Thesis

By

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THE UNIVERSITY OF IBADAN

CODESRIA

DETERMINANTS OF UTILISATION OF INFORMATION AND COMMUNICATION TECHNOLOGIES FOR AGRICULTURAL EXTENSION DELIVERY IN NIGERIA

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DETERMINANTS OF UTILISATION OF INFORMATION AND COMMUNICATION TECHNOLOGIES FOR AGRICULTURAL EXTENSION DELIVERY IN NIGERIA

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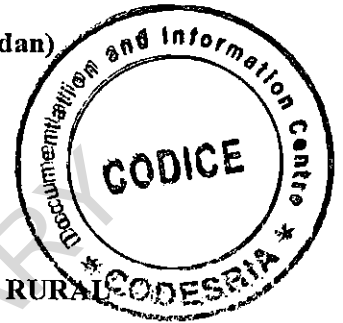FACULTY OF AGRICULTURE AND FORESTRY IN PARTIAL FULFILMENT OF

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DEDICATION

I dedicate the achievement of this effort to Allah ﷻ, my Lord, Who destined and facilitated it; and to my parents especially my late father, Alhaji Yekinni Owoseni AbdulAzeez, may Allah's mercy abide by him till eternity.

ABSTRACT

Low level of information sharing within the agricultural knowledge and information system limits growth in the sector. The Information and Communication Technologies (ICTs) has the potential to bridge the gap. Utilisation of ICTs among agricultural researchers, extensionists and farmers has not been adequately investigated in Nigeria. The extent to which ICTs are used by these stakeholders to advance agricultural practices in Nigeria was investigated.

Multistage random sampling was adopted to select the respondents. Proportionate random sampling technique was used to select three, two and two of the research stations in the South-Western, Central and North-Western agricultural zones respectively while the only research stations in each of South-Eastern and North-Eastern zones were selected. Ten percent of the researchers at the selected stations were randomly sampled. Then, 10% of the extensionists in the 6 state ADPs, where the research stations have been selected were randomly selected. From the ADPs farmers' list in each of the selected states, 35 farmers were randomly selected. Three sets of structured questionnaire were used to elicit information from the different categories of respondents. Data were collected on perception of the use of ICTs, access, availability, level of use and knowledge of ICTs, farmers' information sources, needs and use of available ICTs and willingness to use digital ICTs. Descriptive statistics, knowledge index and logit regression model were used to analyse the data collected. All tests were carried out at $p = 0.05$.

Farmers ranked their information needs in order of importance as agricultural production, product price, marketing, community development, politics, education and weather. Seventy five percent of farmers were willing to use digital ICTs to access information. Mean ICT use score was 33.0±15.8 for researchers, 25.8±15.0 for extensionists and 3.4±1.7 for farmers. Most researchers (75.3%) and few extensionists (34.1%) had high ICT knowledge score. Farmers use the analogue ICT formats (2.33) than the researchers (1.90) and extensionists (1.93). The log likelihood of researchers' use of ICTs was significantly reduced by grade level (β=-0.729), increased by access to ICTs (β=1.807), and increased by perception of sustainable use of ICTs (β=0.303). The log likelihood of extensionists' use was significantly increased by available ICT facilities (β=0.343), access to ICTs (β=1.410), and severity of constraint assessment (β=0.182). The log likelihood of farmers' use of ICTs was significantly increased by number of information sources (β=0.267) and marital status (β=1.490).

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The disparity in the available information and communication technology formats to agricultural development researchers, extensionists and farmers present a serious challenge to agricultural information management in Nigeria. Multiplicity of information sources predisposed farmers to use Information and Communication Technologies. Availability and accessibility were major determinants of Information and Communication Technologies used by researchers and extensionists.

Keywords: Agricultural information, agricultural extensionists, Information and Communication Technology

Word count: 441

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Taofeeq Oyedeji Yekinni, Dhul-Qadah 1431/November 2010

CERTIFICATION

I certify that this research work was carried out under my supervision by Mr Taofeeq Oyedeji Yekinni in the department of Agricultural Extension and Rural Development, University of Ibadan, Nigeria.

08/02/2011
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Date

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CHAPTER ONE
INTRODUCTION

1.1   Background to the study

Agriculture is of cardinal importance to any nation; be it developed, developing or underdeveloped. It is through this activity that food, fibre and foreign exchange earnings are provided for individuals and countries. In recent years, new sets of challenges are emerging for agricultural production and management activities in developing countries. These issues include exponential increase in the demand for food and fibre, continuous introduction of new pests and diseases, challenges of value addition for agricultural products exports, phytosanitary requirements of agricultural exports, and challenges inherent in World Trade Organisation's (WTO) policy on trade in agricultural products. These issues constitute the burden of globalisation on the agricultural management and practices in developing countries.

Given the fact that information revolution brought about globalisation, information utilisation or application is believed to hold the solution to the challenges of globalisation in whatever form they are manifested. According to CTA (2000), efficient information dissemination remains the key to bridge the gap between the developed and underdeveloped countries. Equally, the unprecedented pace and scale of global flow in information, products, capital, people and ideas, if properly harnessed, offers the potential to create new opportunities for those who have thus far been excluded from gains in human development (UNDP *et al*, 2001). This is part of the challenge that confronts the development actors and stakeholders in developing countries. However, development specialists are yet to adapt the appropriate agricultural and rural development strategies to accommodate the changes brought by globalisation (Antoine, 2000).

On the basis of rural development consideration, the focus of intervention does not have to be specific to agriculture in order to enhance holistic rural livelihoods and overall development. For instance, an intervention such as rural payphone can play significant role in enhancing the ability of rural families to maintain and improve their livelihood while maintaining or enhancing the assets on which their means of living depend. The concept of rural development implies the desire to improve the circumstances and position of rural communities through the recognition that a dichotomous urban-rural relationship exists (CTA, 2006). This focus is important to most developing countries where rural population

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constitute the majority of their population; as obtained in Nigeria where 51.7% of the population live in rural areas (Wikipedia, 2009). The importance of rural development cannot be overemphasised, to the extent that the concept is analogous to human development concerns as a whole; they are deemed identical such that studies on the latter are synonymous with the former (Sharon, 2003).

The rural poor constitute the engines of agricultural production in developing countries while agricultural production and post-harvest activities account for the primary livelihood strategies available to them. Hence, any problem affecting improved general livelihood of the rural poor (such as disasters, lack of information, health provision, education, infrastructure, financial services, and many others) will have significant impacts on agricultural production at household, regional and national levels. This means that interventions that improve the general livelihood of the rural poor will also yield significant development opportunities to rural families, and national food security. Agricultural extension institutions therefore have particularly demanding responsibility to make their clientele (the farmers and other stakeholders) withstand the challenges of globalisation. Aspects of their responsibility include the determination of the information needs of the various actors and stakeholders in agricultural development, acquiring and organising the information items in usable forms and more importantly communicating them through accessible and affordable means. Hence, to strategise on how agricultural extension services can improve rural livelihoods, there is the need to move beyond a narrow understanding of rural development as agriculture-specific.

Information and communication are critical to human life and social development. People have always worked together by sharing information and knowledge through speech, writing, printed word and more recently via telephony and broadcasting. Sharing information empowers individuals and communities, and enables societies to benefit from the experience of everyone within them. In examining the potential of Information and Communication Technologies (ICTs) for rural development, it is essential to recognise that information dissemination is fundamental to any rural development programme, as rural areas are often considered information-poor. Amidst the changes facing extension, there is growing recognition that farmers and members of rural communities have needs for information and appropriate learning methods that are not being met (Greenridge, 2003; Lightfoot, 2003). The emerging issue is how ICTs can be integrated into local knowledge and information networks to address locally identified knowledge gaps. With the emphasis on 'Information and

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Communications', the importance of context-driven and indigenous approaches such as projects that meet local needs, demand-driven content and local language media become obvious challenges. In addition, issues of sustainability, which involve factors of human capacity, social capital and best practises, will determine the extent to which rural communities can optimise the benefits of ICT for agricultural and rural development (FAO, 2000). According to Ballantyne and Bokre (2003), the following are the target benefits of using ICT strategy in extension delivery in developing countries:

- Improve the wellbeing of individuals and communities – this means that the pursuit of wellbeing would implicitly encourage diversification to non-agricultural activities among the people in communities. For instance, access to information would enable the people to have job opportunities from areas other than agriculture.

- Improve production systems and sustain their resource base – this refers to a strategy of promoting the agricultural and non-agricultural activities through provision of technical information and enlightenment about environment protection upon which the enterprises can be maintained on sustainable basis.

- Improve the agricultural and social (economic and political) status of rural communities – this implies adequate access to information on agriculture, being the primary occupation, then other income-generating activities and other aspects of life of the people such as the political situation in the area.

The targets would, in essence, improve the productivity of farm families, their wellbeing and livelihood on a sustainable basis. It has been severally adduced that the level of development of agriculture in a country is a reflection of the performance of the nation's agricultural research and extension services. According to Arokoyo (2003), "a nation's agricultural research and extension system (NARES) is the most important single determinant of the level of its agricultural development and hence the yard-stick of the quality of life of its people". Meanwhile, the extent to which the institutions could be relevant to the contemporary trends will determine their effectiveness to their clientele.

Agricultural extension is typically seen as a service that responds to the needs of farmers and rural people for knowledge they require to improve their productivity, income and welfare, and to manage the natural resources on which they depend in a sustainable way. Specifically, extension brings information and new technologies to farming communities, thereby enabling them to improve their production, income and standards of living. In the

past, extension was seen primarily as a public service, institutionalised and organised by national governments. However, circumstances are changing and government extension institutions are being challenged to adopt diversified and pluralistic national strategies to build dialogue and collaboration among a variety of public, private, non-governmental and community-based entities to promote services to improve rural livelihoods (CTA, 2006). The rural extension service essentially has to adjust to the contemporary challenges and adopt a new paradigm whereby other, non-agricultural concerns will be addressed, especially 'those relating to income-generation and the development of micro-enterprise which includes health and other issues relevant to substantial proportion of people in the rural sector who do not work the land' (Rivera and Qamar, 2003).

According to Qamar (2005), worldwide emphasis on sustainable development, including in rural improvement and agricultural advancement, as well as developments such as globalisation, market liberalisation, decentralisation, privatisation and democratisation, are creating new learning requirements for both subsistence and commercial farmers in developing countries. These requirements, especially when seen within the context of the revolution in information technology, are challenging decades-old mandates and operations within traditional extension systems. It is time for policy-makers in developing countries to challenge and revisit the discipline of extension within a global context, so as to let the service be performed with excellence in line with the global challenges to their economies and especially to their agriculture sector. Cosmetic changes to the existing national extension systems will be of little benefit, as will be the repeated training of staff in stereotyped agricultural subjects.

Information and Communication Technologies (ICTs) are the set of tools, equipment, applications and services that are used to produce, store, process, distribute and exchange information. According to Mobolaji (2004), "ICTs are enabling technologies (both hardware and software) necessary for the delivery of voice/audio, data (high-speed and low-speed), video, fax and Internet services from Point A to Point B (or possibly to multiple points B, C, etc) using wired and wireless media". The ICTs include the previously known facilities like radio, television, telephone, video, over-head projectors among others. Other ICT facilities are computer, CD-ROM technology, digital networking, satellite and other wireless technologies (like GSM and the Internet). The combination of the various ICTs (old and new) "are now able to work together to form our 'networked world' – a massive

infrastructure of interconnected telephone services, standardised computing hardware, the Internet, radio and TV, which reaches into every corner of the globe" (UNDP, 2001).

According to UNDP (2001), the use of ICTs in development programming is not new; in 2000, it assumed a new prominence when the United Nations and G8 group of industrialised countries flagged off Information and Communication Technology for Development (ICTD) as a global development priority. Since then, the understanding of ICTD as a core development issue has been rapidly evolving. It has been argued that the problem of underdevelopment is attributable to the inability of a large portion of the world's population to access and effectively use ICTs and the potential benefits they enable. In fact, "the digital divide, being the disparities between the 'connected' and the 'unplugged', is really a reflection of the age-old divide of poverty, education, and restricted human choices" (UNDP, 2001).

Ajayi (2002), gave the following picture of ICT status in Africa: the continent has 12% of world population but 2% of main telephone lines; three-quarter of the capital cities in Africa have developed some forms of Internet access; there are about three million Internet users in Africa with only one million outside South Africa; and Internet connectivity in Africa is 0.3% of the worldwide connectivity.

Recent years have seen an increase in the use of ICTs in almost every sphere of life, even in developing countries where there are persistent problems of access, connectivity, literacy, content and cost (Antoine, 2000; Wesseler and Ballantyne, 2003). Internet and other digital devices of ICT are being used for information management to the extent to which they can cope despite the ubiquitous constraints. Mundy and Sultan (2001) posit that "in 1996, only 19 countries had full Internet access and by 1999, there are 53 of them, that is, all of Africa except Congo, Eritrea and Somali". A major indicator of infrastructural requirement for digital ICT use is Teledensity. It is a measure of the penetration of telephone lines within a territory. Nigeria's teledensity has grown from near zero at the turn of the millennium to about 8% in just four years. This shows a geometric increase in the availability of the facility to the extent that Nigeria is now officially the largest growth market for telecommunication in Africa and the Middle East (NCC, 2005). Subscription for mobile phones has attained an enviable level of 49% of the population by 2009 as given in fig 1.1 (Pyramid research, 2010), and with potential of continuing the trend of growth. Also, Table 1.1 showed that there is progressive increase in the number of people using Internet in Nigeria facilitated through the enhanced teledensity status.

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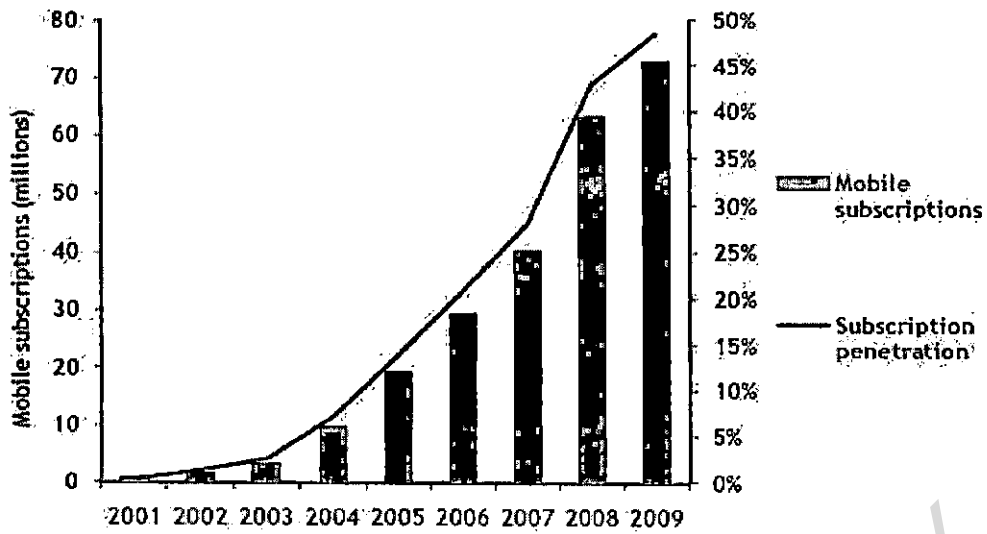
Fig 1.1: Mobile subscriptions and mobile subscriptions penetration of population in Nigeria, 2001   2009

Source: Pyramid Research (2010)

Table 1.1: Growth of the Nigerian Telecommunication industry

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Population	120,000,000	120,000,000	120,000,000	120,000,000	120,000,000	126,000,000	140,000,000	140,000,000	140,000,000	140,000,000
Households	12,800,524	13,173,020	13,545,516	13,893,868	14,254,520	n/a	n/a	n/a	n/a	n/a
Fixed	553,374	600,321	702,000	872,473	1,027,519	1,223,258	1,687,972	1,704,722	1,307,625	1,481,954
Mobile	35,000	266,461	1,569,050	3,149,472	9,174,209	18,587,000	32,322,202	33,603,761	62,990,500	73,101,319
Total	588,374	866,782	2,271,050	4,021,945	10,201,728	19,810,258	34,010,174	35,308,483	64,298,125	74,583,273
Internet users	107,194	153,350	420,000	1,613,258	1,769,661	n/a	n/a	n/a	n/a	n/a
Internet penetration	0.1%	0.1%	0.3%	1.3%	1.5%	n/a	n/a	n/a	n/a	n/a
Teledensity	0.49%	0.73%	1.89%	3.35%	8.50%	15.72%	24.29%	25.22%	46.80%	53.23%

Source: NCC (2010)

However, there has not been optimal deployment of these facilities to various sectors and hence the benefit has not been optimal. Although individual access is scarce, but private cyber cafés and public call offices have become a regular feature of the modern African city (Bertolini, 2004). Specifically, some of the new digital communication facilities such as computers, computer networking (Local Area Network-LAN and Wide Area Network-WAN), CD-ROM technology, GSM and the Internet have been in use in most African cities. The situation has brought a significant challenge to the development actors in these countries who have to contend with the socioeconomic and political dimensions that have been altered as a result of the development; and also the balance between developed and developing countries as well as rural and urban economies (Antoine, 2000).

The old ICTs, such as radio and television among other analogue formats, that have been in use for agricultural and rural development programmes in most developing countries have not been used optimally because the software component (that is, the content) have not been adequately addressed in the strategies (Sharma, 2007). Agricultural extension institutions in Nigeria have particularly significant role to play in the content (software) generation for whatever ICT format (old or new) that have to be adopted for use in their dissemination activities.

1.2   Statement of the problem

Effective information dissemination for agricultural research and development in the developing countries is not optimal between the national and international research institutions. There is also a great problem in the transfer of information from research institutions to the national extension systems, and a greater one in disseminating to the information users (farmers among others). According to George *et al* (2002);

> *the research and development institutional infrastructure may be in place, but substantial blocks to information flow exist in the information hierarchy and knowledge, which remains inaccessible to the farmers, especially in the rural areas. Much of the knowledge and technologies thus remain on the shelves in reports, journals, books, and electronic media because ... the intended users, the farmers, have no say in their production and disposition. Thus, a knowledge divide exists between the more affluent research institutions and the less affluent delivery (extension) institutions and even a greater divide exists between delivery institutions and rural farmers.*

The trend led to a situation in which the critical information required for agricultural development in the contemporary world remains largely unavailable and the farmers have to

resort to seek information from whatever source is available to them and hence, a reflection of the sub-optimal agricultural development level in the country.

The agricultural extension system is an important actor in agricultural and rural development efforts in Nigeria. Extension activities are implemented by the Agricultural Development Programmes (ADP) and other civil societies, private and university-based extension service providers. The relevance of the extension interventions to agricultural development is based on the fact that its activities have been adjudged successful for promoting agricultural development by the World Bank projects in Nigeria (Bukar *et al*, 1997). The ADP, which basically used extension approaches, has impacted, in one way or the other, on the target populace and has been adopted by all state governments in the country. Several dissemination methods have been used in the history of the institution's activities, which include the ministry-based conventional system, commodity-based system, university extension system and the current integrated agricultural development approach. The current approach is coordinated through the Projects Coordinating Unit (PCU), now a component of the National Food Reserve Agency (NFRA), and uses the Training and Visit (T&V) delivery system. Over the past 20 years, the dominant donor-supported extension approach has been the public sector provision of the training and visit system (T&V). Though this system has been adjudged efficient and adequate, but it is constrained by the discontinuation of the counterpart funding by the World Bank (Akinbile, 1999). The system is supposed to incorporate feedback from farmers; however, farmers are often passive recipients of didactic instructions. Messages are typically based on perceptions of farmers' needs, or on the requirements or desires of public sector agencies (IMARK, Undated). Evaluation research demonstrates that T&V has not proven itself to be a system that meets the demands of users for appropriate content and learning methods (World Bank, 1998).

At the inception of the ADP strategy, the development support communication component of the strategy had been instituted to facilitate the communication activities of the programme. Communication strategies included mobile cinema vans going from village to village and supported with minimum extension publications in local languages. Then radio and mobile video vans and television were added with the World Bank assistance. The radio and TV programmes grew with the growth of the ADPs such that by the commencement of the second developmental phase (in 1991 to 1996) of the National Agricultural Technology Support Project (NATSP), virtually all the projects had well developed and equipped Development Support Communication (DSC) units, with video, radio and television (that is,

mainly analogue ICTs) production and viewing facilities. All the ADP radio and TV programmes were initially aired free on the states' and some of the national broadcasting networks. With the commercialisation of these broadcasting networks, the frequency of both the radio and TV programmes dropped appreciably due to financial constraints.

According to Arokoyo (2003), at the inception of the ADPs in 1980 the extension agent-farmer (EA:Farmer) ratio ranged between 1:2000 and 1:3000. This was expected to come down to between 1:800 and 1:1000 by the project completion date and the withdrawal of World Bank support; but this target was not achieved. A field survey by NAERLS and PCU in 2002 showed that the extension agent-farmer ratio was between 1:848 (in Ogun State in the South-West Ecological Zone) and 1:1650 (in Katsina State in the North-West Ecological Zone). This is similar to the finding by Arokoyo *et al* (2002), where the ratio was put between 1:1000 and 1:2000 for the public extension service, and women-in-agriculture programme respectively. It can thus be established that extension delivery through the village extension agent strategy can neither be efficient nor cost-effective for a developing country like Nigeria, with a population of about 150 million. It is therefore convenient to state that deployment of appropriate communication technology is the strategy required to adequately complement the extension delivery functions of the agents so as to bring about substantial agricultural development in the country.

Given the circumstance of improvement in the Nigerian digital ICTs, where teledensity rose from 0.73% in 2001 to 53.23% by the end of 2009; it is important to assess the potential application of the tools for agricultural information dissemination. It is also relevant to find out the extent to which agricultural information system in Nigeria has adopted the technology in their activities. This is based on the fact that ICTs present unprecedented opportunities for individuals and communities to be not only consumers but also producers of information. Through media convergence, ICTs can build on hybrid potentials to integrate the capacities of analogue media (e.g. cinema, video, radio and television) with modern digital communication devices to achieve effective information communication. This will enable low-cost creation, access and distribution of information, which requires a networked rather than centralised approach (FAO, 2000).

These challenges make it clear that the current strategies in use are inadequate and call for a very robust medium that the new digital ICT formats (e.g. computer, mobile phones, CD-ROM and Internet) can fulfil. The challenge to the extension institutions in Nigeria therefore will be to adjust to the new situation and determine how to effectively use

the available ICT formats to take care of their clienteles' information needs and different communication problems (Yahaya, 2003) as well as determine the appropriate ICT formats to use in the dissemination of information to them.

This study therefore intends to provide answers to the following research questions:

1. What are the information needs of farmers in Nigeria?
2. How has the existing extension delivery system met the needs of agricultural research and extension practitioners?
3. What are the attitudes of the research and extension practitioners to the use of ICT for agricultural extension delivery efforts in Nigeria?
4. What are the levels of knowledge of the research and extension service practitioners about the use of new ICTs for agricultural extension delivery in Nigeria?
5. To what extent are ICTs used in the existing research and extension delivery strategy in Nigeria?
6. To what extent are farmers willing to use and pay for ICT mediated information?
7. What are the factors that determine the use of ICTs for agricultural extension delivery in Nigeria?
8. What are the research/extension personnel's perceptions on how ICT formats can be deployed in a sustainable manner for agricultural information dissemination?

1.3   Objectives of the Study

The general objective of the study is to investigate the determinants of the use of ICTs for enhanced research and agricultural extension delivery strategy for agricultural development in Nigeria.

The specific objectives of the study are to:

1. Ascertain the information needs of farmers in Nigeria
2. Determine the extent to which the existing extension delivery system has fulfilled the needs of agricultural research/extension practitioners in Nigeria
3. Determine the attitudes of extension and research personnel to the use of ICTs for agricultural extension delivery in Nigeria
4. Assess the level of knowledge of the extension and research personnel about the use of ICTs for agricultural extension delivery activities in Nigeria

5. Ascertain the extent of use of ICTs in the current extension delivery strategy in Nigeria

6. Determine the extent to which farmers are willing to use and pay for ICT mediated information

7. Ascertain the factors that determine the use of ICTs for agricultural extension delivery in Nigeria

8. Assess the research/extension personnel's perceptions on the sustainable deployment of ICTs for agricultural information dissemination in Nigeria.

1.4   Hypotheses of the Study

The hypotheses of the study, stated in null form, are as given below:

1. There is no significant relationship between the level of knowledge and extent of use of ICTs among the research and extension practitioners

2. There is no significant relationship between the attitude to use and extent of use of ICTs among the research and extension practitioners

3. There is no significant relationship between selected socioeconomic characteristics of the farmers and their information needs

4. There is no significant difference in the attitude of the research personnel and the extension personnel to the use of ICTs

5. There is no significant difference in the extent of use of ICTs by the research and extension personnel

1.5   Justification of the Study

The study is essentially an assessment of the extent of use and potential use of ICTs in the delivery of agricultural information among the various stakeholders in the agricultural sector in Nigeria. The demand of contemporary circumstance is the evolution of new roles for the extension service institution as well as emergence of new actors and stakeholders who will take on intermediating functions. The hitherto linear information flow that dominated the traditional extension delivery systems in developing countries has to be replaced by pluralistic information flows given the new dimension (CTA, 2003). Some of the identified intermediaries in the new strategy include the following:

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- Farmers and their associations
- Non-Governmental Organisations (NGOs)
- The media
- Private companies (input suppliers, brokers/traders, operators of telecentres, etc.)
- The formal (government) extension system
- National agricultural research organisations
- Universities
- International research organisations
- Donors
- Think tanks and networks at various levels
- The political environment (local, national, regional, international governance structures, conventions, treaties, etc.)

