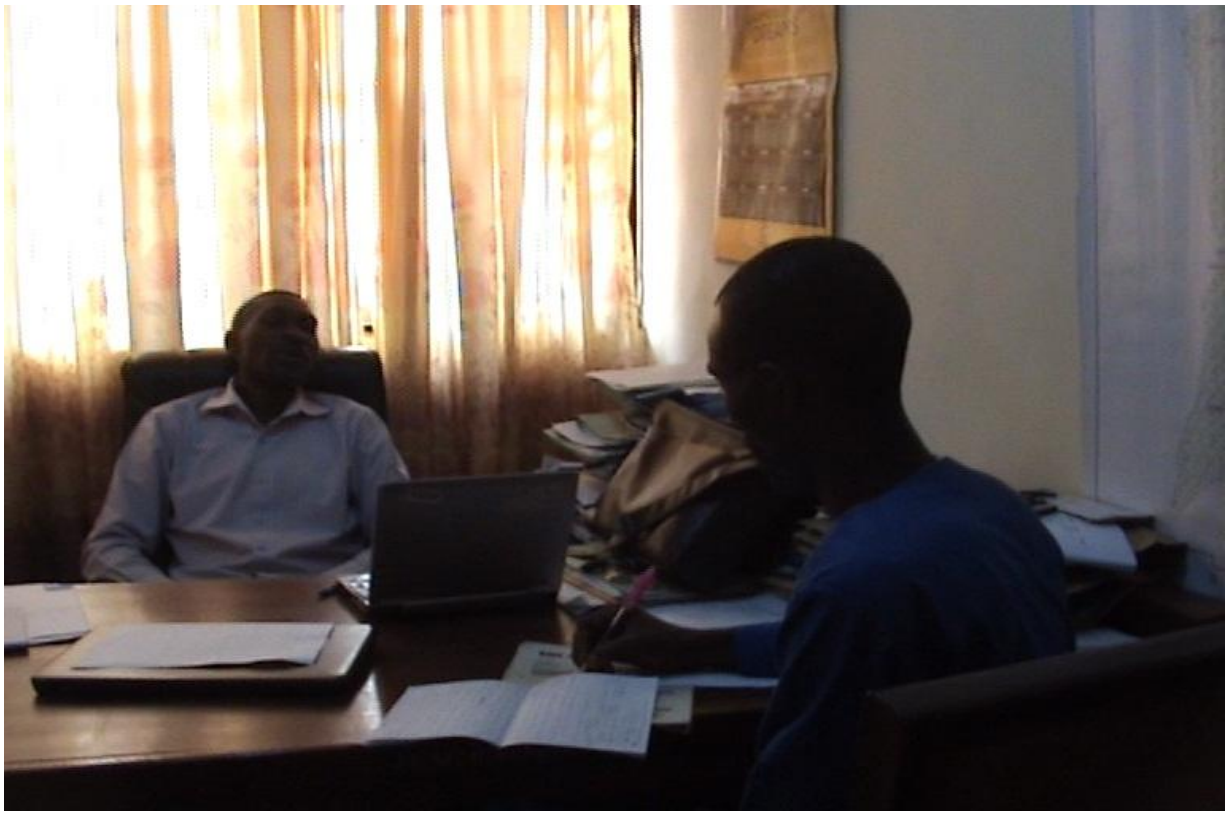


Plate VII: Interview Session with GESS Staff in Awka (ANAMBRA STATE)