These intermediaries can thus be effectively covered with the use of ICT enabled strategy in the dissemination of information within and between all the levels. According to IDRC (undated), the role of ICTs in developing local agriculture may extend to the following:

- Faster and more efficient delivery of information with more relevant and adapted content
- Wider dissemination of information to people hitherto unreached or underserved, and a deeper geographic penetration, especially to rural areas
- Access to information sources worldwide hence fostering empowerment of men, women and the youth in the communities, thereby spreading of knowledge and information about good practices
- Rare opportunities and challenges for government to provide services to the rural population so that they can also participate in the development process.

Thus, use of the ICTs will ultimately lead to real agricultural and rural development in Nigeria because it has the capability to harness all the required information for such a feat, given the trends in the contemporary world. The development will assist in achieving the elusive sustainable food security in the country as well as facilitate the nation's economic diversification efforts into the agricultural sector. The strategy will equally facilitate extension delivery systems by making it ultimately effective and less expensive in comparison to the traditional methods that were hitherto in use.

The relevance of this study is also pursued along preparation of the Nigerian agricultural research and extension institutions for integration into the federal government policy on the use of information technology (IT) strategies in the country. According to NITDA (2003), the National IT policy identified information technology (IT) as;

> *the bedrock for national survival and development in a rapidly changing global environment, which challenges the country to devise bold and courageous initiatives to address a host of vital socioeconomic issues. In addition, the Information Technology strategy, which is built on reliable human resources and infrastructure, constitutes the fundamental tool and means of assessing, planning, managing and developing change for achieving sustainable growth.*

One of the specific strategic outlines of the policy is to establish an agricultural information system to provide support for planning, production, storage and distribution of horticultural crops, livestock, and fisheries products. The core of the application, no doubt, must involve the research and extension institutions for the objectives to be achieved.

The result of this study will provide concrete guideline for the deployment of ICTs for agricultural research information dissemination and rural development goals. This work will facilitate the deployment of the strategy, serving the role of ICTD champion, as advocated by UNDP (2001). This study will therefore be relevant to the policy makers and all other institutions, private and public, with interests in the agricultural and information sectors in Nigeria. It will also be useful for researchers and students with studies on the roles of ICTs in agriculture and rural development in Nigeria.

1.6   Theoretical and operational definition of terms

- **Digital divide** - The term 'digital divide' characterises the fact that the world consists of people who do and people who do not have access to – and the capacity to use – ICTs, including the telephone, television and the Internet.

- **Globalisation** - an umbrella term for a complex series of economic, social, technological, cultural and political changes in the contemporary world, which depicts increasing interdependence, integration and interaction between people and entities in disparate locations.

- **ICTD** - Information and Communication Technology for Development. A core concept to use ICTs to address development goals, especially in developing countries. ICTD, according to UNDP (2001), encompasses a complex, multi-sectoral arena - from ICTD as a sector in-and-of-itself, through to ICTs as enablers of other

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development areas like governance, poverty alleviation, the environment, health and education.

- **Information and Communication Technologies (ICTs)** - can be interpreted broadly as technologies that facilitate communication as well as the processing and transmission of information by electronic means. This definition encompasses the full range of ICTs; from radio, television, video, telephones (fixed and mobile), and the computer-mediated media, especially the Internet.

- **Internet** - open interconnection of computer networks that enables the computers and the programs they run to communicate directly.

- **Teledensity** - The term 'teledensity' is used internationally by organisations such as the International Telecommunication Union (ITU) as an indicator of telephone accessibility. Teledensity is a measure of the number of telephone lines per 100 inhabitants.

- **World Wide Web (www)** - library of resources available to computers that are connected to the global network of computers, that is, Internet. It enables users to view a wide variety of information, including journals, magazines, reports, archives, public and private library resources, and current world and business news.

CHAPTER TWO
LITERATURE REVIEW

2.1   Agricultural and rural development in Nigeria

Nigeria has a highly diversified agro-ecological condition which makes the production of a wide range of agricultural products possible. Agriculture constitutes one of the most important sectors of the economy because the sector is particularly important in terms of employment generation, contribution to gross domestic product (GDP) and export revenue earnings. Despite Nigeria's rich agricultural resource endowment, the sector has been growing at a very slow rate and less than 50% of the country's cultivable agricultural land is under cultivation (Manyong *et al*, 2005).

Smallholder and traditional farmers are the bulk of practitioners in the agricultural sector in Nigeria; they use rudimentary production techniques and are confronted with problems that can be described as the problems of agriculture in the country. These include poor access to modern inputs and credit, poor infrastructure, inadequate access to markets, land and environmental degradation, and inadequate research and extension services. The situation results in low yields in most of the cultivated lands, depicting that the smallholder farmers are operating in constrained circumstances.

2.2   Trends and strategies of government policies in agriculture

Nigeria's agricultural policy framework has gone through a number of evolutionary processes and fundamental changes that reflected the changing characteristics of agricultural development problems and the multifaceted nature of these problems. The form and direction of agricultural policy at a point in time was dictated by the philosophical stance of government, thereby tying the trend of agricultural development, like other sectors, to the role of government in the development process.

According to Manyong *et al* (2005), four distinct agricultural policy phases can be identified in Nigeria. The first phase spanned the entire colonial period and the first post-independence decade from 1960 to about 1969; the second phase covered the period from about 1970 to about 1985; the third phase started from about 1986 in the structural adjustment period; while the fourth phase could be characterised as the post-structural adjustment era, starting from about 1994.

2.2.1 The pre-1970 period

In this era, the government's philosophy of agricultural development was characterised by minimum intervention in the sector. As such, government's attitude to agriculture was relaxed, with the private sector and the millions of small traditional farmers bearing the brunt of agricultural enterprise efforts. Government's efforts were merely supportive of their efforts in terms of agricultural research, extension and export crop marketing and pricing activities. Most of these activities were regional based towards the end of the colonial era with federal government's contribution being confined largely to agricultural research (Manyong *et al*, 2005).

The low involvement of government in agricultural development efforts was borne out of a general philosophy of economic *laissez faire*. Despite this, some regional governments made their presence felt in agriculture; especially in the 1950s and 1960s, by creating government-owned agricultural development corporations and launching farm settlement schemes. However, these involvements found their justification more in welfare considerations than in core economic necessities.

Towards the end of the 1960s, the Nigerian agricultural economy started running into some stormy weather. The signs of emerging problems manifested in declining export crop production and food shortages. Even when these problems were ascribed to the civil war, and as such transitory in nature, the assumptions were proven wrong as the agricultural sector sank deeper after the transient circumstance and the problems became much more intractable than anticipated (Manyong *et al*, 2005).

2.2.2 Pre-structural adjustment period (1970-1985)

Agricultural situation at the turn of the 1970s was characterised by a state of general apprehension about the sector in Nigeria. This led to a fundamental change in the philosophy of government on agricultural development from one of minimum government intervention to one of almost maximum intervention, particularly by the federal government. The feeling was pervasive that the solutions to the increasing problems of agriculture and especially those of food supply required heavy involvement of government in the form of multi-dimensional agricultural policies, programmes and projects; and even some of them requiring the direct involvement of government in agricultural production activities (Manyong *et al*, 2005). The feeling was further reinforced by the instance of oil fortune on the country. The decade of the

1970s and early 1980s therefore witnessed an unprecedented deluge of agricultural policies, programmes, projects and institutions; a highlight of which is presented as follows.

i.   Agricultural sector policies and institutions

Sector-specific agricultural policies were largely designed to facilitate agricultural marketing, reduce agricultural production cost and enhance agricultural product prices as incentives for increased agricultural production. Major policy instruments for this purpose included those targeted at agricultural commodity marketing and pricing, input supply and distribution, input price subsidy, land resource use, agricultural research, agricultural extension and technology transfer, agricultural mechanization, agricultural cooperatives, as well as agricultural water resources and irrigation development.

ii.   Institutional framework

To support the macroeconomic and microeconomic policies of government in this period, a number of institutions were created. The major ones were the institutions created for: credit supply to farmers, that is, the Nigerian Agricultural and Cooperative Bank (NACB) now Nigerian Agricultural Cooperative and Rural Development Bank (NACRDB); technology transfer, that is, the institutions in the extension system; improved seed supply; agricultural research, that is, the institutions in the agricultural research system; the agricultural mechanisation and agricultural commodity marketing and pricing.

2.2.3   Structural adjustment period

Nigeria's dwindling fortune in the petroleum export market, unprecedented debt burden and an unhealthy investment climate led to the realisation that the country's economy required some drastic restructuring. This led to the structural adjustment programme (SAP) launched in July 1986. The structural adjustment programme was aimed not only at correcting price distortions in the economy but also structural imbalances and for promoting non-price factors which would enhance the effectiveness of price factors. The programme has the following key elements as its principles regarding agricultural development in the country:

- Agriculture was essentially a private-sector business and the role of Government must be largely facilitating and supportive of private-sector initiative.
- The agricultural economy should be as free of government administrative control as possible and market forces must be allowed to play a leading role in directing the economy.

- The agricultural economy should be more inward looking and self-reliant by depending more on local resources while also ensuring self-sufficiency in food production and the supply of raw materials to industries.
- The agricultural economy should serve as a primary avenue for the diversification of exports.

The major policies for agricultural development which were in operation in the SAP period included those on agricultural research, agricultural extension and technology transfer, input pricing and subsidy, water resources and irrigation, and land development. Their key elements are outlined by Okunmadewa and Olayemi (1999) as follows;

- The National Agricultural Research Project (NARP) was created in 1991 to fund priority agricultural research, strengthen agricultural research institutions and strengthen agricultural research -extension -farmer linkage.
- The creation of institutional arrangements for a strong linkage between agricultural research, extension and farmers. In 1987, the National Agricultural Extension and Research Liaison Services (NAERLS) evolved through a long process of mutation to become the organ for the planning and co-ordination of agricultural extension liaison nation-wide and for conducting research on technology transfer and adoption.
- The major thrust of agricultural input supply and pricing policy in the years was the withdrawal of government from agricultural input procurement, distribution and pricing activities. In this regard, government disengaged itself from the procurement and distribution of fertiliser, petroleum products, seed and agro-chemicals through a regime of deregulation and commercialisation, while market forces largely determined their market prices. Most input price subsidies were also withdrawn. But government still retained its ownership of petroleum refineries and fertiliser plants.
- The River Basin Development Authorities (RBDAs) established in 1977 were partially commercialised as a result of which some of the subsidy on irrigation water supplied to farmers was removed. The move towards full commercialisation was expected.
- The implementation of land development policy in the country was largely the responsibility of a National Agricultural Land Development Authority (NALDA) established in 1991. However due to inefficiency, NALDA was scrapped.

2.3   Agricultural knowledge and information system

Agricultural Knowledge and Information System (AKIS) is a concept designed to link people and institutions in order to promote mutual learning and generate, share and utilise agriculture-related technology, knowledge and information. The main purpose underlying the concept is to promote rural development by reducing poverty, promoting gains in agricultural productivity, and ensuring food security and environmental sustainability in developing countries. FAO (2000) conceived the idea as agricultural knowledge and information systems for rural development (AKIS/RD) which, sets out to achieve the following operational purposes:

1. To set forth a shared vision for an integrated approach to agricultural education, research and extension that would respond to the technology, knowledge and information needs of rural people, helping them to reach informed decisions on the management of their farms, households and communities.

2. To facilitate dialogue with decision-makers, in both government and development organisations, ensuring that proposals for investment are well founded and receive due consideration.

3. To provide the development staff in various countries with a common set of principles to guide their work in agricultural education, research and extension.

4. To ensure synergies from complementary investments in education, research and extension, resulting in more effective and efficient systems.

A successful institutional system is more than the sum of its parts because the institutions becomes a "system" when its individual components are interlinked or articulated, and the separate institutions are connected so that they communicate and cooperate in action to share their human, physical and financial resources in order to achieve the common goals. In most countries, modern agricultural development efforts started with the establishment of research, extension and agricultural education institutions. These were frequently stand-alone research institutes, universities and extension services that, in theory, maintained linkages with each other to promote the development and transfer of new technologies to farmers. However, linkages among the institutions are often weak, while those with the clients (e.g. farmers) are even weaker (FAO, 2005). This led to situations in which the overall performance was far below expectations, and the need to move beyond independent AKIS agencies in order to promote rural innovation more efficiently and effectively.

The system integrates farmers, agricultural educators, researchers and extension agents to harness knowledge and information from various sources for better farming and improved livelihoods. This integration is suggested by the "knowledge triangle" displayed in Fig 2.1.

Rural people, especially farmers, are at the heart of the knowledge triangle; education, research and extension are services from public or private sources, which are designed to respond to their needs for knowledge with which to improve their productivity, incomes and welfare and manage the natural resources on which they depend in a sustainable way. A shared responsiveness to rural people and an orientation towards their goals ensures synergies in the activities of agricultural educators, researchers and extension personnel. Farmers and other rural people are partners within the knowledge system, and not simply recipients.

The illustration simply highlights the three basic institutional components of AKIS/RD and the central purpose of the system, that is, to serve farmers. It does not point to other entities involved, such as government, the private sector, civic society, support systems, markets, etc. nor does it recognise the importance of AKIS to users and beneficiaries other than rural farmers. In addition, it implicitly emphasises the importance of agriculture for rural development; even though it is widely recognised that agricultural innovation is important in itself and in its support for other pathways, while also contributing to the development of the rural sector (De Janvry and Sadoulet, 2001; Rivera and Qamar, 2003).
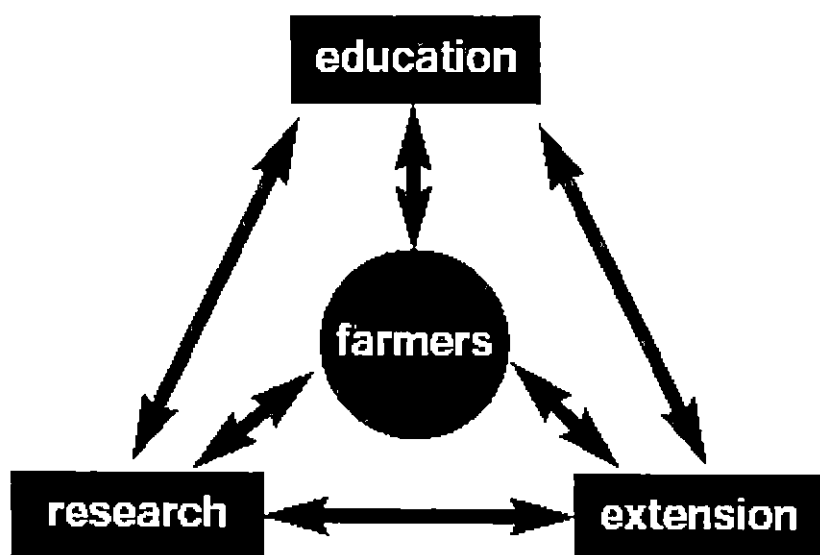
Fig 2.1: Knowledge triangle in the AKIS concept
Source: FAO and World Bank (2000)

The illustration in Figure 2.1 suggests that agricultural information systems for rural development link institutions with people (the end-users of knowledge and information) to promote learning. AKIS/RD proposes generating, sharing and utilising agriculture-related technology, knowledge and information in a strategically aligned system. Such a system integrates farmers, agricultural educators, researchers and extension personnel to harness knowledge and information from various sources for better farming and improved livelihoods, as well as regional and national stability and growth. This integration is needed now more than ever, as countries confront the challenges of competing in a globalised economy and building competitive advantages aimed at global agricultural market opportunities.

Rural development as a focus includes, but is broader than, agriculture and its development. Indeed, non-agricultural activities such as micro-enterprise development are priorities within the rural development strategies. However, agriculture remains central to rural development; this is because most rural populations are engaged in some form of agricultural activities. Although agricultural pursuits may not comprise the majority of all endeavours undertaken by rural people; they represent a plurality among the income-generating activities pursued by rural populations.

The other models of AKIS/RD that have been put forward are more applicable to the contextual and environmental requirements of the systems involved. According to FAO (2005), the model used by the consultant for the Pakistan case study, illustrates four major subsystems and their idealised information flows:

i. The knowledge creation subsystem;
ii. The knowledge diffusion subsystem;
iii. The knowledge utilisation subsystem; and
iv. The agricultural support subsystem involved in credit, input and market functions.

Given the inclusiveness of the AKIS/RD vision, if both public and private entities operate within the four subsystems, the idealised model offers a more comprehensive model that includes agricultural support systems, such as credit institutions, supplies and markets as shown in Figure 2.2.
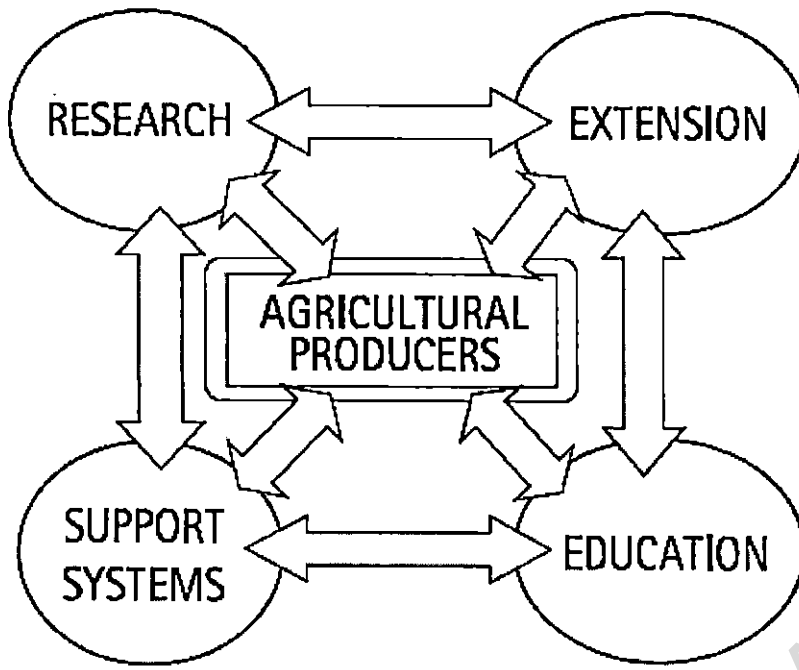
Fig 2.2: An idealised AKIS/RD model

Source: FAO (2005)

The Pakistan or idealised model of the AKIS/RD can be further shaped to include relevant non-system components, such as government policy, institutional commitment, communication systems other than those assisting extension, and other relevant physical and human resources, as shown in Figure 2.3. This model, which illustrates the various components surrounding and influencing an AKIS/RD, is a more comprehensive rendering of the idealised AKIS/RD model, thereby bringing together the main actors with an impact on AKIS/RD and the specific subsystems that comprise the system. Although the addition of these components (policy, physical and human resources, communications, and institutional commitment) may render the model slightly cumbersome, the figure nonetheless suggests the numerous elements in AKIS/RD. In fact, it could be made more cumbersome in that the policy, physical and human resources, communications and institutional elements should be connected to each of the four main sets of institutions - research, extension, education and support systems - which themselves should include both public and private sector entities. In reality, the figure would more likely look like a web of criss-crossing connections.
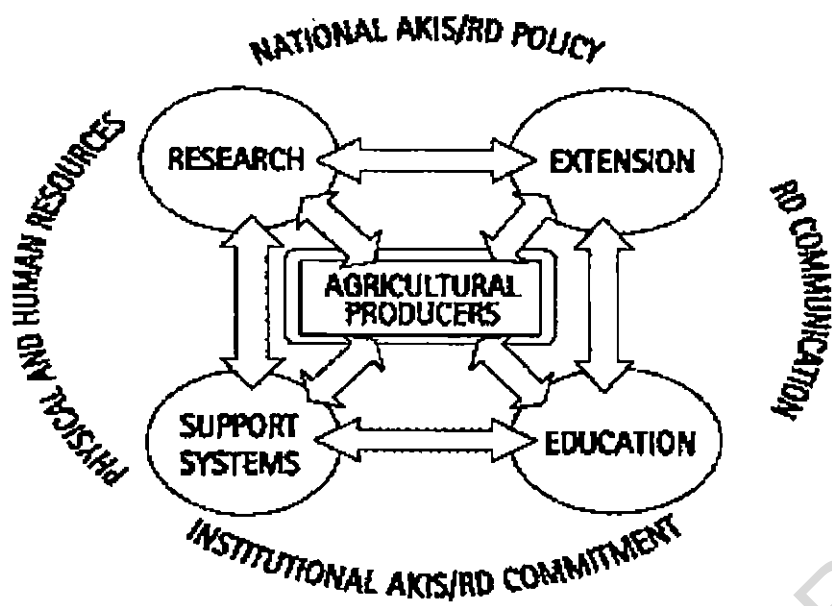
Fig 2.3: A comprehensive AKIS/RD model

Source: FAO (2005)

Specialists (Nagel, 1979; Röling, 1988; Blum *et al*, 1990) that have touched on the basic elements of AKIS/RD in discussing agricultural extension agreed that agricultural knowledge system (AKS) has five essential components:

1) the existing stock of knowledge, that is, memory;

2) the means of increasing knowledge e.g. experience, surveys, research;

3) the means of testing and developing knowledge, that is, research and development;

4) the practical application of knowledge, that is, to increase output, lessen the costs of production and adjust the production system; and

5) the dissemination of knowledge, that is, education, training and extension (Bunting, 1986). They also posit that efforts to advocate and popularise the AKIS concept early will set the stage for the development of AKIS/RD.

AKIS/RD is distinct from other contemporary linkage concepts. For example, National Agricultural Research Systems (NARS) are essentially loose conglomerates of agencies or actors involved in conducting national agricultural research. According to Chema *et al* (2003), "the idea of a pluralistic NARS is only gradually being accepted by the key players in agricultural research". Another similar concept to AKIS/RD is that of National Systems for Innovation (NSIs). These differ in being national rather than rural, and are sometimes limited to promoting systems that foster research innovations (Lundvall, 1992; Edquist, 1997). FAO and the World Bank explicitly added the term 'information' to the AKS concept, stating that knowledge is generated and information transferred; only after it has been transferred can information be transformed into beneficial innovation (FAO, 2005). NSI, AKIS and NARS are rooted in systems theory and analysis. Chema *et al* (2003) are of the opinion that any system is usually part of a larger system and consists of interlinked subsystems. They noted that systems analysis emphasises four dimensions:

1) system elements and structure;

2) system environment;

3) system linkages; and

4) system performance.

To improve the last of these (performance), either the performance of the system components or the internal and external system linkages must be improved. AKIS and NSI tend to focus on the latter of these two options.

Information and communication technology (ICT) specialists have stressed the applications of ICTs and their contribution to agricultural and rural development in terms of Agricultural Information Systems (AIS), which underscores the AIS as a main characteristic of a knowledge society. The focus of ICT intervention in the system is such that research results have to feed into "Agricultural and Rural Knowledge and Information Systems" (ARKIS), which composed of networks of researchers, extension personnel, development practitioners and farmers, and aim to generate technological and social innovation on the basis of interactive learning and knowledge development processes. Although distinct, these various nomenclatures tend towards the same result, the development of a more productive and interconnected knowledge society.

2.4   Extension delivery system in Nigeria

Research and extension establishment in Nigeria dates back to 1910 when Department of Agriculture was founded in southern part of the country and 1921 in the north. Subsequently, national agricultural research institutes (NARIs), faculties of agriculture in universities, agricultural universities and international agricultural research centres were established. These institutions have specific mandates for research, while extension was the main responsibility of the State Departments of Agriculture. Some of the approaches adopted to facilitate links between research and extension systems, according to Bukar *et al* (1997) are as follows;

2.4.1   Extension research liaison service - The Northern ministry of agriculture had two divisions; the Specialist Services Division at Samaru for research and the Field Services Division at Kaduna, which had extension demonstration unit to support its services. At the creation of 12 states in 1967, Extension Research Liaison Service (ERLS) was established, which functions in conjunction within the Institute of Agricultural Research (IAR) in Zaria. ERLS became an autonomous institute in 1975 and in 1987; it became the National Agricultural Extension and Research Liaison Services (NAERLS) and was given a national mandate. The NARIs were permitted to have their agricultural extension and research liaison services (AERLS) to facilitate evaluation of new technologies from their research activities.

2.4.2   Village adoption approach - Some universities and NARIs adopted some villages for extension of specific technologies under special programmes. Some of these projects are: Zaria Rural Change Project by Ahmadu Bello University (ABU), Zaria; Isoya Rural Development Project by the then University of Ife; Badeku Rural Development Project by

University of Ibadan; and Okpuje Rural Development Project by University of Nigeria, Nsukka. These programmes succeeded to an extent while they lasted but were stopped due to various logistic and funding problems.

2.4.3 Agricultural development programmes (ADP) approach - Pilot enclaves were established with the assistance of the World Bank at Gusau, Funtua, Gombe, Lafia, Ayangba, Ekiti-Akoko, Ilorin, Oyo North and Bida. The purpose was to provide extension services to farmers through visits and demonstrations. The successes achieved by these enclaves encouraged the government to establish ADPs in all the states in the country. The programmes adopted the training and visit (T&V) extension methodology and thus became the extension arms of the states ministries of agriculture. The extension strategy for the transfer of new technology to the farmers was mainly on crop production, and gradually a unified extension approach, whereby each extension agent transfer technology in all the agricultural sub-sectors, was adopted.

The system was started in 1986 in four pilot ADPs and was adopted in all the ADPs by 1988. The main elements of the system are the continuous training of extension agents, the regular visits to the farmers by extension agents with relevant messages and feedback of farmers' problems to the scientists; then, the continuous supervision, monitoring and evaluation of activities and progress.

The organisational structure of ADPs is such that each state is divided into zones, blocks and cells/circles progressively for field level operations in order to ensure effective coverage and supervision, see Figure 2.4. The number of cells in an area will be determined by factors such as the number of farm families, mobility, geographical terrain and intensity of farm operations.