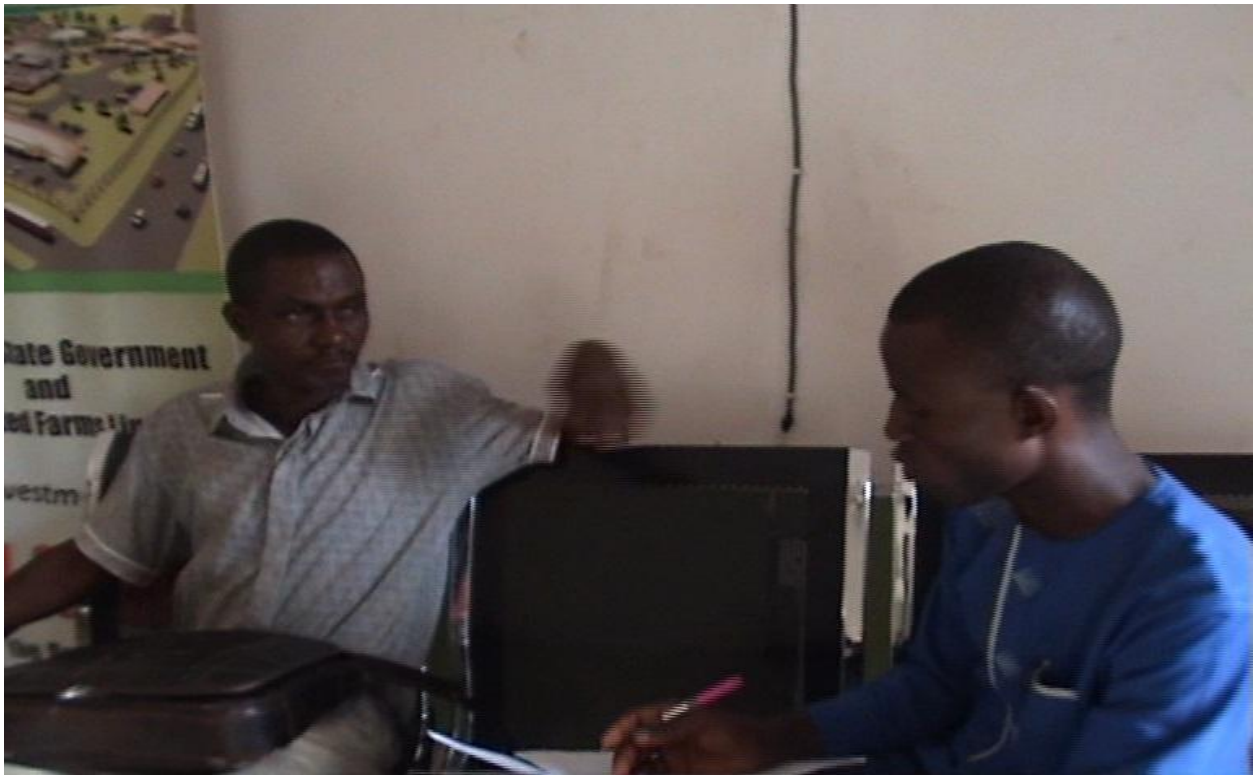


Plate VIII: Interview Session with ADP Staff in Awka (ANAMBRA STATE)

Plate IX:A Cross-Section of Rural Farmers in Ishielu (EBONYI STATE)

Plate X: A Cross-Section of Rural Farmers in Oyi (ANAMBRA STATE)

Plate XI: Researcher with Rural Farmers in Anyamelum (ANAMBRA STATE)

Plate XII: A rural farmer filling a questionnaire in Ishielu(Ebonyi State)

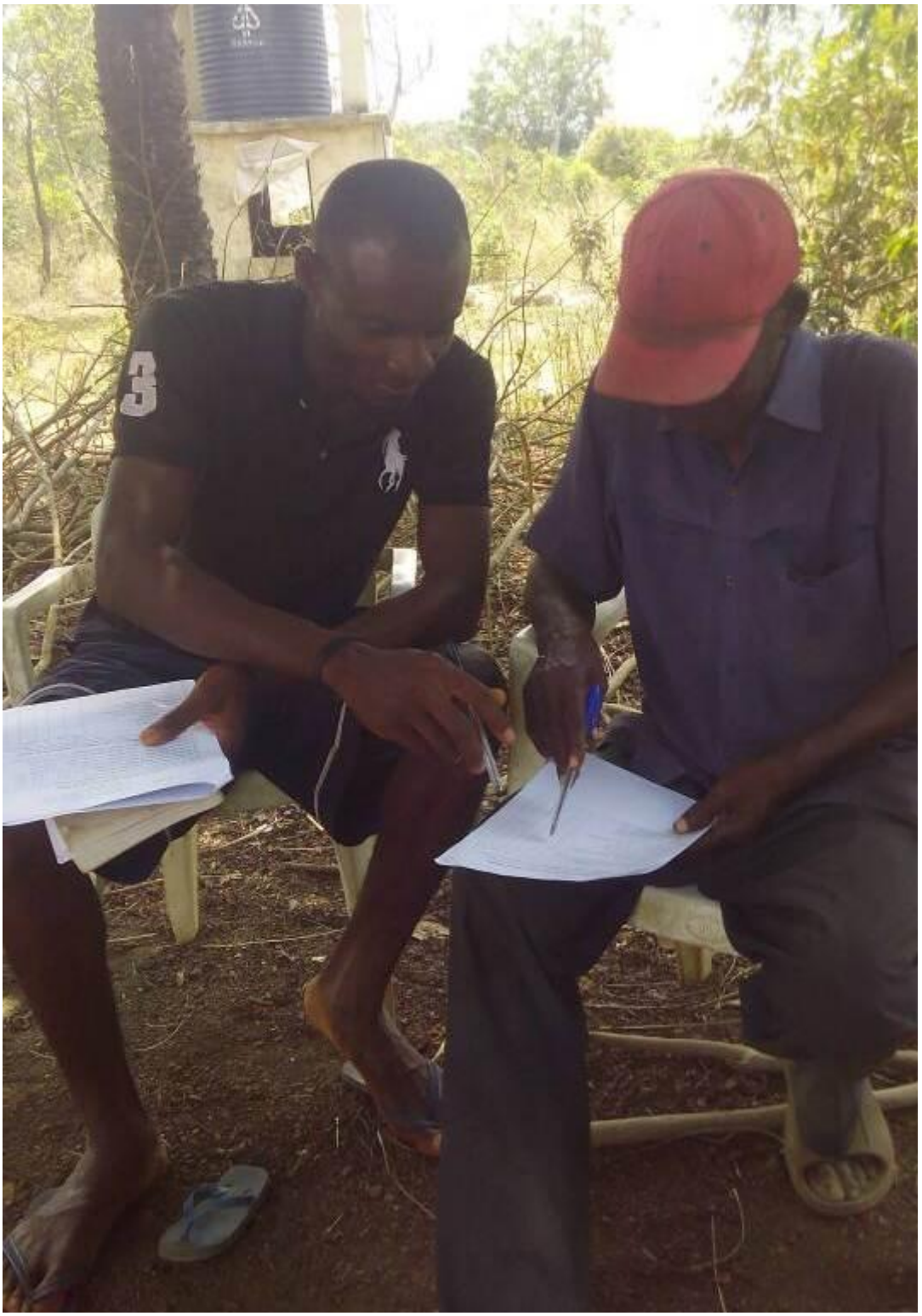


Plate XIII: Rural farmers filling a questionnaire in Ebonyi State