At the headquarters level, the activities of the body are managed by the Programme Manager. The Director of Extension, supported by the Director of Technical Services is responsible for extension services in the state. The Director of Extension Services thus has the responsibility for the planning, coordination and implementation of extension services in the state. The Director is assisted by two deputies, one for Women in Agriculture (WIA) and the other for general extension. The Subject matter specialists (SMSs) at the headquarters are under the Director of Technical Services. They provide technical guidance and support to zonal SMSs in their training roles.

At the zonal level, the Zonal Extension Officer (ZEO) is responsible for the coordination and supervision of extension activities in the zone. He is technically responsible to the Deputy Director of Extension Services and administratively responsible to the Zonal Manager. At the block level, the Block Extension Supervisor supervises the extension activities; being specifically responsible for providing guidance to Block Extension Agents. At the cell/circle level, an Extension Agent (EA) is responsible for day-to-day extension work for between 1000 and 1200 farm families.
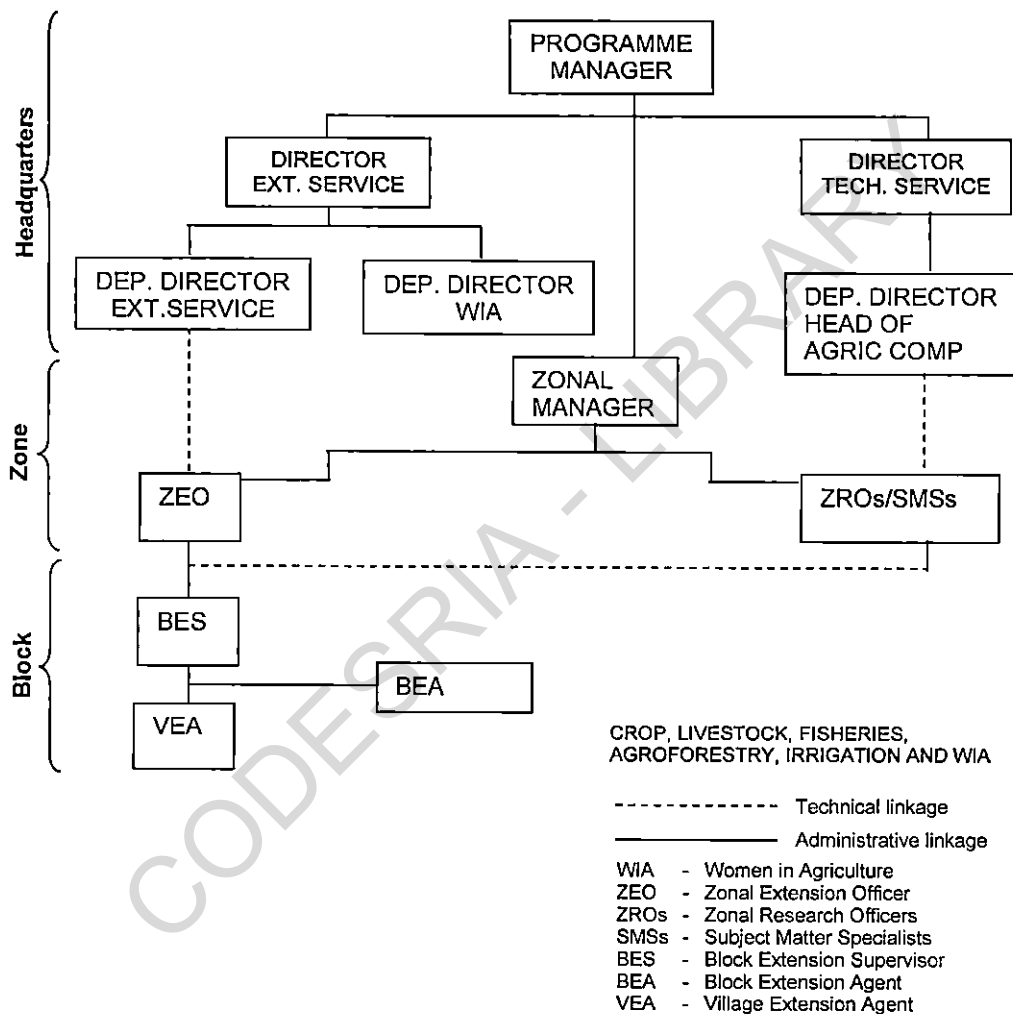
Fig 2.4: Organisational structure of the ADPs
Source: Bukar *et al* (1997)

In 1992, the National Agricultural Technology Support Project (NATSP) was established with World Bank assistance in five (Bauchi, Kano, Jigawa, Sokoto and Kebbi) states. The focus was on the adaptation of technology and its dissemination to farmers. The project, according to Arokoyo (2003), essentially facilitated the ADPs' Development Support Communication (DSC) units, with video, radio and television production and viewing facilities such that virtually, all the ADPs radio and TV programmes were aired by government (state and national) broadcasting networks.

2.5   Institutional arrangements for current research/extension nexus

The research/extension nexus in Nigeria has evolved over time. The principal actors are: the five zonal coordinating research institutes, the then Federal Agricultural Coordinating Unit (FACU), which is now a component of National Food Reserve Agency (NFRA), National Agricultural Extension and Research Liaison Services (NAERLS) and National Agricultural Research Institutes (NARIs)/universities. They provide technical support for the ADPs in on-farm adaptive research and monthly technology review meetings (MTRMs) and in operating extension services. The description of the institutions involved in the research/extension model is as given in Table 2.1.

The Training and Visit (T&V) research/extension model adopted in Nigeria is comprehensive and has generated a favourable climate for close interaction between research and extension organisations (Bukar *et al*, 1997). The model is illustrated in Fig 2.5 and due to recent modification, as given in Fig 2.5a.

While the various modified forms of the Training and Visit (T&V) extension system remain the basic strategy for public extension delivery, the Research Extension – Farmer – Input – Linkage System (REFILS) is the management mechanism that has been used to identify and bring together the stakeholders in agriculture development as equal partners in development (Fig 2.5a). It provides the structures and mechanisms for collaboration in technology generation, adaptation, dissemination and utilisation with clear micro-credit financing and supply of essential inputs in several communities in the country. A nation-wide study by NEST (1992) revealed that a majority of the NGOs in Nigeria are engaged in agricultural production.

Although approaches used by most of the NGOs are generally more participatory, their linkage with both NARS and the public extension service remain weak (Arokoyo *et al*, 2002).

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Table 2.1: Coordinating and collaborating institutes in research/extension model

Zone	Coordinating Institute	ADPs	Collaborating Institutes/Universities	Coordinating PCU Office
South East	National Root Crops Research Institute (NRCRI), Umudike	Enugu, Anambra, Akwa-Ibom, Imo, Cross River, Abia and Rivers	University of Nigeria, Imo State University, FUT Owerri, University of Uyo, RSUST Port Harcourt, UNICAL, PCU Enugu, NAERLS	PCU, Enugu
South West	Institute of Agricultural Research and Training (IAR&T), Ibadan	Lagos, Ogun, Osun, Oyo, Delta, Edo and Ondo	University of Ibadan, Obafemi Awolowo University, UNIBEN, Lagos State College of Technology, Olabisi Onabanjo University, FUT Akure, NIHORT, University of Agriculture Abeokuta, NIFOR, PCU Benin, NAERLS	PCU, Benin
Central	National Cereal Research Institute (NCRI), Badeggi	Kwara, Kogi, Benue, Niger, Plateau and Abuja	University of Ilorin, University of Agriculture Makurdi, FUT Minna, University of Jos, NRCRI, NVRI Vom, PCU Lokoja, PCU Jos NAERLS	PCU, Lokoja
North East	Lake Chad Research Institute (LCRI), Maiduguri	Borno, Yobe, Adamawa and Taraba	University of Maiduguri, Federal University of Technology Yola, PCU Jos, NAERLS	PCU, Jos
North West	Institute of Agricultural Research (IAR), Zaria	Kaduna, Sokoto, Kebbi, Kano, Jigawa, Bauchi and Katsina	NAERLS Zaria, NAPRI Shika, University of Sokoto, Tafawa Balewa University Bauchi, Bayero University Kano, PCU Kaduna, PCU Jos, NAERLS	PCU, Kaduna

Notes:

FUT	Federal University of Technology	NAPRI	National Animal Production Research Institute
RSUST	Rivers State University of Science and Technology		
		UNIBEN	University of Benin
NIHORT	National Institute of Horticultural Research	NVRI	National Veterinary Research Institute
		UNICAL	University of Calabar
NIFOR	National Institute of Oil Palm Research	PCU	Project Coordinating Unit
NAERLS	National Agricultural Extension & research Liaison Services		

Source: Bukar *et al* (1997)
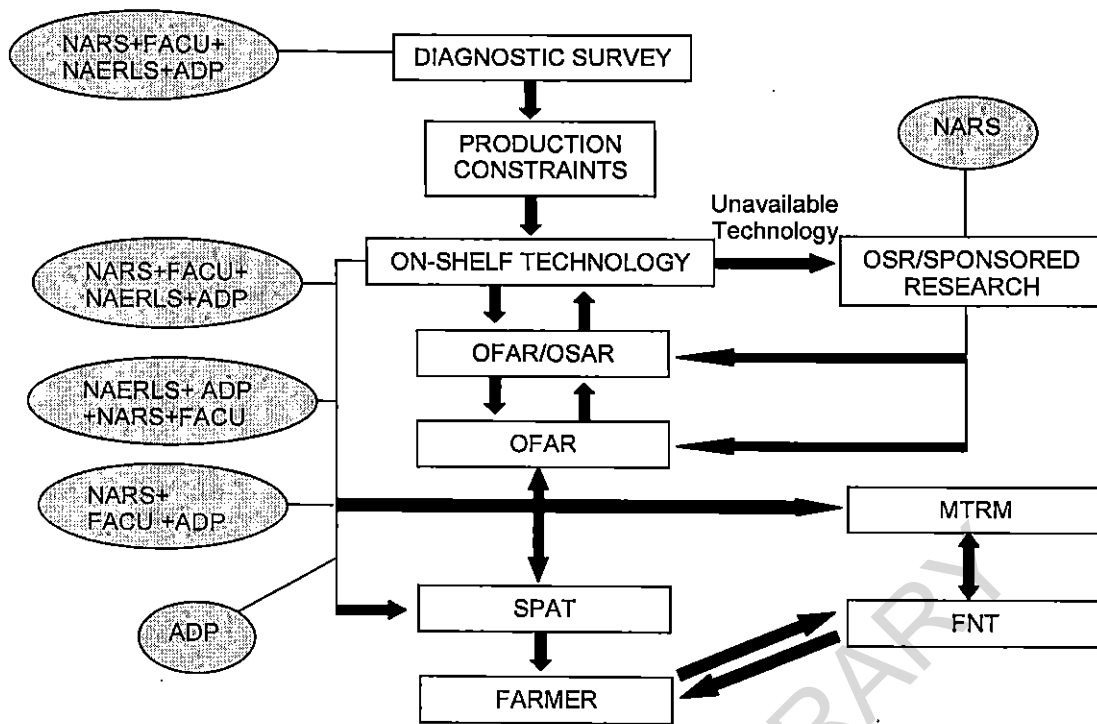
Note:
FNT	-	Fortnightly Training
MTRM	-	Monthly Technology Review Meeting
SPAT	-	Small Plot Adoption Technology
NARS	-	National Agricultural Research System
FACU	-	Federal Agricultural Coordinating Unit, now Project Coordinating Unit (PCU)
ADP	-	Agricultural Development Programme
OFAR	-	On-Farm Adaptive Research
OFR	-	On-Farm Research
OSAR	-	On-Station Adaptive Research
OSR	-	On-Station Research

Fig 2.5: Research/extension Linkage Model
Source: Bukar *et al* (1997; 127)
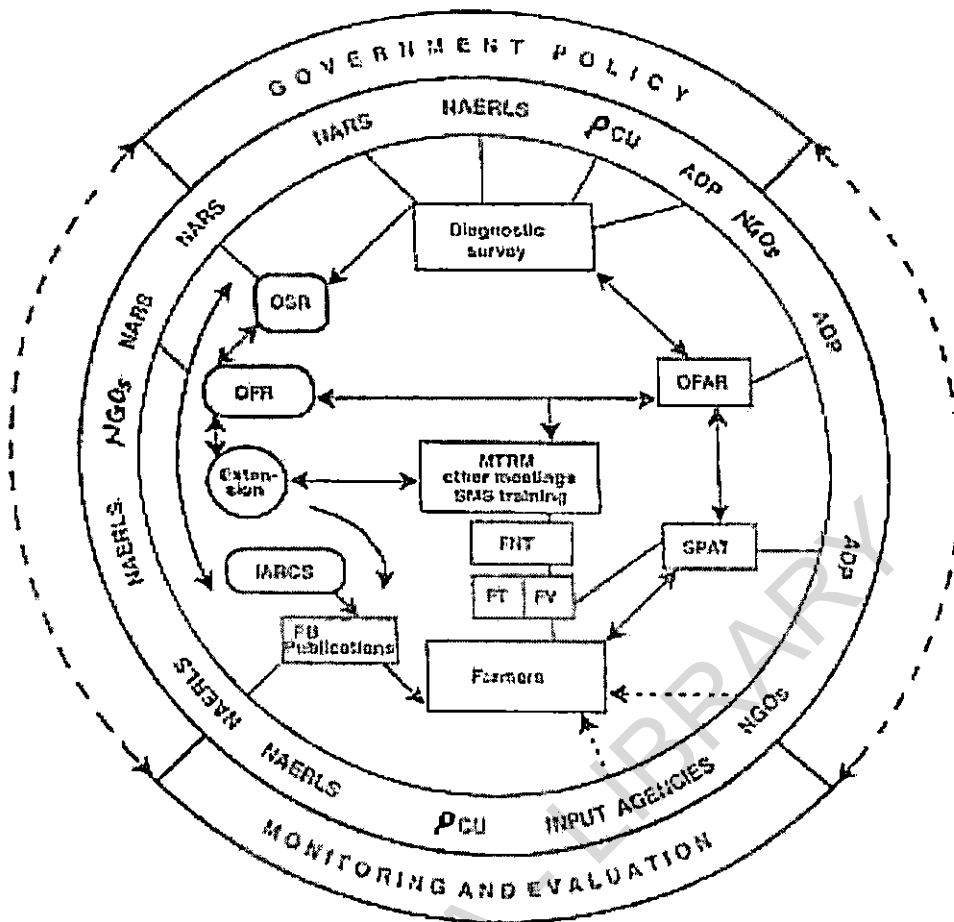
ADP	– Agric Development Project	NARS	– Nat. Agric Res. Systems
FB	– Farm Broadcast.	NGOs	– Non Governmental Orgs
FT	– Farm Training	OFAR	– On Farm Research
FV	– Farm Visit	OSR	– On Station Research
IARCS	– International Agric Research Centres	PUB	– Publication
NAERLS	– Nat. Agric Ext. & Res. Liaison Services	SMS	– Subject matter Specialist
PCU	– Projects Coordinating Unit.	SPAT	– Small Plot Adoption Technique

Fig 2.5a: Research Extension Farmer Input Linkage System (REFILS) Model for Nigeria

Adapted from Arokoyo, 1998

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The responsibilities of the principal actors in the present research and extension linkage are as given below;

2.5.1 Coordinating Research Institutes

o Provide coordination for all on-farm adaptive research (OFAR/MTRM) activities in the zone, and identifies resource scientists from coordinating and collaborating research institutes/universities for all agricultural sub-sectors.

o Prepares recommendations for different crop production systems, agro-forestry, fisheries and livestock for each state included in the zone, based on technology generated from OFAR.

o Organises jointly with PCU and ADPs, the annual OFAR extension workshops for review of OFAR/SPAT results, and finalises technology packages or recommendations and research/extension programmes for the following year.

2.5.2 Agricultural Development Programmes (ADPs)

o Conduct diagnostic surveys in collaboration with coordination and collaborating research institutes/universities and PCU

o Conduct OFAR trials in different zones of the states. Organise OFAR/OSAR field visits by the OFAR team comprising scientists, PCU and ADP staff.

o Organise monthly technology review meetings (MTRMs) and pre-MTRM field visits.

o Organise state-level workshops each year to finalise the package of recommendations for the various cropping systems and other sub-sector of agriculture

2.5.3 Collaborating Research Institutes/Universities

o Provide leadership/scientists in different agricultural sub-sectors for the ADP, OFAR/MTRM teams, under the overall supervision of the zonal coordinators.

2.5.4 Project Coordinating Unit (PCU), now a component of NFRA

o Coordinates activities between ADPs, research institutes/universities and other institutions involved in OFAR and MTRMs

o Facilitates the implementation of all aspects of the Memorandum of Understanding (MOU) by all parties involved, including the execution of MTRM and OFAR activities

o Edits and publishes diagnostic survey reports

o Organises meetings, workshops, seminars and publications

2.5.5 National Agricultural Extension and Research Liaison Services (NAERLS)

o Coordinate overall planning of research/extension activities throughout the country

o Coordinate the production of television, radio programmes and films on agricultural extension activities nationwide, in collaboration with research institute-based AERLS

o Coordinate national training, conferences and workshops, and research in areas of technology transfer and adoption processes

o Publish the *National Agricultural Journal of Extension* and technical bulletins

o Assist in improving performance of research institute-based AERLS from time to time in order to enhance their performance

2.6   Communication strategies for extension delivery in Nigeria

Since the inception of the ADP strategy with the pilot/enclave, the training and visit (T&V) method has been adopted. A number of development support communication components were used for the strategy. Some of these are mobile cinema vans supported with minimum extension publications in local languages. Thereafter radio, mobile video vans and television were added. Then, radio and TV programmes grew with the growth of the ADPs, consequent of the creation of more states in the country.

By the commencement of the National Agricultural Technology Support Project (NATSP), being the second developmental phase (1991 – 1996) of the World Bank loan facility support for the ADPs, virtually all the Projects had gotten well equipped Development Support Communication (DSC) units, with video, radio and television production and viewing facilities (Arokoyo, 2003). Virtually, all the radio and TV programmes by ADPs were aired by government (state and national) broadcasting networks initially free of charge. At the commercialisation of these broadcasting networks, the frequencies at which the mass media programmes feature on air dropped appreciably due to financial constraints. Arokoyo (2003) reported a survey by NAERLS and PCU in 2002, which revealed that 70.3 percent of the States' ADPs in Nigeria produced at least one or more radio programmes and that 75.6 percent of these are in local languages. The survey also showed that only 48.6 percent of the ADPs, by 2002, produce and air TV programmes and of these, 57.7 percent are in local languages.

This shows that the public extension dominates information delivery activities in the country and that radio and TV have been the major ICTs used. Private involvement by

corporate entities and NGOs are rare; as they are not usually involved in direct farm broadcasts except to sponsor those of the ADPs through advertisement placements. This implies that these are the channels that are found relevant and appropriate by the development practitioners in the agency. Despite the importance of these channels, they are still principally owned and controlled by either the State or Federal governments. Community-based radio is virtually unknown in the country unlike the experience in several Franco-phone countries in West Africa (Arokoyo, 2003).

Another information issue in the use of these channels is that their content is more provider-driven than user-driven and this has implications for effective and appropriate extension delivery. Since the recent revolution in the teledensity in Nigeria, telephone has become more pervasive to a large extent (NCC, 2005); and it is expected that the facility would be applicable in extension delivery. The use of telephone for this purpose is non-existent or to a very insignificant extent. This will impose a serious limitation to communication within and between organisational networking for information exchange. Given the fact that most of the research/extension personnel now have computers; the communication facilitation has not been realised because most of them do not have access to the Internet. Arokoyo (2003) also identified a serious problem of low level of computer literacy among the managers and research/extension staff, which makes the ICT-readiness of the system very low.

2.7 Potential for ICT use in extension delivery in Nigeria

Developments in the ICT world and in Nigeria since the present democratic dispensation have clearly shown the enormous potential of ICTs to transform agricultural extension in Nigeria. Principal among these include:

o Government's liberalisation and privatisation policies to encourage private sector participation and attraction of foreign investment. Consequently, prices of computers and other ICT equipment have drastically come down, thus making them more accessible. A recent federal government circular has made it mandatory for all government agencies to purchase "Zinox", made in Nigeria computers as a first choice (SGF, 2002).

o The launching of the global system of mobile (GSM) communication has made phone lines more accessible nation-wide.

o The establishment of Internet cyber cafes in all the major urban areas in the country, even if the rates are still high and services epileptic.

o Government's requirement of computer literacy for promotion in the senior cadre of the civil service.

Unique among the recent development that is expected to revolutionise information availability through ICT use in agricultural extension is the establishment of CTA – supported Question and Answer service in Nigeria. It is hosted by the National Agricultural Extension and Research Liaison Service (NAERLS) and known as the "Nigerian Question and Answer Service (NAQAS)" and operated in collaboration with nine collaborating institutions scattered in all the ecological zones of the country. The main objective of NAQAS is to provide information on demand by users through bibliographic references, full text documents, factual information, referral and advisory services. It has a website: www.naqas.org and an e-mail contact: naqas@hotmail.com. A profile of the NAQAS clients in 2002 as can be seen in Table 2.2 showed that students and researchers dominate the user categories (total of 65.63%), as compared to farmers (12.36%) and the extension of officers (3.27%) who form a total of 15.63% of users. There implies that there is the need to build up the demand capacity of the last group, who are of primary concern to agricultural development efforts.

Table 2.2: Categories of NAQAS clients in the year 2000

Category of Users	Frequency	Percent
Students	194	35.27
Farmers	68	12.36
Researchers	167	30.36
Lecturers	102	18.55
Extension Officers	18	3.27
Others	1	0.18
Total	550	100.0

Source: Arokoyo (2003)

Another event is the launch of the Information and Communication Support for Agricultural Growth in Nigeria (ICS – Nigeria) in 2002 (www.ics.nigeria.org). The objective of ICS – Nigeria is "to strengthen capacity of Farmer assistance organisations to package and disseminate information to farmers, thus enhancing information flow" (Ogunyinka, 2002). The project, which is being funded by the United States Agency for International Development (USAID), has NAERLS, International Institute of Tropical Agriculture (IITA), CFC (Communication for Change, an NGO) and the Federal Ministry of Agriculture and Rural Development (FMA&RD) as project partners. The project is currently on a Pilot phase in 8 States; Katsina and Kano in the North-West Zone, Adamawa in the North-East Zone, Niger in the North Central Zone, Abia in the South-East and Oyo in the South-West Zones. Project networking encompasses farmers and Farmer Associations, the Extension (ADPs and NGOs), the Private Sector, Information makers (such as NAERLS, CFC, IITA etc), Research organisations (NARS and IARC) and Resource Partners (USAID). Among the activities of ICS – Nigeria is the establishment of a Farmer Resource Centre in each of the participating states. A Farmer Resource Centre is expected to have the following: -

- o Telephone and Fax.
- o Multimedia Computer with Internet Access.
- o Radio and Television.
- o Video recorder/player and Camera.
- o Scanner, Printer and Photocopier.
- o Cassette recorder/player.
- o Laminator and Spiral binding machine.
- o Stand by Generator.

As conceptualised, the ICS – Nigeria, making maximum use of ICTs, is planned to transform agricultural extension in Nigeria. Under both NAQAS and ICS-Nigeria, emphasis has shifted in the nature of information, from previously being provider-driven to being user-driven and thus with higher probability of meeting the real needs of the farmers for sustainable development. The capacity of the information users, the farmers and their associations needs to be strengthened in this new partnership. The main worry though apart from inability of the major information user to access and fully utilise the facilities is its sustainability when the external (CTA and USAID) support ends.

2.7.1 Major constraints to ICT use in extension delivery in Nigeria

Despite the potential of the use of ICTs for extension delivery, there are certain factors that naturally impede the adoption of the technology for the purpose of development agenda pursuit in Nigeria. Arokoyo (2003) gave some of these factors as follows:

o Poor and erratic funding of the agricultural research and extension system.

o Poor ICT infrastructural development as well as limited and unstable power supply.

o High cost of telephone services either by landlines or GSM. It has been stated that Nigeria has one of the highest rates for GSM calls in the world

o Limited access to computer and an even lesser access to the Internet, thereby making basic inter and intra organisational networking for information exchange very difficult.

o High-level rural poverty.

o High-level illiteracy of farmers

o Low level of computer literacy among research and extension personnel.

o Limited access to worldwide databases on CD-ROMs due to financial constraints.

o The limited coverage of ADP programmes by public media broadcasts, which is compounded by the near absence of rural radio.

o Commercialisation of government radio and television stations has resulted in exorbitant cost for farm broadcasting

2.8 Information and communication technologies

Information and Communication Technologies (ICTs) can be conceived broadly as technologies that facilitate communication, processing and transmission of information by electronic means (Wesseler and Ballantyne, 2003). This definition encompasses the full range of ICTs, from radio and television to telephones (fixed and mobile), computers and the Internet. According to the United Nations Economic Commission for Africa, ICTs cover Internet service provision, telecommunications equipment and services, information technology equipment and services, media and broadcasting, libraries and documentation centres, commercial information providers, network-based information services, and other

related information and communication activities (Adeya, 2000). ICTs often refer to the Internet. They equally refer to the possibilities offered by the convergence of data processing techniques, electronic media, and telecommunications; a convergence that has become evident over the past few years. ICTs therefore do not exclude traditional services such as radio and television, which can be broadcast through the same digital medium as the other services (IDRC, 2003). Duncombe and Heeks (1999) attempted to simplify the definition by describing ICTs as 'electronic means of capturing, processing, storing and disseminating information'. It is important to emphasise that these technologies only provide new mechanisms for handling an already existing resource, that is, information. Therefore, to understand ICTs, one must first understand information practices and needs.

Much of the recent attention to the role of ICTs in development has focused on new technologies, such as the Internet and mobile phones. Yet the full range of ICTs is relevant to pursue developmental objectives. Radio and television are important information tools that are much more widespread in developing countries than telephones or the Internet. Computer, even if not linked to global networks, is also an important facility that can be used to increase efficiency in all sectors of society. New technologies do not change the fundamental role of information and knowledge as drivers of development and poverty reduction, nor obscure the role of more established information and communication technologies. However, they create new opportunities to expand the availability, exchange and impact of information and knowledge (Marker *et al*, 2002).

The development and spread of information and communication technologies (ICTs) is often touted as the harbinger of a new industrial revolution. Talero and Gaudette (1995) point out that the diffusion of information technologies to all areas of human activity is accelerating change in economies and societies; and that these changes are creating a new economy – an information economy – in which information is the critical resource and basis for competition. Although most of the development actors agree intuitively on the positive role that ICTs can play in the development process, the links between development and the use of ICTs are yet to be clearly established and rigorously supported by empirical results from Africa (IDRC, 2003).

The focus of the advocates of the use of ICTs by development specialists is that at the micro level, the poor can use ICTs directly to address their information needs, develop their own strategies and solutions for improving their lives, and articulate their interests in societal processes and institutions that affect them. If properly used and broadly deployed, ICTs can

increase the access of the poor to information on market prices for their crops and other goods, to health and educational resources, to information about government services and their own rights as citizens (Marker *et al*, 2002). ICTs can equally be used to facilitate involvement, lending the voice and participation of the poor in policymaking, and help them express their needs and priorities to decision-makers.

2.8.1 Characteristics of information and communication technologies (ICTs)

There is increasing recognition of the importance of ideas, knowledge and information in the development process (World Bank, 1998). The assertion is that knowledge gap is an important determinant of persistent poverty and that the advancement of developed countries is based on possession of knowledge required to assure adequate standard of living. This suggests the need for strategies, which encourage greater communication and information flows both within and between people. One of the best possible ways to achieve this interaction is through the use of information and communication technologies (ICTs).

ICTs are able to serve as information channels due to their ability to support the decoupling of information from its physical repository. This separation or decoupling property truly revolutionises the impact of these technologies (Pohjola, 1998). This property allows the immediate transmission of large volumes of information and permits communication independent of the physical movement of individuals. The capability to support information separation is the key attribute underlying the wide range of activities and services offered through ICTs.

The decoupling property of ICTs is further complemented by their pervasive nature. The potential use of ICTs is not restricted to a particular sector of the economy. Their widespread application and the possibility of tailoring them to suit individual, sectoral, corporate and government needs explain the wide range of potential positive effects attributed to the diffusion of these technologies. According to UNDP *et al* (2001) ICTs have unique characteristics and can be a powerful enabler of development goals because of its capability to dramatically improve communication and the exchange of information to strengthen and create new economic and social networks. Some of the characteristics include:

- **Pervasive and cross-cutting** - ICTs can be applied to the full range of human activity from personal use to business and government. They are therefore multifunctional and flexible; they allow for tailored solutions - based on personalisation and localisation to meet diverse needs.

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- **A network creation enabler** - ICTs facilitate network creation and thus allow those with access to benefit from exponentially increasing returns, as usage increases (that is, network externalities).

- **Dissemination of information and knowledge** - ICT fosters effective information and knowledge dissemination by separating content from its physical location. This characteristic thereby removes the barrier of access due to location of information source. This flow of information is ordinarily impervious to geographic boundaries; the facility allows remote communities to become integrated into global networks thus making information, knowledge and culture accessible, in theory, to anyone.

- **Zero or declining marginal costs** - The digital and virtual nature of many ICT products and services allows for zero or declining marginal costs. Replication of content is virtually free regardless of its volume; hence, marginal costs for distribution and communication are near zero. As a result, ICT can radically reduce (information communication) transaction costs.

- **Efficiency gains** – The characteristics of ICTs to store, retrieve, sort, filter, distribute and share information seamlessly can lead to substantial efficiency gains in the management of production, distribution and markets. ICTs streamline supply and production chains and make many business processes and transactions economical and more effective.

- **Innovative business models and new industries** - The increased efficiency and subsequent reduction of costs brought about by ICTs is leading to the creation of new products, services and distribution channels within traditional industries, as well as innovative business models and whole new industries. Intangible assets such as intellectual capital are increasingly becoming more relevant and key source of value.

- **Intermediation** - ICTs facilitate intermediation, as it makes it possible for users to acquire products and services directly from the original provider, reducing the need for intermediaries. This is a considerable factor of efficiency in development programmes and has been one of the criteria enhancing its potential to cater for the needs or preferences of users and consumers on an individual basis.

- **Global** - Through its characteristic creation and expansion of networks, ICTs can transcend geographical, cultural and tribal barriers by providing individuals and groups with the ability to live and work anywhere. It allows local communities to

become part of the global network economy regardless of nationality thereby challenging international policies on legal and regulatory structures within and between nations.

Another characteristic of ICTs is that they are regarded as being able to improve and enhance two-way information flows and 'there is substantial evidence that without two-way information flow development efforts will fail' (Zijp, 1994). This perspective is centred on the concept that development should be more participatory, allowing for the voices of the poor to be heard. The assumption is that information delivery from development agencies to rural communities represents a mode of top-down approach, which was historically a one-way paradigm. The 'two-way' concept means 'participatory' in the context of development strategy, though requiring greater efforts and time, which is the role ICTs are expected to facilitate.

This potential suggests that 'access to information and communication technologies (ICTs) implies access to channels and modes of communication that are not restricted by language, culture or distance. New forms of social organisation and of productive activity emerge which, if nurtured could become transformational factors as important as the technology itself'. Taken together, these characteristics of ICTs clearly make the facility unique. An appreciation of these characteristics and the economy-wide effects they generate would permit a greater understanding of the development potential they offer.

These characteristics suggest that ICTs can be seen as being intrinsically beneficial for social and economic development, if they are conceived as a means and not an end in themselves. However, the fact that ICTs can assist development efforts, in theory, does not mean that it will necessarily do so in practical terms. Although the technologies may be impressive, they cannot determine the changes expected from their uses. They are no more than catalysts that facilitate these changes. Like any other technology, it is the social context in which they have been introduced and implemented that determines their uses and impacts. The digital revolution is relevant for Africa only if it takes into consideration the daily realities and aspirations of individuals (Uimonen, 1997).

2.8.2 Concept of telecentres as conduit of ICTs to rural areas

Telecentre are public access points for ICT resources. Some telecentres are commercially run. They usually offer limited services (like telephone) that generate profits. Commercial "cybercafes" are usually restricted to urban centres. By contrast, donor-funded

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centres, usually located in remote, impoverished or rural areas, tend to offer a wide range of services like radio, television viewing, fax, computers, e-mail and web. Although donor-funded centres are undertaken to service specific developmental objectives, none has proven to be sustainable to date (UNDP, 2001). Telecentre is the widely recognised term that encompasses variants of shared access facility with an explicit development objective. Most telecentres are multipurpose, offering a range of services and ICTs, often including photocopying, computer typesetting, faxing, Internet, phone and computer training, plus other value-added services that vary from site to site. Most telecentres in Africa have been established by external funding agencies in partnership with local NGOs and/or government structures. They are intended to 'bridge the digital divide' by reaching those who otherwise would be unlikely to access services. As such, telecentres are sometimes located in places where the market is not providing such services, or otherwise attempt to reach a broader segment of the population than the market would.

2.8.3 Information communication for agricultural and rural development

Communication includes information and education. It is an extremely diverse concept, covering a range from the simplest conversation between two people to the most sophisticated mass medium. Progress in human activities is achievable and distinguished because of the ability of communication; such achievements would be unimaginable without it. Despite the importance of this concept, people who are involved in development efforts still neglect it. Mundy and Sultan (2001) assert that huge research organisations, whose sole purpose is to develop new farming technologies (that is, generate new information) and communicate them to farmers, relegate the communication aspects of the projects. Hence, instead of creating progress and wealth, research findings gather dust. Institutions sometimes seem to be more concerned with self-advancement than with serving their clients. This is an indication that evaluation criteria for researchers and their institutions need to be reassessed (Wesseler and Brinkman, 2002).

It is generally recognised that improved communication and information access are directly related to social and economic development. People at all levels of rural society, especially the food-insecure and the organisations that serve and represent them, must be able to access critical information and to communicate their needs. A great deal of research has taken place on the information needs both of the rural population and of extension agents that serve them and attention has been paid to the processes of information transfer (Correa *et al*, 1997). Hence, as a result of the researches, information delivery models and strategies have

to be reformulated and new types of services introduced to adjust to new realities in information communication for development. Since information is a basic element in any development activity, it must be available and accessible to all (be it scientific, technical, economic, social, institutional, administrative, legal, historical or cultural in nature). Information is useful only if it is available, if the users have access to it, in the appropriate form, it will be effectively used to achieve developmental goals; this is the reality of use of ICTs for development.

Efforts to use communication in development, according to Wesseler and Brinkman (2002) aims to do three things:

- Provide information to audiences;
- Help audiences find information;
- Facilitate dialogue among audiences.

The first is the traditional role of communication. In the field of agricultural research, scientists who have developed a new technology need to communicate their findings in such a way that farmers will hear about them, and possibly decide to try this new technology. Therefore, they must involve the communication specialists (extension personnel) to promote the technology using the appropriate channels (e.g. radio, brochures and plant demonstration plots) so that the farmers can be carried along about the technology. This bring to fore the relevance of specialised institutions such as extension agencies, which are expected to facilitate the information communication process (Wesseler and Brinkman, 2002). There are often gaps between the cooperating institutions in the information generation and dissemination activities. The most obvious and notorious one is the between the 'high-status' research and 'low-status' extension personnel. Most of the time, these gaps are ignored and the communication efforts will fail with the consequences that new research findings stay at the research station, the farmers go poor and people go hungry.

2.8.4 Challenges of changing environment to information need in agricultural development

Many things are changing, spurred by the democratic revolutions of the 1980s and 1990s, its attendant restructuring and decentralisation, and the technological leaps made in computers and telephones. With these came new interest in all aspects of information and communication for development (Wesseler and Brinkman, 2002). Three sweeping economic

and institutional changes have marked developing countries over the past ten years (CTA, 2001):

- Economic globalisation that modifies the relationships between the international, national and local scales; as well presenting challenges for production and commercialisation; and access to markets, capital and information.

- Economic liberalisation, which has led to a marked reduction in the state's hold on the management of rural development. Planning logic is progressively giving way to market steering of development. The role of the private sector is thus considerably strengthened.

- Political democratisation, seen in the possibility for different civil society stakeholders to participate in the debate on the orientation of policies on rural development.

These transformations depict a major change in the circumstances of rural development stakeholders in developing (especially African) countries. Particularly the liberalisation of international agricultural product markets comes with the risk of marginalisation for small-scale producers of agricultural commodities in these countries, as cheap, imported products flood national markets to the detriment of lower performance national products. Meanwhile, the expected increase in the export of developing countries' products has not manifested. This is in part due to the difficulties producers and entrepreneurs have in conforming to the quality norms required by the world market. It may also be due to lack of access to information on technological and commercial opportunities. In these circumstances, developing countries would risk falling further behind if the enabling facility in not appropriately deployed to salvage the situation.

ODI (2007) canvassed new approach to pursuit of development agenda given contemporary changes; this includes an approach to growth which recognises the impact of globalisation. Supply chains, including in agriculture, have become more highly integrated and more geographically specialised, requiring higher standards and greater timeliness.

2.8.5 Criteria for effective use of ICTs

In the context of development, effective use of ICTs should have positive impact on one or more aspects of development. In order to ensure judicious investment of scarce resources on the facility investment, the following should guide the deployment of development projects.

Affordable - this means that the project should have a reasonable price given the benefits and the funding available. It is easy to find examples of projects which would have poverty reduction benefits, but where the costs far outweigh the benefits or where funding is unattainable on a large scale. For instance, several initiatives are now making the prospect of telephone communication in rural communities a real possibility and making it affordable (CTA, 2008).

Scalable – Scalability refers to project that can be widely replicated to help many more people. Non-scalable projects cannot be replicated because the initial conditions are unique, or replication would require other non-financial resources which are in short supply.

Self-sustaining - The self-sustaining criterion is related to the previous two, but implies that ultimately, the project can continue to help people without external financial or staffing support.

Sensible - If a project is sensible, it accepts the realities of the environment in which it is operating. As a trivial example, if you are going to deploy PC-based computers, it would only be sensible if you knew that technical support people would be available.

Exceptions - The previous criteria are, in essence, a rather simple-minded recipe for the successful use of ICT to help alleviate poverty. It is very important to note that projects which do not meet all of the criteria can and will be successful. Because they do not meet one or more of the criteria, they have a somewhat higher risk of failure. This risk can be off-set by other factors which make the project particularly desirable.

2.9 Agricultural and rural development stakeholders and their information needs

The Farmers - The main key stakeholders in rural development are farmers. Rural women are also essential in the production and commercialisation of goods, yet their role is still too often neglected. This category includes the agricultural businesses that sell farm products or initially process them, and cooperatives and farmers' organisations that bring these small rural producers together.

Information needs: The information sought pertains to the production and processing of farm products, and market information such as prices, scale/quantity, quality, mandatory norms, etc. This technical information is tied to production systems, and priorities in favour of any of the information varieties change with circumstances and region.

Limitations: Many limitations must be addressed in order to meet the information needs efficiently. These limitations include illiteracy, poor communication networks

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(deficient or non-existent infrastructure), and inappropriate support from service providers (Wesseler and Brinkman, 2002). Furthermore, farmers' abilities to evaluate their own information needs and turn them into communication strategies and activities need to be strengthened. Information on natural resources and their management is not sufficiently available. Finally, development experts, especially the extension practitioners have to determine the most appropriate set of media to use for this category of stakeholders and compose relevant content for each of them for effective information dissemination.

Researchers - Researchers have realised the need to work closer with the end-users and facilitators of their research activities viz. the extension agents/practitioners as well as other stakeholders. They are beginning to work in closer collaboration with the development partners in the framework of national agricultural research systems. This gave rise to a situation in which research centres, extension institutions, universities, NGOs and farmers' organisations are joining forces. Apart from this, agricultural research is now organised on a global scale, with a system for work carried out through regional and international networks, and with the creation of a global forum on agricultural research for development.

This circumstance requires the researchers to respond to the demands from the field, as well as to the methodological preoccupations of grassroots stakeholders and support organisations. They must help these stakeholders improve their technical production systems, in order to make their activities relevant to the goal attainment of economic and social development in the rural areas.

Information needs: Researchers in many parts of sub-Saharan Africa are still poorly equipped with scientific reference documents, and often lack the tools to respond to the needs of rural populations and their associations. They need information on works that have been undertaken in their fields of expertise, both internationally and sub-regionally. They need better access to the results obtained and innovations perfected in other developing countries. Such information will form the basis of adapting such practices to their environments so as to advance agricultural development in their localities. The adaptation will involve formal and informal information linkage between their institutions and the extension institutions and ultimately to the beneficiaries – the farmers. The challenges confronting the institutions regarding the responsibility of agricultural information management as highlighted is as indicated in Figure 2.6.

"Developers"

"Carriers"

"Users"

IARC

NARS

ARI

NGO

NAES

LGU

Farmers

IARC –	International Agricultural and Research Centres
NARS –	National Agricultural Research Systems
ARI –	Advanced Research Institutes
NGO –	Non-Governmental Organisation
NAES -	National Agricultural Extension Systems
LGU –	Local Government Unit

Indicates block in information flow
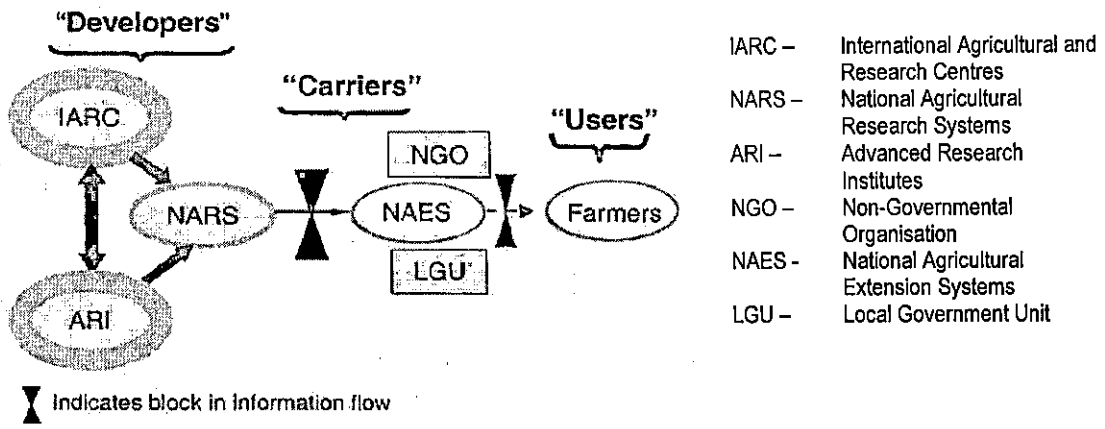
Fig 2.6: Flow pattern in Agricultural Information System in developing countries

Source: George *et al* (2002)

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Extension workers - Extension workers supposed to be the facilitators of information that are generated from research centres; they are the ones to facilitate the carriage framework in Fig 2.7. They are faced with a lot of challenges ranging from determining the issues upon which attention are desired to the appropriate strategy to use for information dissemination efforts. Hence, they are also believed to have unmet information needs.

Information Needs: They lack proper links with research centres, outside their parent bodies, and have nowhere to store information (Mchombu 1993). Knowledge is lost as soon as extension services are withdrawn (Ndiaye, 1995).

Other stakeholders - The public sector is no longer the only decision-maker playing key role in the decision-making process; the private sector, NGOs, and service providers in general, take part in decisions on rural development orientations. The newcomers among these decision makers are the farmers' and producers' associations, and their federations and unions.

Information needs: They have the same kinds of information needs as all those who participate in decision-making. In general, they need synthesised, up-to-date information on simple and dynamic indicators of changing trends and of policy impacts. They often lack information that would enable them to establish alternative scenarios (Wesseler and Brinkman, 2002).

Limitations: Many limitations remain in the area of defining and efficiently implementing coherent and operational information strategies:

- analysing needs;

- gathering information;

- assessing information quality;

- knowing how to translate the information into terms that can be understood by each category of stakeholders;

- choosing the tools and media with which to communicate and exchange information.

2.10   Empirical evidences of roles of ICTs in agricultural information delivery

Being a study of potential use of ICTs by agricultural information practitioners and farmers, literatures on the usage of ICTs as exemplified by e-resources and internet by

development practitioners and other stakeholders were sought after. Several authors have looked at: the usage of ICTs as communication tools, purpose of use, dimensions in use of internet, extent of access, place and purpose of use of internet, advantages of ICTs and problem faced practitioners in the use of the facilities. This section endeavours to review some of the works so as to bring them in relevance with this study.

2.10.1 Purpose of use of the internet

Regarding the use of the internet and its purpose, Laite (2003) surveyed 406 graduate and undergraduate students from Shippensburg University. The survey revealed that a majority of the undergraduate students used the internet one or two times per week. The survey also showed that all graduates and undergraduate students used e-mail services. The study of Zhang (2001) on scholarly use of internet-based electronic resources showed that e-mail was the most frequently used tool. All respondents indicated that they used e-mail at least once in a week, while almost 94 percent of them used it almost every day. Web browsers were the second most frequently used internet tools, with nearly 94 percent of respondents using them at least once in a week. Next to e-mail and web browsers, mailing lists and internet search engines are the next most frequently used internet tools.

Chang and Perng (2001) carried out a study on "Information search habits of graduate students at Tatung University". They found that world wide web-based databases, electronic journals and search engines are extensively used by the respondents. Kanaujia and Satyanararayana (2003) conducted a study in the science and technology community of Lucknow city (India) to assess the level of awareness and demand of web based learning environment among science and technology information seekers. The study revealed that 49 percent of users browsed the web for more than two to four hours and 14 percent for more than five hours a day. The study further showed that 37 percent of users consulted e-journals regularly on the internet, 40 percent used the internet for consulting technical reports, a quarter (25 percent) to find online databases and 10 percent for telnet service. In the case of the study by Kelley and Orr (2003), which was conducted at the University of Maryland, it revealed that most graduate students (69 percent) are more likely to use the databases than their undergraduates (32 percent) counterparts.

Jagboro (2003) evaluated the level of utilisation of the internet for academic research at the Obafemi Awolowo University, Ile-Ife, Nigeria. The findings of the study showed that the respondents ranked the use of research materials on the internet fourth (17 percent). However, respondents who used the internet ranked research materials second (53 percent) to

e-mail (70 percent). The study concluded that the use of the internet for academic research would significantly improve through the provision of more access points at departmental and faculty levels. A survey by Panda and Sahu (2003) revealed that 50 percent of the engineering colleges of Orissa, Ahmedabad, India used dial-up connections, though a majority of the colleges used the internet to provide on-line demonstrations. Nicholas *et al* (2003) examined the use of the web for health information and advice in Britain. More than 1,300 people were surveyed and the study revealed that 66 percent of the respondents accessed the internet from home, 28 percent from their work place and only 6 percent of them used a combination of both work place and home.

Hanauer *et al* (2004) surveyed a diverse community college to assess the use of the internet by the students for health-related information. The survey showed that although all the students surveyed had free internet access through their community college, yet only 97 percent of the students reported having accessed the facility. The survey further noted that 83 percent of the internet users had access to the internet at their home and 51 percent of the respondents accessed internet at college or library. Just over 80 percent of the students reported they accessed the internet mostly for college work and 80 percent for e-mail/chat. Men and women searched for health information in almost equal numbers. Robinson (2005) examined the extent of internet use among African-American college students. The results of the study indicated that most of the African-American college students (76 percent) had used the internet for more than three years. For most of them, use occurred at school or at the work place with 49 percent of the responses at home. Of the responses, 47 percent indicated they spent an average of two hours per day online, though a small percentage of the students spent five to six hours per day on the internet. Of the students, 43 percent used the internet primarily to learn and find school resources.

Study results of Asemi (2005) show that all the respondents were using the internet frequently because all faculties were providing connections to the internet. It was revealed that the researchers of the university were getting quality information through the internet. Indeed, somewhat over half of the respondents searched for scientific information through the internet because the university library had provided access to various databases and online journals for all the students and staff. Lal *et al* (2006) also proved that medical students use the internet for educational purpose and for sending mail. The respondents use computers to access online journals, teaching materials, and dissertations, as well as for communication through e-mail and other tools. The study by Chan and Fang (2007) found that the internet

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plays a prominent role among the young people in Hong Kong. Majority of the young respondents (aged between 15 and 24 years) spent one to three hours per day on the internet. The main reasons for internet usage were for listening to music and for fun. The internet was the preferred media choice for information-driven activities, though magazines retained importance for entertainment and shopping activities while the television retained importance for news and current affairs.

The study of Kaur and Manhas (2008) showed that all their respondents make frequent use of the internet because they have access either at college or at home. The survey revealed that the majority (66 percent) of the respondents access the internet from college or their workplace. More than 75 percent of the respondents used the internet services mainly for educational and research purposes. Google and Yahoo search engines are found to be more widely used than other search engines. More than 70 percent of the respondents feel that the internet is useful, informative, easy to use, inexpensive and time saving.

2.10.2 Purpose of use of e-sources

A study at the University of Patras by Monopoli *et al* (2002) revealed that academics used electronic journals mainly for writing up publications and teaching. Most academics also accessed the electronic journals from their offices and prefer to read the articles onscreen (66 percent). In the year 2001, Dillon and Hahn (2002), found that half of the students and faculties of University of Maryland reported they used electronic journals at least once a month. More were using electronic journals especially if they did not find print equivalents. About 70 percent preferred both electronic and print to be made available especially in situations where core journals were considered important in respondents' fields. The trend depicted by these studies indicated that the use of electronic journals is expected to increase in future. The indispensability of electronic journals was also indicated by an Israeli study (Bar-Ilan *et al*, 2003).

Rani and Zainab (2006) study indicated that users seem to use the electronic journals to mainly support research and teaching needs. About 50 percent of respondents rated the journals as "good", while almost 21 percent rated them "fair". The majority of respondents (70 percent) indicated preferring retrieving articles in PDF or HTML. About 42 percent of respondents access the electronic journals while making searches on Google or Yahoo. Most respondents believed that electronic journals will co-exist with print journals (46 percent). The rest believed that electronic journals will either replace the print journals (25.5 percent)

or will supplement them (25.5 percent). The list of functions and features preferred by users of electronic journals is also provided in their study.

2.10.3 Problems in use of the internet

Saeed *et al* (2000) looked at internet use in university libraries in Pakistan and highlighted the use of internet tools namely, e-mail, World Wide Web, FTP, telnet and Gopher. The results of the study show that there are very few university libraries in Pakistan with access to the internet, while those who have internet access suffer shortage of infrastructure (e.g. poor telecommunications, limited hardware and software, library personnel etc). These effects on the access of internet by university libraries are mainly due to insufficient funds. In another study by Dillon and Hahn (2002) at the University of Maryland, 31 percent of the faculty members reported that they never used electronic journals; the reasons cited were unfamiliarity with how to access the journals and a lack of need because of requirement for personal subscriptions. Similarly, Majid and Tan (2002) in a study of computer engineering undergraduate students in Nanyang Technological University in Singapore discovered that more than one-third of the respondents had never accessed computer-engineering databases available through the library and of those, half of them had never even heard of computer-engineering databases.

Mishra *et al* (2005) conducted a study to investigate the internet utilisation patterns of undergraduate students at the G B Pant University of Agriculture and Technology, Pantnagar, India. The findings of the study indicate that majority (86 percent) of the students used the internet. It also showed that 61 percent of the males and 52 percent of the females used the internet for academic purposes. A majority of the respondents, 83 percent male and 61 percent female, indicated that they faced the problem of slow functioning of internet connections. In 2005, another comprehensive study on use of the internet by students and faculty of universities in Karnataka State by Biradar and Sampath-Kumar (2005) showed that the internet is primarily used for academic purposes. The majority of users opined that the major obstacle for internet use is the lack of internet facility in the university environment.

Madhusudhan (2007) conducted a study on the internet use by research scholars in University of Delhi, India and found that researchers, like others elsewhere, are beset with the problems of inadequate computers with internet facilities, slow internet connection and lack of skills and training. The survey also revealed that 57 percent of the respondents are facing retrieval problems. Some research scholars lack research techniques and training. A study showed that that there is a significant relation between academic females' use of the internet

and their social ranking. The findings also revealed that as users navigate through the internet they would find more hidden threats and vague content (Riahinia and Azimi, 2008). Some studies also show that the slow speed of data transfer is the main reason for dissatisfaction (Trivedi and Joshi, 2008). But overall, the research findings of all the previous studies discussed above clearly indicate that electronic information sources are increasingly important to today's scholars and researchers.

2.10.4 Farmers' use of ICTs to seek agricultural information

CTA (2009) reported that on the African continent alone, the use of mobile phones grew by more than 30% in the last year. Delivering market information via mobile phones, and especially text messages (SMS) is, therefore, as important as it was in 2002. And each new project brings its own innovation. The Zambia National Farmers' Union, for example, adapted a text messaging scheme used in Kenya and adapted it to suit their own needs and now back it up with a website. The Kenya Agricultural Commodity Exchange supports its SMS information system by developing local market resource centres.

In Uganda, a group of dairy farmers used a microfinance loan to buy two mobile phones, complete with a car battery to provide electricity, a solar panel charger and an antenna to amplify the phone signal enough to reach the distant network. The farmers used the phones to connect with the FoodNet market information service to find buyers and arrange more precise delivery times. They no longer have to travel long distances, risking the milk going sour in the heat. Now each farmer uses a mobile phone to deal directly with buyers and enter new markets by developing more dairy products.

CHAPTER THREE
THEORETICAL AND CONCEPTUAL FRAMEWORK
3.1   Theoretical framework

This study aims at proposing a strategy for effective information communication to achieve agricultural and rural development in Nigeria. The conceptualisation of this study, being an assessment of the potential of use of Information and Communication Technologies (ICTs) in agricultural research and extension activities in Nigeria, considered the enabling factors necessary for a successful integration of the strategy.

In examining the potential of ICT for agricultural and rural development, it is essential to recognise the fact that information dissemination is a fundamental element of rural development programme because rural areas are often characterised as information-poor (Chapman and Slaymaker, 2002). The challenge of how ICT can be integrated into local knowledge and information networks to address locally identified knowledge gaps, especially considering the literacy factor as well as relevance of the content of the ICTs is of utmost concern to the study. With the emphasis on 'Information and Communication', the importance of context-driven and indigenous approaches such as projects that meet local needs and demand-driven content become significant. Equally, issues of sustainability, which involve factors of human capacity and financial resources, is considerable.

Knowledge and information are important factors for accelerating agricultural and rural development by the increase of agricultural production and improving marketing and distribution enabled by effective dissemination strategy. ICT has the capacity to enhance the efficiency of agricultural systems by opening new communication pathways and reducing transaction costs, given greater accessibility of information on important production issues like prices, transportation, and production technologies. According to Sharon (2003):

> '...access to ICT can provide a set of resources and tools that communities, and individuals living in communities can use to pursue their goals...It includes in the developing country context, how to ensure that individuals or communities may make use of the opportunities provided by ICTs

Various ICT formats (old and new) are deemed important for the conceived strategy. It is believed that the old ICT formats, which include radio, TV, video, overhead projector among other analogue ones have not been optimally utilised for the development of the sector. These ICT formats, radio and TV especially, do not have the problem of dearth of facility; hence content development and conscious strategic integration remain the challenge for their adoption for the extension information delivery. As for the new (digital) ICT

formats, the challenge for their integration include dearth of software and hardware, that is, content development as well as availability of infrastructural facility.

The major issue that concerns all the ICT formats, therefore, is the content development. The content (software) for the ICTs in the developing countries have not been done in an organised manner (Sharma, 2007) hence the need to consider it as a very serious issue in order to effectively incorporate ICT into extension delivery system in Nigeria.

3.1.1 Knowledge utilisation models

This study reviews knowledge utilisation models according to Hood (2002) as it relates to the importance of knowledge sourcing, dissemination and utilisation for the purpose of development pursuit.

The basic conceptualisation of the knowledge utilisation implies the following model:

RESEARCH ----> DISSEMINATION ----> USE/APPLICATION

Or perhaps this model if two-way "exchange" is considered:

RESEARCH <----> DISSEMINATION <----> USE/APPLICATION

Dissemination has become the "gap-filler" between research and use/application. The concept of development seems to have received less emphasis. Dissemination has become the generic term for all knowledge transfer or communication activities. Some people have questioned the adequacy of such an encompassing concept of dissemination. It may be a convenient short-hand, but we need knowledge use (KU) models that will discriminate among vastly different models of research-based knowledge use as well as an understanding of how these models differ from other KU models that are not particularly research-based in terms of the source of knowledge.

This leads to a set of simple questions about models of knowledge use:

- What is the character of the knowledge that is used?

- Who is the user? What do we know/assume about the user?

- What is the purpose of use? What outcomes are intended?

- What would it be important to know about the use situation/context?

- What do the answers to these questions imply for improving knowledge transfer, communication and knowledge utilisation?

- If there is a challenge to create a better research and dissemination "system," what should be the super-ordinate goal of the system? What is the shared vision around which collaboration should be organised?

At the most fundamental level, there seems to be a tension between two vastly different, almost diametrically opposed, conceptions of knowledge acquisition. One extreme seems to be a conception of filling an "empty vessel" with facts or information. Here, information is the "objective"; easily communicated and easily apprehended. The notion is 'facts speak for themselves'; products and programmes can be adopted and implemented. At the other extreme we find a conception of engaging or supporting "communities of learners" of individual learning as a complex reconstruction of cognitive frames and meanings/values, or of organisations that must "restructure" and become "learning organisations". Somewhere between the two extremes seems to be much the current "in-practice" in models of KU.

A related tension is between attending to and defining, simple, universal "needs" of knowledge users versus attending to the "voice of the customer" through a protracted "conversation", which results in continuous feedback that effectively couples with the knowledge production process. Market research can inform either conception of "needs assessment", but the process will be markedly different. At one extreme, we assume we know what the user wants or needs; at the other we maintain a dialogue that intimately affects both the knowledge producer and the knowledge consumer.

This line of discussion provoked the distinction between two paradigms:

The dissemination paradigm — this is one in which some form of knowledge, produced at someplace, is broadly disseminated to many users, often at some distance, physically and sometimes culturally, from the point of knowledge production. Thus the knowledge is "external" to the user system. From the knowledge producer's standpoint, the challenge is to communicate with and achieve producer-intended forms of use of this knowledge among many potential users. Dissemination, marketing, mass media, on-line information systems, and telephone numbers for information services become some of the vehicles for communication between producer and user.

The systemic change process paradigm — this is one in which the main focus of knowledge use and production is in one location, whether that is a person's head or a large organisation. The knowledge use process is local, complex and dynamic. And most of the knowledge production is "local". Externally produced knowledge (ideas, products,

programmes, technologies) may be simulative or facilitative, but this use of external knowledge is often incidental or subordinate to achieving synergistic changes in group or organisational structures, policies, operating procedures, and perhaps even the working environment of the organisation and in the attitudes, skills, motives, values, and shared visions of those involved in this form of systemic change process. "Research-based" knowledge may be represented more by processes of local disciplined inquiry and reflection than by the products of externally produced research. But this is rarely an either-or situation; rather it is a melding of knowledge in many forms from many sources.

Many of current conceptions of KU involve some mixture of these two paradigms. Thus, there are extension agents, linking agents, technical assistance providers, trainers, consultants, and other forms of "external assistance" that may support the local systemic change process. Yet, the closer we get to the core of a complex systemic change process and the more we stay with it, the more we realise that "dissemination" is an alien, almost irrelevant, concept for comprehending or dealing with what seems to be at stake. As we take seriously the challenges to employ research to support systemic reforms in development, we may see more of a shift from the *Dissemination Paradigm* to the *Systemic Change Process Paradigm*.

3.1.2 Model for information and communication technologies' (ICTs) content (software) development

The importance of ICTs content development to agricultural and rural development cannot be overemphasised. If the appropriate facility is made available and all the expected actors and stakeholders have access to the ICTs, without the relevant content, there may not be significant change in the status quo. Africa (excluding South Africa) generates only 0.02% of Internet content (Wilson and Rodriguez, 1999). This means that most of the information available may not be applicable to African situation unless the experts adapt them. UNDP (2001) reported that numerous telecentre evaluation reports indicated that the services are not being patronised by the targeted local population due to the lack of understandable and relevant content. Research suggests that up to 80% of e-Government initiatives have ended in total or partial failure due to lack of relevant content (Heeks, 1999).

Using the local content (media richness) concept implies that the content of messages conveyed through the different electronic media should be in accordance with their specific characteristics. Mass media, such as radio and television are most suited to convey basic, informative information on campaigns (e.g. health care, education, agricultural programmes,

and rural development initiatives), government and private sector financing opportunities, available (economic) development support from government institutions, NGOs and other organisations, among others (van Koert, 2000). Radio is more widespread and should thus be the initial medium. This mass media will be more effective when audience participation, discussion forums, and testimonials, are incorporated into the media execution strategy. Television broadcasts should be added later, using the specific advantages of combining audio and visual aspects. Radio and Television as mass media create limited conversational patterns through audience participation; this is the strength of the networked electronic media like Internet where electronic mail can be incorporated into the dissemination strategy to elicit effective feedback from all categories of audience regardless of where they are located.

Placing emphasis on feedback is intended to consolidate a strategy of encouraging local input into the ICT content. Most ICT projects in developing countries focus more on technological aspect of the strategy. According to van Koert (2000), the following ideals should be achieved in an ICT project for development;

- Ownership of information centres by local organisations and institutions;
- Network information centres, while retaining individual independence;
- Promotion and support of independently owned and operated local mass media;
- Deployment of electronic media to facilitate and support existing information exchanges at local levels; and,
- Using and creating local content to engender sustainable patronage.

This approach supports decentralisation of the power structure, to create independent information generation and storage, and subsequently facilitates, or provides conditions for social change through local level, horizontal information exchange, complemented by vertical information provision.

This trend emphasises the disjuncture between what ICTs can achieve in theory and how the potentials can be missed in practice. These problems often arise when the project focus is on installing the technological system, rather than on understanding the organisational culture and the dynamics of existing information flows. This, in essence, is what the idea of ICT content development is out to achieve. In this wise, this study considered the model for sustainable use of ICT for agricultural information dissemination as given in Fig 3.1 below:
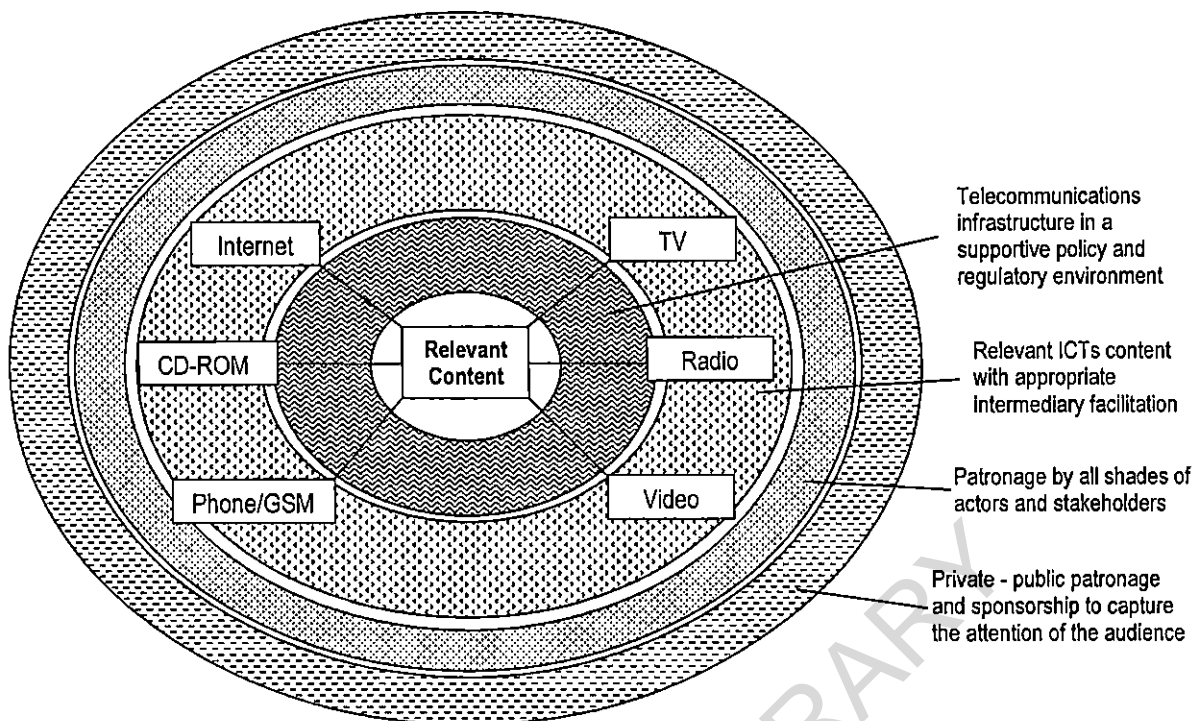
Fig 3.1: Model for sustainable use of ICT for agricultural information dissemination
Source: Yekinni (2008)

The model for sustainable use of ICT for agricultural information dissemination is premised on having 'relevant content' as the core upon which other issues hinge. It is assumed that if the information is relevant to the audience, they will seek it and will even be willing to pay for access to it. The continued demand for information and willingness to pay for it by the local farmers will be influenced, largely, by the benefit they derive and/or what they have been able to get from it. Research suggests that even the poor, under certain conditions, will spend some 2% of their income on telecommunications (Kenny *et al*, 2001). Hence, local and relevant content can play a critical role in stimulating the commercial expansion of telecommunications infrastructure and services to under-serviced areas. It can stimulate demand for ICT access, which in turn can attract private sector investment in telecommunications infrastructure (given a supportive policy and regulatory environment) (UNDP, 2001). The expected patronage of the information media is likely to attract relevant private entrepreneur in terms of sponsorship and advertisements (e.g. by agro-allied industries) in order for them to capture the audience of the media. The conceptualisation of the model is in line with the idea of Daly (2001) in his conceptual framework for the understanding of the impact of Internet (as shown in Fig 3.2). The 'penetration' frame emphasised service, content and demand which are the core issues in his model.

Penetration   Utilization   Impact
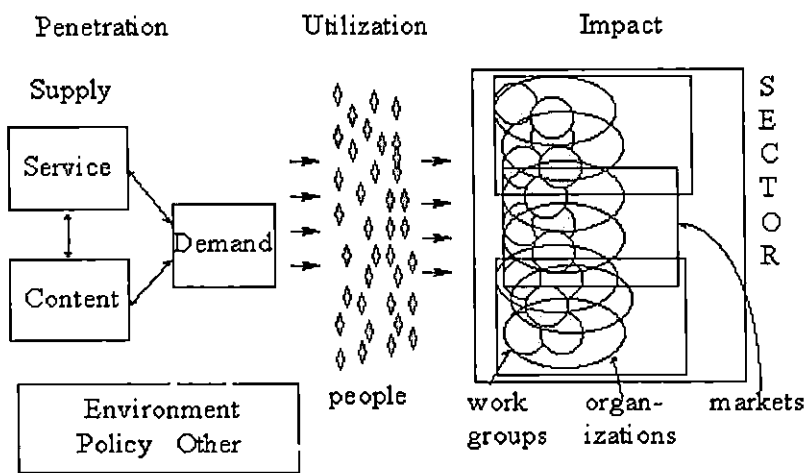
Fig 3.2: Conceptual Framework: Understanding Internet
 Source: Daly (2001)

3.1.3 Framework for agricultural information content development

In accordance with the National IT policy, "To enable Nigeria become a net provider of Internet content on the World Wide Web, as opposed to its status of being a net recipient of Internet content" (NITDA, 2003), the content development has to be started in a sustainable manner from the onset. In line with the mandates of the extension and research institutions in Nigeria and as mediated by the adoption of the new (ICT) strategy, content of research publications by these institutions would have to be evaluated on the basis of its appropriateness for publication on the new media. This will enable continued and sustainable content development on the basis of information priority areas through various ICT media using various strategies for the different categories of actors and stakeholders.

As shown in the figure below, any of the information priority areas may be chosen as the focus, to be disseminated through any of the ICT media using any of the dissemination strategies for any of the actors/stakeholders. The framework will provide almost limitless issues on which to generate content by the research and extension personnel and other actors in the agricultural and rural development agenda in the country.

Information Priority Areas	Various ICT Media	Dissemination Strategies	Various Actors and Stakeholders
• Practical skills for maintenance of wells • Farming methods and techniques • Sources of high yielding seeds and animal breeds • Market information • Technologies and innovations • Research findings • Training opportunities • Training institutions • Proper project planning/management • Soil types and their appropriate uses • Employment opportunities • Zero grazing • Nutrition • Afforestation • Weather forecasts • Herbicides and pesticides • Credit • Financing institutions and schemes and • Farm produce processing methods at household level, etc	• Radio • Television • Video • Computer • CD-ROM • Phone/GSM • Intranet • Internet, etc	• Instructions • Opinions • Review • Analysis • News • Demonstration • Entertainment Education (EE) • Documentary, etc	• Farmers and their associations • Non-Governmental Organisations (NGOs) • The media • Private companies (input suppliers, brokers/traders, operators of telecentres, etc.) • The formal (government) extension system • National agricultural research organisations • Universities • International research organisations • Donors • Think tanks and networks at various levels • The political environment (local, national, regional, international governance structures, conventions, treaties, etc.)

Fig 3.3: ICTs content development framework for agricultural and rural development

Source: Yekinni (2008)

3.1.4 Information and communication technology integration into agricultural extension delivery

This study intends to use this concept to assess the e-readiness of the agricultural extension system (among other systems in the country) using the model developed by Centre for International Development and Conflict Management (CIDCM) at the University of Maryland. The model was designed to help advance the diffusion of ICTs in developing countries, especially Africa, by helping decision-makers improve the processes of negotiation through which governments, NGOs and the private sector diffuse ICTs (CIDCM, 2001). The framework measures four categories of information for each country:

1. Background and history – structural context, political structure and culture, cultural norms (religion, etc)

2. Key players in Internet development – responsibilities and objectives of relevant players in government, local and foreign businesses, universities, NGOs, international financial institutions, research groups.

3. Internet development and ICT policy over time – access, regulation, competition

4. Negotiations between players in developing the country's Internet - each aspect of Internet development and ICT policy is categorised into one of four stages (i-pre-commercial, ii-commercial, iii-competitive, and iv-consolidated). The 'Negotiation' between players was the focus of the framework – the rest are supporting information.

3.2 Information and communication technologies (ICTs) for agriculture and rural development actors and stakeholders

Having highlighted the enabling facilities in the discussions above, this section intends to propose the integration of the facilities according to realistic capacities of the various actors and stakeholders.

3.2.1 Research and extension institutions

Radio – The benefit of researches that have been carried out in the country have not been met. Hence, given the appropriate content, the use of this facility can be reinvigorated to benefit the target audience.

Television – this facility, with its additional utility for teaching and instruction, can be used (given the appropriate content) for effective dissemination of agricultural information for the various actors and stakeholders in agricultural development agenda in the country.

Video – this facility can be particularly used for specific target instructions and administered with minimal human resource input. This will particularly facilitate dissemination activities given the inadequate extension staffing in the country (Omotayo and Isiaka, 2005).

Computer – these institutions will be required to use computer in the documentation of their activities as well as digitalise the materials that are in analogue forms in order to facilitate digital publication, which is the hub of the new ICT strategy.

CD-ROM – these institutions will be required to create knowledge bases (CD-ROM) using the digitalised data from their activities to make virtual digital library for the various categories of beneficiaries.

Phone/GSM – these facilities will be required to communicate among the personnel as well as receive calls from the beneficiaries of their activities. Apart from this, the telecomm facilities can equally be used to link the Internet with modest investment given the prevalent teledensity growth rate of the sector in Nigeria.

Intranet/Internet – with digital networking (intranet through LAN or WAN) of the various institutions in the country, knowledge and resource sharing will be better facilitated. The outcome of the activities can then be published on a single or multiple websites of the institutions for public use.

Research and extension personnel can also use this facility to access information from the various International Agricultural Research (IAR) institutes among other sources to adapt relevant ones for local use. This will give then a leap in their research activities and bridge the gap to agricultural development.

3.2.2 End users' (farmers and other stakeholders)

Farmers among other stakeholders will access the output of agricultural research and extension activities in a packaged form as disseminated through CD-ROM technology and the Internet. In the case of illiterate audience, there will be the need for an intermediary medium.

Telecentres – there will have to be a reinvigoration of the existing telecentres as well as the establishment of others where they do not exist. These centres will no more be radio-listening or television-viewing places alone; they will be equipped with computers, CD-ROM digital libraries and ultimately Internet connections. The centres are to be operated on commercial basis though with a level of subsidy facilitation for the operators. This facilitation falls within the provision of the national IT policy as mentioned above. The required connection

infrastructure can be provided by the public Information Infrastructure backbones or by any of the private telecomm companies who is vibrant enough to take the responsibility. According to UNDP (2001), it will be better if the telecentres are facilitated by youths from within the local communities who can be trained for that purpose. However, the local extension agents will have a great responsibility in the interpretation of information and management of the centres.

CD-ROM – for centres that are yet to be connected to the Internet, information need can be met through the virtual libraries provided by the CD-ROM technology. The content is what is important here, almost all basic information needs can be met through this versatile technology. For instance, the Community Development Library 2.1, produced by the New Zealand Digital Library and Human Info NGO, contains more than 1.785 publications (160.000 pages).

Internet – centres that are connected to the Internet can access all the information needs as soon as they are available at the research and extension institutions as well as send feedback to the information sources (feed-forward facilitation). Apart from this, analogue facilities can also be used with this facility. Audio and video files can be sent through the Internet to be played on a multimedia enabled computer for all categories of audience. According to Gomez (2001), community radio stations operate as local broadcasting centres for Internet content, which they download and rebroadcast to thousands of illiterate listeners.

3.3   Conceptual framework for determinants of ICTs utilisation for agricultural extension delivery in Nigeria

The determinants of utilisation of ICTs for agricultural extension delivery in Nigeria are conceptualised on the basis of the roles played by the independent and intervening variables in explaining the dependent variable. The characteristics of the research and extension personnel regarding their access and extent of use of ICT are captured with these variables: The personnel's academic background; level of IT knowledge; level of access to ICT; level of availability of ICT in official duties; constraints to the use of ICTs; and current way of information management. All these are expected to influence their perception about the use of ICT in their work schedules as well as their level of use of the available ICT formats in their duties. According to Daly (2001), the demand for ICT is limited by general level of education and levels of competence in computer skills.

Regarding other categories of ICT users, that is, farmers among others, their characteristics about willingness to use ICT – mediated information delivery is captured and

is expected to be influenced by the following variables: farmers' production enterprises; information needs; educational attainment; willingness to pay for service and experience with telecentre. Farmers' experience with telecentres is of importance to this study because technical and literacy constraints are crucial to farmers' willingness to use the facility. This is expected to be circumvented by using an interpreter interface that interacts with the information resource and explains it to the farmers as advocated by UNDP (2001). Hence, their willingness to use the ICT in this form will depend on their previous experiences with telecentres in their communities (Robinson, 2000).

The policy environment including privatisation of Internet service providers, the number of such ISPs allowed to exist in the country, the number of satellite and cable connections from national to global providers, regulation of content, pricing policy, power supply, taxation of Internet services and tariff policies on computers and telecommunications equipment are very important in the framework (Daly, 2001). This environment will determine the availability and affordability or otherwise of this facility to all categories of development actors and stakeholders.

Independent Variables

Research & Extension Staff's Academic/IT background
◊ Academic qualification
◊ IT training received
◊ Level of use of computer

Research & Extension Staff's Status
◊ Grade level
◊ Years of experience

Level of IT knowledge

Level of Access to ICT
◊ Level of access to ICT formats

Constraints to the Use of ICTs
◊ Lack of facilities
◊ Inadequate facilities
◊ Lack of ICT knowledge
◊ Work schedules not adaptable to ICT

Level of Availability of ICT
◊ Level of availability of ICT formats in official duties

Current way of Information delivery

Assessment of ICTs Importance to Work schedules

Farmers' Personal characteristics
◊ Age
◊ Sex
◊ Family size
◊ Education

Farmers' production Enterprise

Farmers' information Need

Information sources

Extent of Access to Information

Farmers' willingness to pay for service

◊ Experience with telecentre
◊ Disposition to the idea of ICT based information system

Intervening Variables

Relevant ICT content

Government Policy on ICT
◊ Full utilisation of SAT3/SAFE cable system
◊ Launching of NIGCOMSAT-1
◊ National Rural Telephony Programme
◊ Investment environment in digital ICT
◊ Govt investment in ICT infrastructure

Government Policy on Power supply
◊ Effective privatisation of power supply

Private sector investment in IT
◊ Level of private investment in ICT infrastructure
◊ Competitiveness of the industry
◊ Effective Regulatory activities of sector

Availability and Affordability of IT Services
◊ Proportion of the populace using IT
◊ Extent of sustained use of the services

Dependent Variables

Perception of Extension and Research Personnel to the use of ICT in their duties

Level of Utilisation of ICT
◊ Level of use of the available ICT formats in official duties

Farmers' willingness to use ICT

Fig 3.4: Conceptual framework for the determinants of ICT utilisation

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CHAPTER FOUR
METHODOLOGY

4.1   Area of study

Nigeria lies between latitudes $4^0 16'$ and $13^0 53'$ north and between longitudes $2^0 40'$ and $14^0 41'$ east. It is located in West Africa and bordered in the west by the Republic of Benin, on the north by the Republic of Niger and on the east by the Republic of Cameroon. It is bordered to the south by about 800 kilometres of the Atlantic Ocean. Nigeria occupies a land area of 923,738 kilometres (91 million hectares) and the vegetation ranges from mangrove forest on the coast to desert in the far north (The World Fact Book, 2007).

4.1.1   Cultivable land area

The total cultivable area in the country is estimated at 70 million hectares, which is 76% of the total area of the country. Arable crops are planted in 28.2 million hectares while permanent crops occupy 2.6 million hectares of the cultivable land. About two-third of the crop area is in the north, with the rest being equally distributed between the middle belt and the south (National Bureau of Statistics, 2005).

Nigeria has freshwater sources covering 12 million ha, 960 km of coastline fishery resources and an ecological diversity which enables the production of wide variety of crops, livestock, forestry and fisheries products. Farm holdings generally fall into three categories namely; small-scale (0.1 to 5.99 ha), medium scale (6 to 9.99 ha) and large scale (10 ha and above). Small-scale farm holdings predominates Nigerian agriculture, accounting for 81% of the total area and 95% of agricultural output.

4.1.2   Agro-ecological zones

The agro-ecology of Nigeria was initially categorised into four zones, comprising of a humid forest, moist savanna, mid-altitude and drier savanna zones. Currently, six agro-ecologies are recognised, namely humid forest, derived savanna, southern guinea savanna, northern guinea savanna, and mid-altitude and arid/semi arid zones. The humid forest zone covers Bayelsa, Rivers, Imo, Akwa Ibom, part of Cross Rivers, Ebonyi, Anambra, Edo, Ondo, Delta and Ogun States. Derived savanna includes parts of Oyo, Ekiti, Kogi, Nassarawa, Plateau States and part of the FCT. Southern guinea savanna covers parts of Niger, Kwara, Adamawa, Gombe and the FCT. Northern guinea savanna cuts across parts of Kaduna, Bauchi, Gombe, Zamfara, and Kastina States. The mid-altitude zone includes parts of Plateau, Bauchi, and Taraba States. Yobe, Borno, Sokoto, Kebbi, and Zamfara States make up the arid/semi arid zone.

Crops cultivated in the humid forest zone include cassava, cocoa, coconut, oil palm, yam and plantain. Crops such as cassava, maize, melon, and cocoa are cultivated in the derived savanna agro-ecology. Yam, cassava and soybean are some of the plants found in the southern guinea savanna agro-ecology. Maize, millet and cowpea are common crops in the northern guinea savanna while rice, cassava and yam are common in the mid-altitude agro-ecology. Millet and cowpea are part of the cropping system in the arid/semi arid agro-ecology.
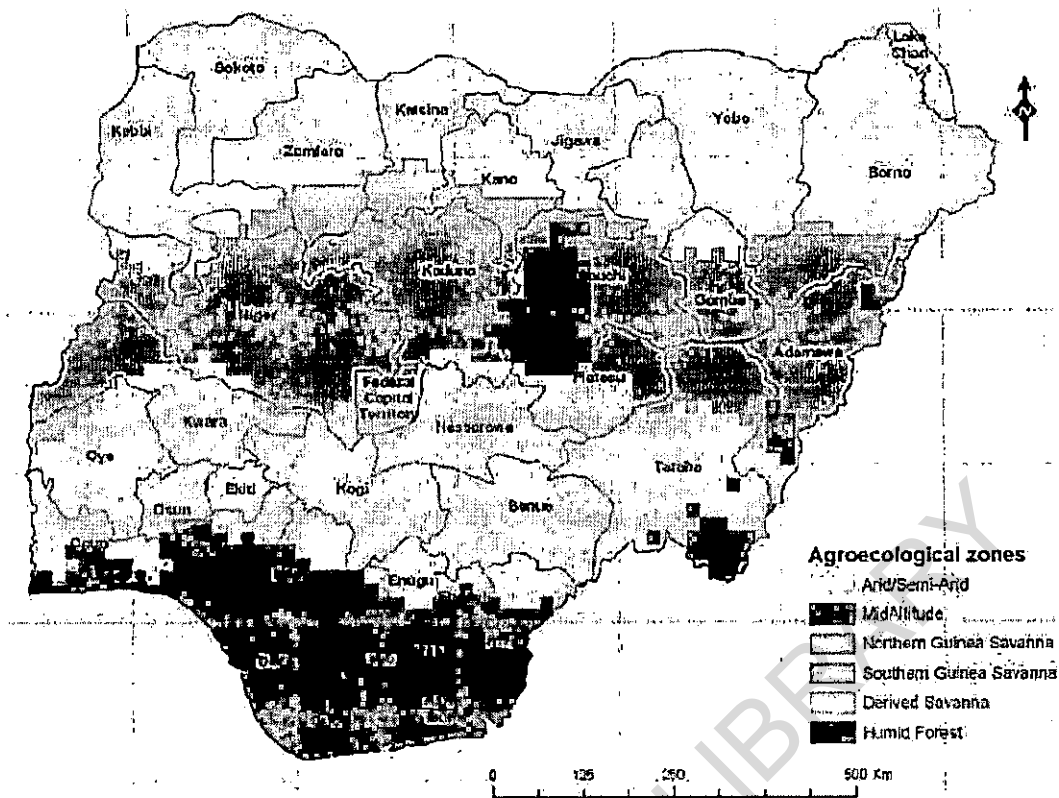
Fig 4.1: Map showing the agro-ecological zones of Nigeria

Source: Manyong *et al* (2005)

4.1.3 Agricultural zones

In 1987, the Federal Government grouped the states in the country into five (5) agricultural zones. The grouping was patterned on the system developed by the Project Coordinating Unit (PCU), formerly Federal Agricultural Coordinating Unit (FACU). The aim is to support the activities of the state ADPs in the country and to strengthen the farming system research and research-extension linkage by assigning the responsibility of each zone to a research institution in the area. The Institute of Agricultural Research (IAR), Zaria covers the North-West zone; Lake Chad Research Institute (LCRI), Maiduguri covers the North-East zone; National Cereal Research Institute (NCRI), Badeggi covers the Central zone; Institute of Agricultural Research and Training (IAR&T), Ibadan covers the South-West zone; and National Root Crop Research Institute (NRCRI), Umudike covers the South-East zone.

North-West Zone – this comprises of Kaduna, Katsina, Sokoto, Zamfara, Kano and Kebbi states. There are about nine (9) million people who are primarily engaged in agricultural production activities in the zone. Adult males contribute about 70% of the farm family labour supply; Muslim women do not generally take part in outdoor fieldworks while women of other faith do. Young girls, widows and old women are usually involved in planting, harvesting and local processing.

The average farm holding is 3 ha for upland and 0.2 ha for fadama farms in the zone. Crops cultivated include sorghum, millet, wheat, maize, rice, cotton, groundnut, onion, tomato, pepper and leafy vegetables. Cattle rearing are widespread throughout the zone. There are four (4) national research institutes in the zone; the Institute of Agricultural Research (IAR), National Animal Production Research Institute (NAPRI), National Agricultural Extension and Research Liaison Services (NAERLS), and National Institute for Trypanosomiasis Research (NITRI). The International Institute for Tropical Agriculture (IITA), International Livestock Centre for Africa (ILCA) (now International Livestock Research Institute (ILRI)) and International Crop Research Institute for Semi Arid Tropics (ICRISAT) operate research stations in the zone. The Institute of Agricultural Research (IAR) serves a coordinating role in the transfer of technology in collaboration with the state ADPs and the National Agricultural Extension and Research Liaison Services (NAERLS).

North-East Zone – it comprises of Adamawa, Borno, Jigawa, Bauchi, Gombe, and Yobe states. There are 1.7 million ha of fadama land out of the 7.9 million ha of arable land in the zone. Being the most important livestock-producing zone in the country, it has 5.7 million cattle, 8.9 million goats, 7.1 million sheep, 15.8 million poultry of all types and 0.6

million pigs. The zone contributes 41%, 26% and 32% in the production of cattle, goats and sheep respectively in the country.

The average farm holding ranges between 1.5 and 1.8 ha depending on population densities within the zone. The major crops cultivated include sorghum, millet, maize, rice, cowpea and groundnut. Others are cotton, tomato, onion, pepper, carrot and date palm. The zone has only one (1) national research institute within it; the Lake Chad research Institute (LCRI), which has four (4) functional stations throughout the zone. The National Agricultural Extension and Research Liaison Services (NAERLS) and National Institute for Freshwater Fisheries Research (NIFFR) also have sub-stations in the zone.

Central Zone – it comprises Benue, Kogi, Kwara, Niger, Nassarawa, Taraba and Plateau states as well as the Federal Capital Territory (FCT), Abuja. Rural population constitutes 77% of the population while the total arable land is estimated at 24.7 million, but only 6.6 million are currently under cultivation, out of which 64,007 ha are under irrigation.

Average farm holding capacity is estimated at 12.2 ha per farm family, of which only average of 2.5 ha are cultivated. The region is considered the food basket of the nation; producing over 40% of rice and groundnut, 64% of soybeans, 34% of yam, 25% of maize, sorghum and cowpea as well as 98% of Irish potato.

There are three (3) national research institutes in the zone namely; the National Cereal Research Institute (NCRI), National Institute for Freshwater Fisheries Research (NIFFR) and National Veterinary Research Institute (NVRI). Aside these, the Cocoa Research Institute of Nigeria (CRIN), Institute of Agricultural Research (IAR), National Animal Production Research Institute (NAPRI) and National Root Crops Research Institute (NRCRI) operate one or more sub-station each in the zone. The state ADPs in the zone collaborate with the NAERLS at Badeggi for dissemination of agricultural technologies.

South-West Zone – it includes Bayelsa, Delta, Edo, Lagos, Ogun, Ondo, Ekiti, Osun and Oyo states. About 65% of the population live in rural areas in the zone. There are 4.06 million ha of land suitable for cultivation of all crops though only 2.4 million ha are currently under cultivation. There are three (3) major drainage systems in the area namely Ogun, Osun and Osse river basins.

Agriculture is the main occupation of the inhabitants though variation exists among the states in the zone. Average farm size of 1.2 ha obtains for forest area and 2.0 ha for the savanna areas in the zone. Crops produced include cassava, yam, maize, melon, okra, tomato, pepper, cocoyam and plantain. Others are cocoa, which is almost exclusive to the region, oil palm, kola and rubber.

The zone has the largest concentration of agricultural research institutes; there are eight (8) of them namely Cocoa Research Institute of Nigeria (CRIN), Forest Research Institute of Nigeria (FRIN), Institute of Agricultural Research and Training (IAR&T), National Institute for Horticultural Research (NIHORT), National Institute for Oil Palm Research (NIFOR), Nigerian Institute of Oceanography and Marine Research (NIOMR), Federal Institute of Industrial Research, Oshodi (FIIRO) and Rubber Research Institute of Nigeria (RRIN). Some other research institutes such as NAPRI, NCRI and NRCRI have functional sub-stations in the zone. The headquarters of IITA is in the zone while ILRI operates from IITA, Ibadan.

South-East Zone – it comprises Abia, Akwa-Ibom, Anambra, Cross River, Enugu, Ebonyi, Imo and Rivers States. About 60% of the population reside in rural areas. The total arable land in the zone is 5.8 million ha, out of which 2.8 million ha is under cultivation.

Farm sizes are typically between 1.0 ha and 1.5 ha with a mean of 1.0 per family. Agriculture employs 60 to 70% of the population while women provide between 58 and 68% of agricultural labour force in the zone. The crops generally cultivated are yam, cassava, cocoyam, maize, rice, banana/plantain, pawpaw, egusi-melon, tomato, leafy vegetable, pineapple and mango. Others are oil palm, cocoa, rubber and cashew.

There is only one (1) agricultural research institute in the zone; the National Root Crops Research Institute (NRCRI), in addition to which NCRI, NIHORT, FRIN, CRIN, NVRI, NIOMR and IITA have functional sub-stations in the region. The African Regional Aquaculture Centre (ARAC) also has a station in the zone. The state ADPs and the AERLS of NRCRI are responsible for the dissemination of agricultural technologies to the farmers in the zone.

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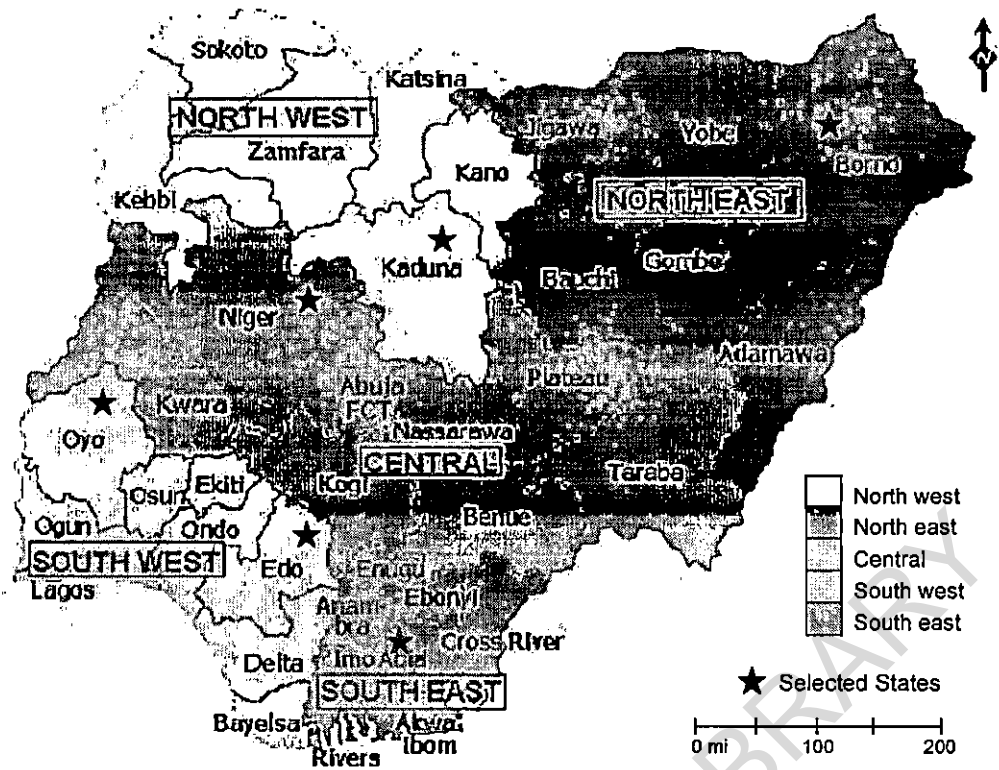
Fig 4.2: Map of Nigeria showing the states as they fall into the agricultural zones

4.2   Source of data

The study made use of primary data. The data was gathered from the three set of respondents of the study viz. the research personnel in the nation's research institutes, the extension personnel at the ADP stations and the farmers.

4.3   Data collection procedure

The data for the study were collected through the administration of pre-tested structured questionnaires/interview schedule to collect information from the respondents. The questionnaires for the research and extension personnel were distributed to the randomly selected officials to complete.

Trained enumerators were used to collect information from the farmers. The research instrument was administered as interview schedule to this set of respondents. The enumerators were trained especially on how to be consistent in the use of the questionnaire as interview schedule so that questions/ items on the instrument will neither be lost nor distorted during data gathering activities.

4.4   Instrument for data collection

The study used structured questionnaire to collect data. The instrument contained both open and close ended questions. There are two set of questionnaires for the three set of respondents; one was used for the research and extension personnel, while the other was used for the farmer respondents.

The questionnaire for the research and extension personnel contained sections, which addressed the following issues:

i.   Personal characteristics – this include personal and professional characteristics of the respondents.

ii.   Assessment of current method of information delivery

iii. Access to ICTs, which also involved assessment of official access to the ICTs.

iv.   Availability of the ICTs, involving the frequency of use as well as constraints to availability of the facilities.

v.   Assessment of knowledge (of competence) in the use of ICTs

vi.   Perceptions about the use of ICTs to disseminate agricultural extension information.

vii. Assessment of importance of ICT formats to research/extension personnel's work schedules.

viii. Research/extension personnel's perceptions of how ICTs can be used on a sustainable basis for developmental information dissemination

The questionnaire for the farmers was mainly administered as an interview schedule, in order to circumvent illiteracy constraints. It contained sections, which addressed the following issues:

i. Socioeconomic characteristics

ii. Farmers' experiences with telecentres

iii. Sources of information, access to ICT formats as well as ranking of the ICTs on the basis of importance

iv. Assessment of farmers' information needs and

v. Willingness to use and pay for access to information through the ICTs

4.4.1 Validation of instrument

The instrument for the study was subjected to both face and content validity so as to ensure that it is valid for data collection purposes. This was carried out with the assistance of experts in the fields of agricultural extension communication and community development. The experts' views were sought on the appropriateness and adequacy of the items on the instruments to measure the variables of the study. This procedure determined the items that featured eventually on the instruments in the pursuit of the objectives of the study.

4.4.2 Reliability of instrument

The reliability test for the instrument was conducted using the test-retest method. This involved two-time administration of the instruments to respondents who are similar in characteristics to the study's respondents but who were not included in the study. The first instrument was pre-tested to Osun state ADP staff at Iwo zonal headquarters, while the other instrument was also pre-tested to farmers in Iwo. The two set of scores for each instrument were then correlated to show the level of reliability of the instruments. A reliability coefficient of $r = 0.65$ was obtained for the Researcher/ ADP staff instrument, while a coefficient of $r = 0.72$ was obtained for the farmers' instrument.

4.5 Population of the study

The study has three categories of respondents, which constitute the population of the study; they include the research personnel at the nation's research institutions, the agricultural

extension practitioners at the states ADPs in the country, as well as farmers in the five (5) agricultural zones in the country. There are 18 research institutes in the country, where the agricultural researchers are situated, as given in Table 4.1. There are 37 ADP stations in the country, where the agricultural extension personnel are domiciled. The spatial location of the research institutes and ADP stations in the states and agricultural zones are as given in Table 4.2.

Table 4.1: National Research Institutes and their locations in Nigeria

SN	Research Institutes	Location	State
1	Cocoa Research Institute of Nigeria (CRIN)	Ibadan	Oyo
2	Federal Institute of Industrial Research, Oshodi (FIIRO)	Oshodi	Lagos
3	Forest Research Institute of Nigeria (FRIN)	Ibadan	Oyo
4	Institute of Agricultural Research (IAR)	Kaduna	Kaduna
5	Institute of Agricultural Research and Training (IAR&T)	Ibadan	Oyo
6	Lake Chad Research Institute (LCRI)	Maiduguri	Borno
7	National Agricultural Extension and Research Liaison Services (NAERLS)	Kaduna	Kaduna
8	National Animal Production Research Institute (NAPRI)	Zaria	Kaduna
9	National Cereal Research Institute (NCRI)	Badeggi	Niger
10	National Institute for Freshwater Fisheries Research (NIFFR)	New Bussa	Niger
11	National Institute for Horticultural Research (NIHORT)	Ibadan	Oyo
12	National Institute for Oil Palm Research (NIFOR)	Benin City	Edo
13	National Institute for Trypanosomiasis Research (NITR)	Kaduna	Kaduna
14	National Root Crops Research Institute (NRCRI)	Umudike	Abia
15	National Veterinary Research Institute (NVRI)	Vom	Plateau
16	Nigerian Institute of Oceanography and Marine Research (NIOMR)	Lagos	Lagos
17	Nigerian Stored Products Research Institute (NSPRI)	Ilorin	Kwara
18	Rubber Research Institute of Nigeria (RRIN)	Benin City	Edo

Source: Bukar *et al* (1997)

Table 4.2: National Agricultural Research Institutes (NARIs) and Agricultural Development Programmes (ADPs) as they fall in the 5 agricultural zones

	SW ZONE	SE ZONE	C ZONE	NW ZONE	NE ZONE
National Agricultural Research Institutes	CRIN, FRIN, IAR&T, RRIN, NIOMR, NIHORT, NIFOR, FIIRO.	NRCRI	NCRI, NIFRR, NSPRI, NVRI.	IAR, NAPRI, NAERLS, NITR.	LCRI
Agricultural Development Programmes (ADPs)	Bayelsa, Edo, Delta, Ekiti, Lagos, Ogun, Ondo, Osun, Oyo.	Abia, Imo, Akwa-Ibom, Anambra, Enugu, Cross-River, Ebonyi, Rivers.	Abuja, Niger, Benue, Kogi, Kwara, Taraba, Nassarawa, Plateau.	Kaduna, Katsina, Kebbi, Kano, Zamfara, Sokoto.	Adamawa, Bauchi, Borno, Gombe, Yobe, Jigawa.

Source: Bukar *et al* (1997)

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4.6 Sampling procedure and sample size

A multistage sampling procedure was used to select the researchers, extension agents and farmers as respondents for the study.

4.6.1 Selection of researchers

A multi-stage sampling procedure was used to select the research personnel from the research stations in the five (5) agricultural zones in the country.

Stages involved

i.   A random selection of one-third of the research stations from South-Western, Central, and North-Western agricultural zones. Then, a selection of the only research stations at South-East and North-East agricultural zones. Seven research institutes were therefore selected from six states. Detail of the selection is as given in Table 4.3.

ii.   Twenty percent (20%) of the personnel at the selected research stations were sampled using a simple random sampling technique. Details of the selection and the sample size are as given in Table 4.4.

Table 4.3: Selected agricultural research institutes in the 5 agricultural zones

Agricultural zones	Number of research institutes	33% selected	Institutes selected	States involved
South-West	8	3	IAR&T, NIFOR and FRIN	Oyo and Edo
South-East	1	1	NRCRI	Abia
Central	4	1	NCRI	Niger
North-West	4	1	IAR	Kaduna
North-East	1	1	LCRI	Borno
Total	**18**	**7**		**6**

Source: Field survey (2007)

Table 4.4: Sampling procedure for the research institutions' personnel

Agricultural zones	Research institutes selected	Scientists	Number sampled (20%)	Number returned
South-West	IAR&T	62	12	12
	NIFOR	52	10	9
	FRIN	38	8	8
South-East	NRCRI	41	8	8
Central	NCRI	61	12	12
North-West	IAR	39	8	8
North-East	LCRI	25	5	5
Sub-Total		**318**	**63**	**62 (98%)**

Source: Field survey (2007)

4.6.2 Selection of ADP Extension agents

A multi-stage sampling procedure was used to select the agricultural extension practitioners at the states ADPs in the country.

Stages involved

i. Selection of the ADP stations that are based in the states where the research institutes have been selected.

ii. Twenty (20%) percent of the extension agents at the selected ADP stations were sampled using simple random technique. Detail of the sampling is as given in Table 4.5.

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Table 4.5: Sampling procedure for the ADP stations' personnel

Agricultural zones	ADP stations selected	Extension agents	Number sampled (20%)	Number returned
South-West	Oyo	158	32	30
	Edo	74	15	15
South-East	Abia	148	30	30
Central	Niger	125	25	19
North-West	Kaduna	158	32	25
North-East	Borno	159	32	27
Total		**822**	**166**	**146 (88%)**

Source: Field survey (2007)

4.6.3 Selection of farmers

A multi-stage sampling procedure was used to select the farmers through the states ADPs in the country.

Stages involved

i.   Selection of the farmers from the states ADPs that were selected.

ii.   Selection of 35 farmers using simple random technique from the list of farmers in the selected states ADPs. Detail of the sampling is as given in Table 4.6

Table 4.6: Sampling procedure for the selection of farmers

Agricultural zones	Selected ADP stations	Farmers selected	Number returned
South-West	Oyo	35	34
	Edo	35	31
South-East	Abia	35	31
Central	Niger	35	33
North-West	Kaduna	35	35
North-East	Borno	35	35
Total		**210**	**199 (95%)**

Source: Field survey (2007)

4.7 Operationalisation of the variables of the study

The variables of the study were measured and operationalised as given in Table 4.6. The dependent variable, in the practitioners' instrument, is their level of use of ICTs. The dependent variable for the farmers' instruments is their willingness to use the ICT mediated information. The details of exact measurement can be seen in the attached questionnaires in the appendix (Appendix 1).

Table 4.6a: Measurement and operationalisation of the variables of the study

Variables	Measurement	Level of measurement	Operationalisation
Research instrument for the research and extension practitioners			
Sex	To indicate a response from listed choices	Nominal	Counted and described
Age	To indicate the exact age in years	Interval	Categorised and described
Marital status	To indicate a response from listed choices	Nominal	Counted and described
Research/extension practitioner	To indicate a response from listed choices	Nominal	Counted and described
Rank	To indicate the actual rank	Nominal	Counted and described
Grade level	To indicate the actual grade level	Interval	Categorised and described
Number of years in service	To indicate the actual no of years	Interval	Categorised and described
Line of activity	To indicate all applicable responses from listed choices	Nominal	Counted and described
Academic qualification	To indicate a response from listed choices	Ordinal	Ordered and described
Computer training	To indicate a response from listed choices	Ordinal	Ordered and described
Information documentation	To indicate a response from listed choices	Ordinal	Ordered and described
Information facilities used	To indicate all applicable responses from listed choices	Interval	Index was created for facilities used
Assessment of current way of information delivery	To indicate a response from listed choices	Ordinal	Ordered and described
Feedback from audience	To indicate a response from listed choices	Ordinal	Ordered and described
Interaction with computer	To indicate a response from listed choices	Ordinal	Ordered and described
Average period of computer use	To indicate a response from listed choices	Ordinal	Ordered and described
Official access to computer	To indicate a response from listed choices	Ordinal	Ordered and described
What resources do you use on the web	To indicate all applicable responses from listed choices	Ordinal	Ordered and described
Adequacy of ICT facility	To indicate all applicable responses from listed choices	Ordinal	Ordered and described
Access to the Internet	To indicate a response from listed choices	Ordinal	Ordered and described
ICT formats availability for official use	To indicate a response for all listed facilities	Interval	Index was created for level of ICT use

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Constraints to ICT availability for official use	To indicate a response for all listed facilities	Interval	Index was created for level of constraint to ICT use
Level of ICT knowledge	Responses to knowledge test was graded and scored	Interval	Categorised and described
Perceptions on the use of ICT for extension information dissemination	To indicate a response for all the perception statements	Interval	Index was created for perception
Importance of ICTs to work schedule	To indicate a response for all the ICT formats assessed	Interval	Index was created for ICT importance
Sustainability of ICT use for agricultural information services	To indicate a response for all the perception statements	Interval	Index was created for perception to sustainable use
Research instrument for the farmers			
Variables	**Measurement**	**Level of measurement**	**Operationalisation**
Age	To indicate the exact age in years	Interval	Categorised and described
Sex	To indicate a response from listed choices	Nominal	Counted and described
Religion	To indicate a response from listed choices	Nominal	Counted and described
Marital status	To indicate a response from listed choices	Nominal	Counted and described
Family size	To indicate the exact number of persons in the family	Interval	Categorised and described
Crop production as an enterprise?	To indicate a response from the dichotomous choices	Nominal	Counted and described
Crops cultivated	To indicate all applicable responses from listed choices	Ordinal	Index of number of enterprises created
Animal production as an enterprise?	To indicate a response from the dichotomous choices	Nominal	Counted and described
Animals reared	To indicate all applicable responses from listed choices	Ordinal	Index of number of enterprises created
Education	To indicate as number of years in formal schools	Interval	Categorised and described
Telecentre in own community?	To indicate a response from the dichotomous choices	Ordinal	Counted and described
Custodian/owner of the centre	To indicate all applicable responses from listed choices	Nominal	Counted and described
Do you patronise telecentre?	To indicate a response from the dichotomous choices	Nominal	Counted and described
Benefit accrued from telecentre	To indicate all applicable responses from listed choices	Ordinal	Ordered and described
Most important benefit	To indicate a response from listed choices	Ordinal	Ordered and described

Is there financial commitment to centre?	To indicate a response from the dichotomous choices	Nominal	Counted and described
Are you financially committed?	To indicate a response from the dichotomous choices	Nominal	Counted and described
Information sources	To indicate all applicable responses from listed choices	Ordinal	Index of number of information sources was created
Ranking of information sources	To indicate the rank for listed sources	Ordinal	Ordered and described
Frequency of information from agency/ies	To indicate all applicable responses to listed choices	Ordinal	Index of access to information was created
Ranking of information needs	To indicate the rank for listed needs	Ordinal	Ordered and described
Availability of information needed	To indicate all applicable responses to listed choices	Ordinal	Index of information availability was created
Willingness to use ICT mediated information	To indicate responses to the listed items	Ordinal	Index of willingness to use ICT was created
Willingness to pay for services	To indicate a response from listed choices	Ordinal	Ordered and described

The index (weighted score) of **information provision by service organisations** was created in order to ascertain the organisation that provides information most to the respondents. This was done by multiplying the assigned (ordinal) scores with the number of respondents to each of the response options; the products of the multiplications were then summed together.

Index (weighted score) of **information availability** was created in order to show the extent of availability of the various information types to the respondents. This was also done by multiplying the assigned (ordinal) scores with the number of respondents to each of the response options; the products of the multiplications were then summed together.

The index of **farmers' willingness to use ICTs** was created by adding the (ordinal) scores assigned to the response options to the related questions for each of the respondents. This gave the extent to which each of the respondents is willing to use the ICTs for their information seeking activities. The index was categorised into two (least willing and most willing) using the above and below the mean classification criterion.

The index of **constraints encountered** was created by adding together the assigned (ordinal) scores to each of the response options for each of the respondents. This gave the

severity of the constraints encountered by respondents. The index was later categorised into two based on above and below the mean classification criterion.

Level of practitioners' ICT knowledge was measured as a knowledge score at interval level. This was later categorised into two (high and low) levels on the basis of above and below the mean classification criterion.

The **attitudinal statements** were operationalised by assigning values to the responses as follows;

Response options	Positive statements	Negative statements
Strongly Agree (SA)	5	1
Agree (A)	4	2
Undecided (U)	3	3
Disagree (D)	2	4
Strongly Disagree (SD)	1	5

The responses were summarised by constructing an attitudinal index of the respondents by adding the assigned (ordinal) scores to each the responses in the statements. Hence, for the 10-statement attitudinal scale, a respondent can have a maximum of 50 points and a minimum of 10 points.

4.8   Analysis of objectives and hypotheses of the study

An analysis of the objectives and hypotheses of the study was carried out as shown in Table 4.7. The data requirement and analytical tool are as indicated.

Table 4.7: Analysis of the objectives and hypotheses of the study

Objectives/Hypotheses	Meaning	Respondent	Data requirement	A priori - expected signs	Analytical tool
1. Ascertain the extent of use of ICTs in the current extension delivery strategy in the country	To find out the extent of use of ICT tools by research/extension personnel	Research and Extension practitioners	• ICT tools used • Extent of use of the tools • Use to which ICTs are put		Descriptive statistics
2. To determine the extent to which the existing extension delivery system has fulfilled the need of agricultural research/extension practitioners	To find out how the research and extension agents assess the delivery strategy in use	Research and Extension practitioners	• Adequacy of facilities • Achievement of interaction with end-users • Adequacy of delivery method in use	+ + +	Descriptive statistics
3. Examine the level of knowledge of the extension and research personnel about the use of new ICTs for agricultural and rural development activities in the country	To find out the extent of proficiency of the practitioners about the use of ICTs in their activities	Research and Extension practitioners	• Performance in the knowledge test for the research and extension	+	Descriptive statistics
4. Determine the dispositions of extension and research personnel to the use of ICT for agricultural and rural development activities in the country	To find out the views of the agents about the use of ICTs in their activities	Research and Extension practitioners	• Responses to the attitudinal statements	+	Descriptive statistics

Objectives/Hypotheses	Meaning	Respondent	Data requirement	A priori - expected signs	Analytical tool
5. Ascertain the information need profile of the farmers in the country	To know the information need and ways of fulfilling the needs by farmers	Farmers	• Information channels available • Ranking of importance of channels • Access to information • Rank of information needs • Access to telecentres	+ + +	Descriptive statistics
6. Assess the research/extension personnel's perceptions on the sustainable deployment of ICTs for agricultural information dissemination in Nigeria	To know the agents' view about the sustainable issues in the use of ICTs in their activities	Research and Extension practitioners	• Responses to attitudinal statements on the issues	+	Descriptive statistics
7. Ascertain the factors that determine that use of ICTs for agricultural and rural development in Nigeria	To find out the factors that influence the use and willingness to use ICTs	• Research and Extension practitioners • Farmers	• Agents' personal & professional characteristics • Farmers' personal and enterprise characteristics		Multinomial logit regression model Binomial logit regression model

Objectives/Hypotheses	Meaning	Respondent	Data requirement	A priori - expected signs	Analytical tool
Hypothesis 1. Test of relationship between level of knowledge and extent of use of ICTs among the research and extension practitioners	To find out the extent to which the practitioners' knowledge of ICT use influenced their use of ICTs	• Research and Extension practitioners	• Level of knowledge of use of ICTs • Level of use of ICTs	+	Spearman rho correlation
Hypothesis 2. Test of relationship between attitude to use and extent of use of ICTs among the research and extension practitioners	To find out the extent to which the practitioners' attitude influenced the use of ICTs	• Research and Extension practitioners	• Index of attitude to use of ICTs • Index of use of ICTs	+	PPMC
Hypothesis 3. Test of relationship between selected socioeconomic characteristics of the farmers and their information needs	To find out the extent to certain socioeconomic characteristics influenced the information needs of farmers	• Farmers	• Socioeconomic characteristics • Level of availability of information needs	+	Chi - square
Hypothesis 4. Test of difference in the attitudes of the research and the extension personnel to the use of ICTs	To find out the difference between the attitudes of researchers and that of extensionists to the use of ICTs	• Research and Extension practitioners	• Index of attitude to use of ICTs	+	Independent sample t-test
Hypothesis 5. Test of difference in the extent of use of ICTs by the research and extension personnel	To find out the difference between the extent of ICTs use by researchers and extensionists	• Research and Extension practitioners	• Index of use of ICTs		Independent sample t-test

4.9   Data analysis and analytical tools

Hypothesis 1: There is no significant relationship between the level of knowledge and extent of use of ICT among the research and extension practitioners.

Level of practitioners' ICT knowledge was measured as a knowledge score at interval level. Index of level of use of ICTs was constructed from their responses to the questions; hence, the hypothesis was pursued by analysing the data using the Pearson Product Moment Correlation (PPMC).

Hypothesis 2: There is no significant relationship between the attitude to use and extent of use of ICT among the research and extension practitioners.

The attitude of the practitioners to the use of ICTs was measured on a Likert scale; an index of the scores was derived and grouped; so also, the index of use of ICTs was categorised. The two variables being at ordinal level of measurement, the hypothesis was analysed using Spearman (rho) rank correlation.

Hypothesis 3: There is no significant relationship between selected socioeconomic characteristics of the farmers and their information needs.

The socioeconomic characteristics of the farmers used in the analysis are age, sex, religion, marital status, family size, education, crop production enterprises, livestock production enterprises and other agricultural production enterprises. The farmers indicated their information needs; the index (count) of the information needs (an indication of the extent to which a farmer seeks information more than others) was analysed against the selected socioeconomic characteristics of the respondents using Chi-square.

Hypothesis 4: There is no significant difference in the attitude of the research personnel and the extension personnel to the use of ICTs

This hypothesis involved measurement of the two set of practitioners' attitude on an opinion scale, which was used to derive their perception (index) scores. It was then analysed using independent samples t-test.

Hypothesis 5: There is no significant difference in the extent of use of ICTs by the research and extension personnel.

The extent of use of ICTs by the two set of practitioners was measured from which index of use was derived. Their scores were analysed using independent samples t-test.

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CHAPTER FIVE

RESULTS AND DISCUSSION

5.1 Personal characteristics of the respondents

This section discusses the socioeconomic characteristics of the farmers as well as the personal and professional characteristics of research/extension practitioners in the study area.

5.1.1 Personal characteristics of farmer-respondents

The personal characteristics of the farmer-respondents discussed are age, sex, religion, marital status, education and family size. Table 5.1 below showed the distribution of the variables.

Age - The age of the farmer-respondents were categorised into four age groups and the distribution as shown in Table 5.1 revealed that the farmers had a mean age of 43.24 years. It showed that 25.1 percent were between the age range of 20 and 34 years, 15.6 percent fell between 35 and 40 years, 45.2 percent of them fell between 41 and 55 years of age while 13.6 percent were between the ages of 56 and 70 years. This shows that most of the farmers were still in their active years. This finding is consistent with the finding of Salimonu (2007) who reported a mean age of 48.1 years for farmers in Osun state. The implication is that the age of an individual affects his mental attitudes to ideas and circumstances. Younger farmers have been found to be more knowledgeable about new practices and may be more willing to bear the risks of adopting a new technology (Olaniyi and Raufu, 2005).

Sex – Distribution of the farmers by sex showed that 89.4 percent of them were male, while 10.6 percent of them were female. This implies that women are not mostly involved in the basic agricultural enterprises in the country. This finding is not surprising given the acknowledged fact of socioeconomic relegation of women in Nigeria, where they are disadvantaged in terms of rights of inheritance and land ownership. Added to this is gender discrimination in respect of land holdings in most communities where women do not have ownership rights over land, although they may have user rights (Manyong et al, 2005). In the same vein, access to extension is very limited for women farmers (Olawoye, 1993), which may inform this finding as the farmers were selected through agricultural extension agencies.

Religion – Results revealed that 52.3 percent of the farmer-respondents were Muslims, 42.6 percent were Christians and 1.0 percent of them were traditional religion adherents.

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Marital status – The distribution by this variable showed that 12.1 percent of the farmer-respondents were single, 86.9 percent of them were married and 0.5 percent of them were widowed. It revealed that most of the respondents were married. According to Salimonu (2007), married persons are expected to be more averse to risk than unmarried persons because of the fact that they may have more family sizes. Such risk aversions make people less likely to adopt technologies because of fear of implication of failure of such ventures.

Education – Responses to this variable revealed that 28.1 percent of the farmer-respondents completed primary education while 31.7 percent had no formal education. The modal response category was no formal education, while the average number of years spent in formal educational institutions was 6.9 years. This shows that the farmers generally had low level of educational attainment. Economic theory posits that people's perceptions are influenced by information and human capital (Bamire and Amujoyegbe, 2005). It is therefore expected to influence the extent of use of new technologies among the farmers.

Family size – Results also revealed that 22.1 percent of the farmer-respondents had family size of between 1 and 4 persons, 55.8 percent had between 5 and 10 persons and 8.5 percent had between 15 and 28 persons. The modal group is between 5 and 10 persons while the average family size is 7.28, which depicts a fairly large family size. Household size has considerable implication for food security in terms of number of dependants on family resources and also in terms of family labour availability for resource generation in some instances. The implication of this is that people with large family sizes are less likely to adopt technologies than people with lesser family sizes because of fear of consequence of failure of such risks (Salimonu, 2007).

Table 5.1: Personal characteristics of farmer-respondents

Variable	Frequency	Percent	Parameters
Age			
20 - 34 years	50	25.1	Mean = 43.24
35 - 40 years	31	15.6	Median = 44.00
41 - 55 years	91	45.7	Mode = 45.00
56 – 70 years	27	13.6	S.D = 11.16
Sex			
Male	178	89.4	Mode = Male
Female	21	10.6	
Religion			
Islam	104	52.3	Mode = Islam
Christianity	92	46.2	
Traditional	2	1	
No Response	1	0.5	
Marital Status			
Single	24	12.1	Mode = Married
Married	173	86.9	
Widow	1	0.5	
No Response	1	0.5	
Education			
Primary education	56	28.1	Mean = 6.94
Secondary education	39	19.6	
Tertiary education	41	20.6	
No Formal education	63	31.7	
Family Size			
1 – 4	44	22.1	Mean = 7.28
5 – 10	111	55.8	Median = 6.00
11 – 14	13	6.5	Mode = 6.00
15 – 28	17	8.5	S.D = 4.55
No Response	14	7	
Total	199	99.9	

Source: Field survey (2007)

5.1.2 Enterprise characteristics of farmer-respondents

The enterprise characteristics of the farmer-respondents and their access to community telecentres in their locality are discussed in this section.

Agricultural enterprise characteristics – The result of farmers' responses to the variables as shown in Table 5.2 revealed that 92.5 percent of them were mainly involved in crop production, 49.2 percent were involved in livestock production and 1.3 percent of them were engaged in mini-livestock production enterprises. This implies that most of the farmers were engaged in crop production enterprises, while fewer but substantial proportion was involved in livestock enterprises.

The farmers' responses to the specific agricultural enterprises in which they are involved was given on multiple response basis; it showed that 44.2 percent of the farmers were involved in maize production enterprises, 38.2 percent in cassava production, 35.7 percent in millet/guinea corn production, 19.6 percent in yam production and 0.5 percent in cocoa production. This revealed that maize, cassava and millet/guinea corn dominated crop production enterprises among the farmers in the study area.

Distribution of the specific livestock production enterprises in which the farmers were involved showed that 10.6 percent of the farmers were involved in cattle rearing, 11.1 percent in poultry, 36.2 percent in sheep and goat, while 1.0 percent of them were involved in piggery production enterprise. This revealed that sheep and goat is the most patronised livestock enterprise in which farmers are engaged in the study area.

Farmers' involvement in agricultural enterprises was pursued further by assessing the number of enterprises in which the respondents were involved so as to describe their extent of diversification. Distribution of their responses showed that 20.6 percent were involved in only one enterprise; 68.8 percent of them are those who had between two and four enterprises; and 7.5 percent of them had between five and seven enterprises. This shows that most of the farmers were involved in more than one enterprise, while those with two and four enterprises were in the majority.

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Table 5.2: Distribution of farmer-respondents by enterprise characteristics

Enterprise characteristics	Frequency	Percent
Main agricultural production enterprise		
Crop production	184*	92.5
Livestock production	98	49.2
Mini-livestock production	3	1.3
Specific crop production enterprises		
Maize	88	44.2
Cassava	76	38.2
Yam	39	19.6
Cowpea	36	18.1
Potato	4	2.0
Millet/Guinea corn	71	35.7
Rice	31	15.6
Groundnut	18	9.0
Vegetable	29	14.6
Cocoa	1	0.5
Specific livestock production enterprises		
Cattle	21*	10.6
Poultry	22	11.1
Sheep/Goat	72	36.2
Piggery	2	1.0
Number of enterprises		
One only	41	20.6
Between 2 and 4	137	68.8
Between 5 and 7	15	7.5
No response	6	3.0
Total	**199**	**100.0**

* Multiple responses
Source: Field survey (2007)

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5.1.3 Personal characteristics of the research/extension practitioners

The personal characteristics of the research/extension personnel discussed are age, sex, marital status, academic qualification, and level of computer training. Table 5.3 showed the distribution of the respondents by their personal characteristics.

Age – The research/extension personnel's age was categorised and described; the distribution showed that 23.3 percent of the researchers fell within the age bracket of 20 and 34 years, 46.6 percent were between 41 and 55 years and 1.4 percent of them were between 56 and 65 years of age. This showed that most of them fell within 41 and 55 years age bracket while the mean age was 40.3 years. This infers that most of the practitioners are still in their active age.

The extensionists' age distribution showed that 14.1 percent of them fell within the age bracket of 20 and 34 years, 60.0 percent were between 41 and 55 years and 3.7 percent of them were between 56 and 65 years of age. This showed that most of them also fell within 41 and 55 years age bracket while the mean age was 42.8 years. This infers that most of the practitioners are still in their active age.

This is in consonance with the findings of Fameso (1992) and Oyedokun (2000), who reported modal age group of between 41 and 50 years for research scientists in Nigeria.

Sex – Distribution of the research respondents by sex revealed that 90.4 percent of the respondents were male, while 9.6 percent were female. This means that most of the research practitioners were male. As for the extension respondents, their distribution by sex revealed that 83.7 percent of them were male, while 16.3 percent were female. This means that most of the extension practitioners also were male.

This finding is consistent with that of Alao (2004), who reported male domination of the Nigerian research/extension organisations.

Marital status – Among the researchers, the singles constitute 11.0 percent of the respondents and 86.3 percent were married. Among the extensionists, 6.7 percent of them were singles and 91.9 percent were married.

This revealed that most of the practitioners were married. Alao (2004) also found that 84.0 percent of the practitioners in Nigerian agricultural system were married.

Academic qualification – The distribution of the research practitioners by academic qualification showed that 13.7 percent of them had diploma, 35.6 percent had Masters degree and 20.5 percent had PhD degrees. This revealed that most of the researchers had Masters degree.

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The extensionists' distribution showed that 0.7 percent of them had O - level certificate, 55.6 percent had Diploma, while only 1.5 percent of them had Ph.D degree. This revealed that most of the extensionists had diploma certificate.

These set of findings revealed that the researchers are generally more educated than the extensionists.

Level of computer training – Distribution of the research practitioners' computer training showed that 47.9 percent of them had learnt the use of computer on-the-job, 23.3 percent had diploma certificate in computer training and 6.8 percent had it taught within formal academic curriculum. This distribution showed that most of researchers learnt the use of computer while using it.

The extensionists' computer training distribution showed that 37.8 percent of them had no computer training at all, 27.4 percent had learnt the use of computer on-the-job and 11.1 percent had it taught within formal academic curriculum. This distribution shows that most of extensionists do not have any form of training at all.

These set of findings are indications of dearth of capacity for the use of the critical ICT facility. This constitutes an important factor that is likely to influence the extent to which the practitioners will use the new information and communication technologies in their official activities.

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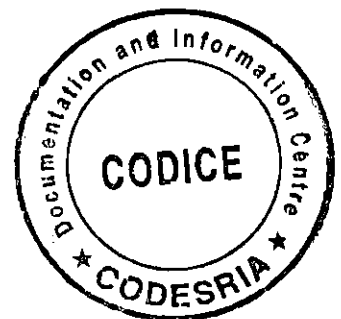
Table 5.3: Distribution of personal characteristics of research/extension personnel

Variable	Response options	Researchers	Extensionists	Parameters
Age	20 - 34 years	17 (23.3)	19 (14.1)	Mean = 41.93
	35 - 40 years	21 (28.8)	30 (22.2)	Median = 42.00
	41 - 55 years	34 (46.6)	81 (60.0)	Mode = 42.00
	56 - 65 years	1 (1.4)	5 (3.7)	S.D = 7.59
Sex	Male	66 (90.4)	113 (83.7)	Mode = Male
	Female	7 (9.6)	22 (16.3)	
Marital status	Single	8 (11.0)	9 (6.7)	
	Married	63 (86.3)	124 (91.9)	Mode = Married
	Widow	0 (0.0)	2 (1.0)	
	Widower	2 (2.7)	0 (0.0)	
Academic qualification	O-Level	0 (0.0)	1 (0.7)	
	Diploma	10 (13.7)	75 (55.6)	Mode for extensionists = Diploma
	Bachelor Degree	22 (30.1)	36 (26.7)	
	Masters Degree	26 (35.6)	21 (15.6)	Mode for researchers = Masters degree
	PhD	15 (20.5)	2 (1.5)	
Level of computer training	No Training at all	4 (5.5)	51 (37.8)	Mode for extensionists = Learning on-the-job
	Learning on-the-job	35 (47.9)	37 (27.4)	Mode for researchers = Learning on-the-job
	Certificate	12 (16.4)	8 (5.9)	
	Diploma	17 (23.3)	24 (17.8)	
	Taught within formal academic curriculum	5 (6.8)	15 (11.1)	
	Total	**73 (100.0)**	**135 (100.0)**	

Source: Field survey (2007)

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5.1.4 Professional characteristics of research/extension personnel

The professional characteristics of the research/extension respondents considered are professional practice, number of years in service, line of activity, information storage method and facilities used in their activities. Their responses are as given in Table 5.4.

Number of years in service – Distribution of research practitioners by the number of years in service revealed that 24.7 percent of them had spent between 1 and 6 years on their jobs, 46.6 percent had between 7 and 15 years of experience, while 4.1 percent had between 26 and 34 years of experience. It showed that most of the personnel had between 7 and 15 years in service.

As for the extensionists, 43.0 percent of them had between 7 and 15 years of experience, 34.1 percent had between 16 and 25 years, while 10.4 percent had between 26 and 34 years of experience. It showed that most of the extension personnel also had between 7 and 15 years in service.

It showed that most of the respondents had spent appreciable period of time in their professions. This finding is in tandem with the finding of Olowu *et al* (2004), who found similar trend in the years of experience of agricultural information practitioners in Nigeria. This suggests that they would be in position to appreciate and respond appropriately to issues regarding the use of ICTs in their service delivery activities.

Line of activity – The distribution of the research respondents by the official duties they are involved in (in multiple responses) as given in Table 5.9 showed that 12.3 percent were involved in administration, 84.9 percent of them were involved in research and 11.0 percent were involved in extension/information dissemination activities.

For the extension personnel, their responses showed that 14.8 percent were involved in administration, 20.7 percent in field survey and 56.3 percent were involved in extension/information dissemination activities.

Information storage method – The practitioners were required to indicate the medium they mostly used method in storing information of their activities. The distribution of the researchers' responses showed that 52.1 percent of them mainly use hard medium such as papers while 47.9 percent mainly use electronic media such as computers.

The extensionists' responses indicated that 80.0 percent of them mainly use hard medium such as papers while 20.0 percent mainly use electronic media such as computers.

This means that most of them still stored information in papers. This might be as a result of limited access to computer facility among the practitioners (Arokoyo, 2003). This finding is similar to that of Tahir *et al* (2010), who found that 69 percent of humanity scholars in Pakistan prefer print medium along with electronic resources.

Table 5.4: Distribution of research/extension personnel by professional characteristics

Professional characteristics	Researchers	Extensionists
Number of years in service		
1 – 6	18	17
	(24.7)	(12.6)
7 – 15	34	58
	(46.6)	(43.0)
16 – 25	18	46
	(24.7)	(34.1)
26 – 34	3	14
	(4.1)	(10.4)
Line of Activity*		
Administration	9	20
	(12.3)	(14.8)
Research	62	15
	(84.9)	(11.1)
Documentation	2	14
	(2.7)	(10.4)
Field survey	6	28
	(8.2)	(20.7)
Extension/Information Dissemination	8	76
	(11.0)	(56.3)
Mostly used storage method		
Hard medium (paper)	38	108
	(52.1)	(80.0)
Computer	35	27
	(47.9)	(20.0)
Total	**73**	**135**
	(100.0)	**(100.0)**

* Multiple responses

Source: Field survey (2007)

5.2   Objectives of the study

This section highlights the findings of the study that addressed the specific objectives according to how they were stated.

5.2.1   Information profile of the farmers

This objective was pursued by asking the farmers the information communication tools they have access to, rank how important the tools are to them, indicate frequencies of access to information from the sources, information needs, rank their information needs and indicate telecentre availability in their locality.

Available information communication tools

The distribution of the farmers' responses shown in Fig 5.1 revealed that 93.5 percent of them had access to radio, 81.9 percent had access to television, 35.0 percent had access to mobile phone, 43.7 percent had access to agricultural magazine and 54.3 percent had access to newspapers. This shows that a substantial proportion of the farmers had access to radio, TV, magazine and newspaper.

Importance of information communication tools

The farmers were required to rank the available ICTs by their relevance; 1 for the most important and 7 for the least important. Arithmetic mean was derived for their responses as given in Table 5.5. The result showed that most of the respondents rated radio as the most important, followed by TV, then mobile phone, newspaper, magazine and fixed phone in that order. This finding is consistent with that of Chapman and Slaymaker (2002) which recognised that popularity of local radio stations stems from engendering a sense of proximity with the listening community, which other media have not been able to achieve. The implication of this is that radio and television, of all the media, are the ones that can easily reach out to the grassroots communities in the country.
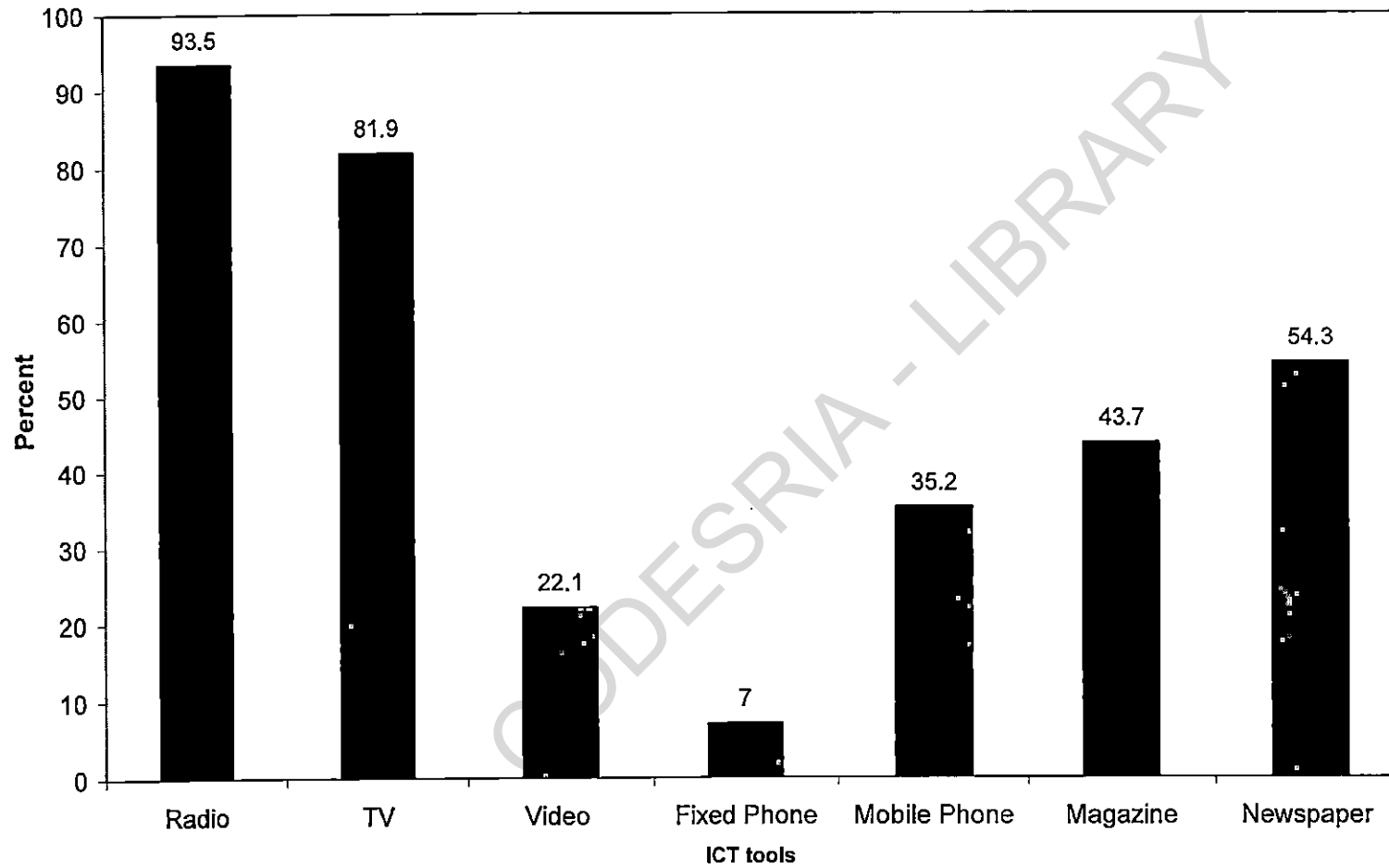
Fig. 5.1: Distribution of farmer-respondents by access to ICT tools

Table 5.5: Farmers' ranking of importance of ICTs (n=199)

ICT Tools	Mean importance	Rank
Radio	1.2125	1st
TV	2.4130	2nd
Mobile Phone	3.1607	3rd
Newspaper	3.4651	4th
Magazine	3.7015	5th
Video	4.1935	6th
Fixed Phone	4.3333	7th

Source: Field survey (2007)

Information sources

The study sought to identify the sources of information to the farmers by asking them to indicate their formal information sources. The focus here is different from informal information sources such as family/friends, neighbours, other farmers among others. They were asked to identify the organisations that provide information to them and the frequencies of provision of the information. Table 5.6 showed the distribution of their responses. The result showed that 64.8 percent of the farmers always get information from agricultural extension agencies, 21.1 percent often get it from them, 9.0 percent rarely get information from them and 5.0 percent never get information from them. It also showed that 16.6 percent of the farmers always get information from agricultural credit/cooperative organisations, 23.1 percent often get information from them, 24.6 percent rarely get information from them and 35.7 percent never get information from them. Farmers' responses also revealed that 18.1 percent of the farmers always get information from agricultural input dealers, 33.2 percent often get information from them, 18.1 percent rarely get information from them and 30.7 percent never get any information from them.

The distribution of their responses was used to construct indices of information provision by the various organisations, as highlighted in Fig 5.2. The result showed that agricultural extension agencies, with an index of 245.6, provide information to most of the farmers, followed by the NGOs with index of 151.4, then agricultural input dealers with 138.8, and followed by agricultural credit/cooperative schemes with index of 120.6. This showed that agricultural extension organisations provide information to most of the farmers in Nigeria. This finding is supported by the finding of Arokoyo (2003) that the nation's agricultural research and extension system (NARES) is the most important single determinant of the level of its agricultural development and hence the yard-stick of the quality of life of its people. The implication of this is that if other information types are made available to the extension systems, such information may easily reach majority of the farmers in the country. This underscores the importance of the extension system to agricultural information system in the country. According to UNDP (2001), such institutions constitute the mid-levels of government, the line managers who are often the implementers of initiatives. They are also seen as important identifiers and promoters of new initiatives.

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Table 5.6: Distribution of farmers by organisations that provide information to them (n=199)

Organisations	All the time	Often	Rarely	Never	Index of provision
Agricultural extension service agencies	129 (64.8)	42 (21.1)	18 (9.0)	10 (5.0)	245.6
Non Governmental Organisations	26 (13.1)	52 (26.1)	41 (20.6)	80 (40.2)	151.4
Agricultural input dealers	36 (18.1)	66 (33.2)	36 (18.1)	61 (30.7)	138.8
Agricultural credit/cooperative scheme	33 (16.6)	46 (23.1)	49 (24.6)	71 (35.7)	120.6

Figures in parentheses are percentages

Source: Field survey (2007)
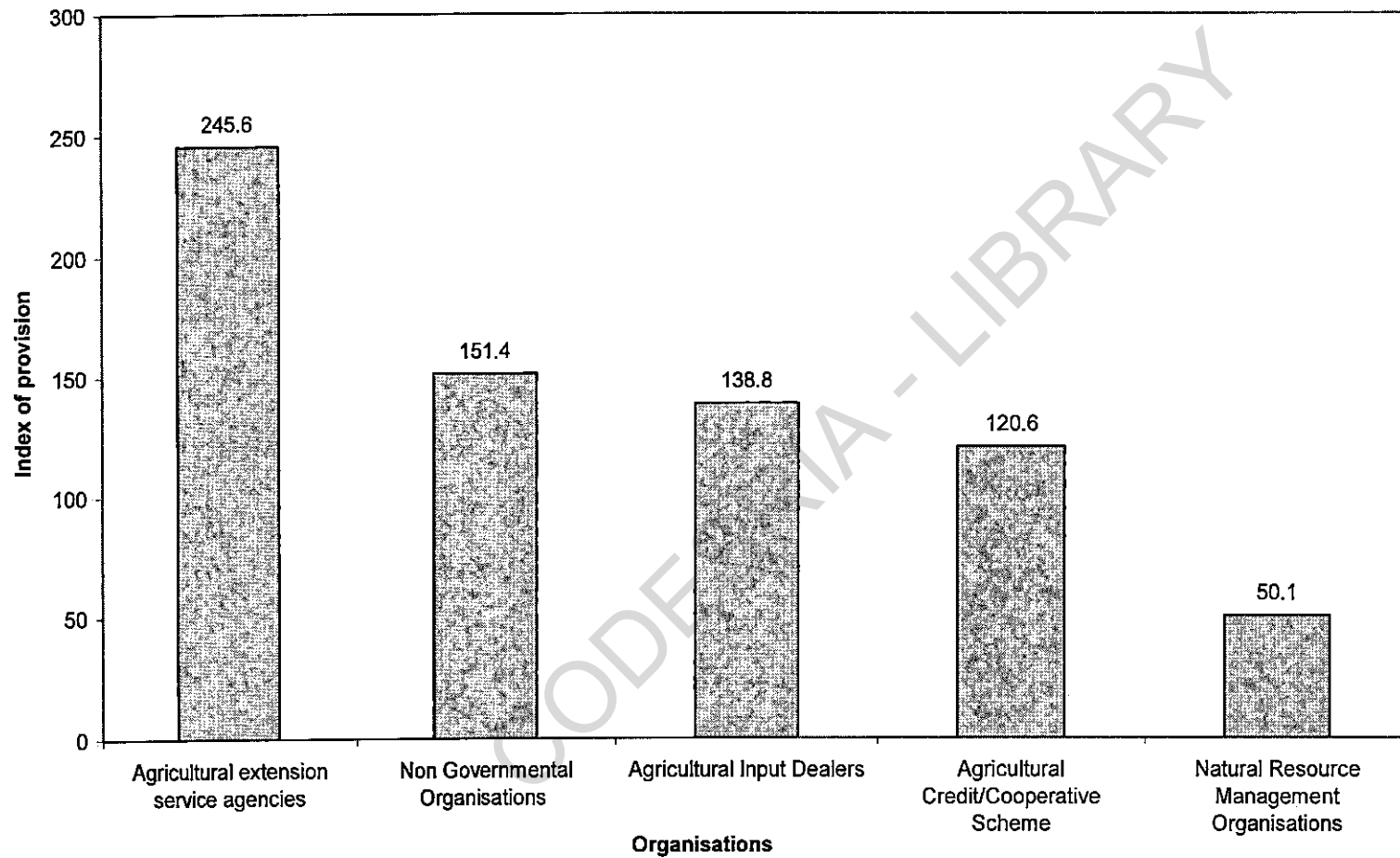
Fig 5.2: Distribution of organisation that provide information to farmers by index of provision

Information needs

The farmers were also required to assess the extent of availability of information needed by them. Distribution of their responses in Table 5.7 showed that agricultural production information was always available to 59.3 percent of them; the information was rarely available to 15.6 percent and never available to 25.1 percent of the farmers. It also showed that information on agricultural product price was always available to 32.7 percent of the farmers, rarely available to 27.1 percent and never available to 40.2 percent of them.

The distribution of the farmers' responses also showed that non-agricultural marketing information was always available to 11.1 percent of the respondents, rarely available to 13.1 percent and never available to 75.9 percent of the farmers. It also showed that weather information was always available to 19.6 percent of the farmers, rarely available to 18.1 percent and never available to 62.3 percent.

Farmers' responses also show that information on community development was always available to 30.7 percent, rarely available to 20.1 percent and never available to 49.2 percent of them. Information on skill acquisition was always available to 14.1 percent of the respondents, rarely available to 22.1 percent and never available to 63.8 percent of the farmers.

Indices of available information types were derived from these responses, as highlighted in the table, revealed that agricultural production information was the mostly available information type to most the farmer-respondents. Other types of information that were available to some extent were agricultural product price, community development, religious, politics and health information in that order.

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Table 5.7: Distribution of farmers by extent of availability of information type (n=199)

Information Type	Always	Rarely	Never	Availability index
Agricultural production information	118 (59.3)*	31 (15.6)	50 (25.1)	134.2
Agricultural product price information	65 (32.7)	54 (27.1)	80 (40.2)	92.5
Community development information	61 (30.7)	40 (20.1)	98 (49.2)	82.5
Religion	73 (36.7)	13 (6.5)	113 (56.8)	79.9
Politics	62 (31.2)	33 (16.6)	104 (52.3)	79.0
Health information	59 (29.6)	38 (19.1)	102 (51.3)	78.3
Other agricultural marketing information	37 (18.6)	47 (23.6)	115 (57.8)	60.8
Weather information	39 (19.6)	36 (18.1)	124 (62.3)	57.3
Education	47 (23.6)	12 (6.0)	140 (70.4)	53.2
Skill acquisition	28 (14.1)	44 (22.1)	127 (63.8)	50.3
Food/Nutrition information	23 (11.6)	39 (19.6)	137 (68.8)	42.8
Non-agricultural marketing information	22 (11.1)	26 (13.1)	151 (75.9)	35.3

Figures in parentheses are percentages

* Multiple responses

Source: Field survey (2007)

The information availability index to the respondents was classified into two (low and high) categories, based on above and below the mean criterion. The distribution of the categories in Table 5.8 showed that 57.8 percent of the farmers fell within the low level category of information availability while 42.2 percent fell within high level category of information availability. This showed that most of the farmers in the country do not have their information needs met. This infers that despite the pervasive outreach of the extension systems, the information needs of the target audience were not met. This is probably because the extension institutions lacked most of the information items desired by the farmers in the country. This may also be because of the fact that the extension system has not been working on the basis of the theoretical framework of overall information needs of farmers, being an instance of inadequacy in the system (Ozowa, 1995).

Table 5.8: Distribution of farmers by levels of their information needs

Level of availability	Frequency	Percent
Low	115	57.8
High	84	42.2
Total	199	100.0

Source: Field survey (2007)

Farmers were also required to rank their information needs; 1 for the most important and 12 for least important. An arithmetic mean of the responses was derived as shown in Table 5.9. The result showed that agricultural production information is the most important information type to the farmers, followed by agricultural product price and other agricultural marketing information. Other information types that were favourably ranked were in the order: religion, health, community development and politics.

This finding is an indication of the priority of the information need of the farmers in the country. These constitute the information items that need to be provided in order to fulfil the information need of most of the farmers in the country. This finding is supported by the assertion of Ozowa (1995) and Aina (1985), who stated that the information needs of Nigerian small scale farmers revolve around the resolution of problems such as pest hazards, weed control, moisture insufficiency, soil fertility, farm credit, labour shortage, soil erosion etc, which are components of agricultural production information.

Table 5.9: Farmers' ranking of their information needs (n=199)

Information types	Mean	Rank
Agricultural Production Information	1.2419	1st
Agricultural Product Price Information	2.7157	2nd
Other Agricultural Marketing information	3.8621	3rd
Religion	4.0923	4th
Health information	4.3766	5th
Community Development information	4.4667	6th
Politics	4.5467	7th
Education	4.9524	8th
Weather Information	4.9623	9th
Food/Nutrition information	5.037	10th
Skill acquisition	5.0395	11th
Non-agricultural Marketing information	5.4138	12th

Source: Field survey (2007)

Mean = ranking/number of rankers

Farmers' access to telecentres was also assessed to follow the objective further. Distribution of their responses in Table 5.10 showed that 55.3 percent of them had telecentres in their locality, 75 percent of those who had telecentres patronise the centre and all (100.0 percent) of those who patronised the centres had one benefit or the other from their patronage.

The farmer-respondents who had telecentres in their localities but do not patronise them were asked to state their reasons. The distribution of their reasons showed that 4.5 percent felt that the centre was monopolised, 4.5 percent also gave the problem of custodian as their excuses, 31.8 percent adduced their reason to non-convenience of the centres' locations, 4.5 percent believed they do not need the centre and 54.5 percent do not state any reason. This infers that the most stated excuse is the non-convenience of the centre's location.

Farmers were also requested to specify the benefits they realised from patronising the telecentres. Distribution of their responses revealed that 51.1 percent of them indicated political information as their benefit, 47.7 percent indicated social information, 27.3 percent indicated leisure, 27.3 percent indicated social gathering forum, 65.9 percent of them stated agricultural operation information, and 6.8 percent get general information from the centres. This means that agricultural operation information was the specific benefit derived by most of the farmers. This finding might be as a result of the fact that agriculture is the main occupational engagement of the farmer-respondents.

The farmers were asked to specify the most important information benefits from the centres. The distribution of their responses show that 6.8 percent specified political information, 5.7 percent specified social information, 10.2 percent indicated leisure, 6.8 percent mentioned social gathering, 58.0 percent indicated agricultural operation information, 6.8 percent specified general information and 5.7 percent did not respond to the question. This shows that access to agricultural operation information is the most important benefit realised to most of the farmer-respondents.

Table 5.10: Distribution of farmers by telecentre availability factors in their locality (n=199)

Availability Factors	Frequency	Percent
Is telecentre available?	110	55.3
Do you patronise the centre?	88	75.0
Any benefit from the patronage?	88	100.0
Reason for not patronising the centres		
It is monopolised	1	4.5
Custodian problem	1	4.5
Location is not convenient	7	31.8
I don't need it	1	4.5
No response	12	54.5
Specific benefits realised*		
Political information	45	51.1
Social information	42	47.7
Leisure	24	27.3
Social gathering	24	27.3
Agricultural operation information	58	65.9
Most important benefit		
Political information	6	6.8
Social information	5	5.7
Leisure	9	10.2
Social gathering	6	6.8
Agricultural operation information	51	58.0
General information	6	6.8
No response	5	5.7
Total	88	100.0

* Multiple responses

Source: Field survey (2007)

5.2.2 Extent to which the current extension system fulfilled the need of agricultural information delivery

The responses to the questions on the information delivery factors as given by the researchers and extensionists are presented in Table 5.11.

Researchers - The research personnel assessed the adequacy of facilities used in their information delivery activities. Distribution of their responses show that 20.5 percent of them rated the facilities as just adequate, 58.9 percent assessed them as manageable and 20.5 percent believed the facilities are not adequate at all. This finding showed that the research practitioners generally rated the facilities as adequate.

This objective was also pursued by asking the practitioners to assess the extent of achieving end-users' feedback in their information delivery activities. Their responses show that 33.9 percent of them believed that they were able to achieve effective interaction/feedback from the end-users, 60.3 percent believed that they achieved minimal level of interaction and 6.8 percent responded that no end-user feedback was achieved. This revealed that most of the practitioners believed that they achieved minimal level of end-users' feedback.

The practitioners were also required to assess the current way of information delivery. The distribution of the researchers' responses show that 15.1 percent rated it as very good, 52.1 percent rated it as just adequate, 6.8 percent were indifferent, 21.9 rated it as inadequate and 4.1 percent believed the method in-use was obsolete. The finding shows that most of the researchers believed the current method of information delivery was adequate.

Extensionists - The extension personnel also assessed the adequacy of facilities used in their information delivery activities. Distribution of their responses show that 6.7 percent of them rated the facilities as just adequate, 34.8 percent assessed them as manageable and 58.5 percent believed the facilities were not adequate. This finding shows that the extensionists generally rated the facilities as inadequate.

The extensionists also assessed the extent of achievement of end-users' feedback in their information delivery activities. Their responses show that 33.3 percent believed they had been able to achieve effective interaction/feedback from the end-users, 52.6 percent believed they achieved minimal level of interaction and 14.1 percent responded that no end-user feedback was achieved. This revealed that most of the extensionists believed they achieved minimal level of end-users' feedback.

Extensionists gave an overall assessment of the current way of information delivery; the distribution of their responses show that 23.7 percent of them rated it as very good, 37.8

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percent rated it as just adequate, 9.6 percent were indifferent, 24.4 rated it as inadequate and 4.4 percent of them saw the method in-use as being obsolete. The finding shows that most of the extensionists perceived the current method of information delivery as adequate.

Given the fact that most of the extensionists indicated that the facilities are inadequate and generally rated the achieved end-users' feedback as minimal; their rating of the current method as adequate is deemed inconsistent. This might be due to the fact that they have no other method with which to compare. It is important to note that the researchers and extensionists differ in their assessments of the available ICT facilities in their institutions as highlighted in Fig 5.3. This might be connected with the fact of disparity in the funding of the activities of research and extension institutions in Nigeria.

Table 5.11: Distribution of research and extension personnel by information delivery factors

Information delivery factors	Researchers	Extensionists
Assessment of facilities		
Just adequate	15	9
	(20.5)	(6.7)
Manageable	43	47
	(58.9)	(34.8)
Not adequate at all	15	79
	(20.5)	(58.5)
Feedback facilitation		
Facilitated effective interaction achieved	24	45
	(32.9)	(33.3)
Minimal level of interaction achieved	44	71
	(60.3)	(52.6)
No interaction/feedback achieved	5	19
	(6.8)	(14.1)
Assessment of information delivery method		
Very Good	11	32
	(15.1)	(23.7)
Just Adequate	38	51
	(52.1)	(37.8)
Indifferent	5	13
	(6.8)	(9.6)
Inadequate	16	33
	(21.9)	(24.4)
Obsolete	3	6
	(4.1)	(4.4)
Total	**73**	**135**
	(100.0)	**(100.0)**

Figures in parentheses are percentages

Source: Field survey (2007)

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Fig. 5.3: Distribution of Researchers and Extensionists by their assessment of available ICT facilities

5.2.3 Attitudes of extension and research personnel to the use of ICT for agricultural extension delivery

This objective was pursued by eliciting responses to attitudinal statements from the research and extension practitioners. The distribution of their responses is presented separately in Tables 5.12 and 5.13.

Researchers – The responses of the research practitioners show that 94.5 percent of them agreed that ICT can facilitate networking of research activities for easy access to information by all and sundry and 5.5 percent were undecided about the statement. In the same vein, 95.8 percent agreed that ICT can facilitate international cross-fertilisation of ideas for better research efforts. The distribution also showed that 94.5 percent of the research practitioners agreed that use of ICT can facilitate exchange of information between research and extension institutions.

Distribution of the research personnel's responses also showed that 87.7 percent of them agreed that ICT use can incorporate feedback mechanism into research and extension activities and 12.3 percent were undecided about the idea. In the same vein, 89.8 percent of the practitioners agreed that ICT can facilitate incorporation of all stakeholders into research and extension services schedule.

The distribution of the responses also revealed that 34.3 percent of the researchers agreed that the idea of ICT use is elitist; any tangible benefit may not reach the farmers and 45.2 percent disagreed with the statement. Equally, 15.1 percent of the practitioners agreed that using ICT or making it available to farmers would render extension institution irrelevant and 71.2 percent disagreed with the opinion. Also, 28.8 percent of the respondents agreed with the statement that ICT use will not make extension delivery more effective than it has been while 60.2 percent disagreed with the statement.

The researchers' responses also show that 31.5 percent of them agreed with the statement that the cost of ICT acquisition is prohibitive and may never be realisable from government funding and 36.9 percent disagreed with the statement. Also, 17.8 percent of the respondents agreed with the opinion that the cost of acquiring ICT would be much more than the benefit that can ever come from its use, 23.3 percent of them were undecided and 58.9 percent disagreed with the statement.

Extensionists – The responses of the extension practitioners show that 87.4 percent of them agreed that ICT can facilitate networking of research activities for easy access to information by all and sundry. In the same vein, 86.7 percent agreed that ICT can facilitate international cross-fertilisation of ideas for better research efforts. The distribution also

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showed that 84.4 percent of the extension practitioners agreed that use of ICT can facilitate exchange of information between research and extension institutions.

Distribution of the extension personnel's responses also showed that 81.5 percent of them agreed that ICT use can incorporate feedback mechanism into research and extension activities. In the same vein, 65.9 percent of the practitioners agreed that ICT can facilitate incorporation of all stakeholders into research and extension services schedule and 8.1 percent disagreed with it.

The distribution of the responses also revealed that 27.4 percent of the extensionists agreed that the idea of ICT use is elitist; any tangible benefit may not reach the farmers and 38.5 percent disagreed with the statement. Equally, 16.3 percent of the extension practitioners agreed that using ICT or making it available to farmers would render extension institution irrelevant and 63.0 percent of them disagreed with the statement. Also, 25.2 percent of the respondents agreed with the statement that ICT use will not make extension delivery more effective than it has been while 53.4 percent of them disagreed with the statement.

The extensionists' responses also show that 45.2 percent of them agreed with the statement that the cost of ICT acquisition is prohibitive and may never be realisable from government funding and 17.1 percent of them disagreed with the statement. Also, 24.5 percent of the respondents agreed with the opinion that the cost of acquiring ICT would be much more than the benefit that can ever come from its use and 39.3 percent of them disagreed with the statement.

From the responses to the items on the scale, index was derived for each of the categories of respondents. The statistics for the responses of the research and extension practitioners were derived as follows:

Statistics of attitudes to the use of ICTs

	Researchers	Extensionists
Mean	39.62	36.33
Minimum	26	25
Maximum	50	50

Given the fact that the statistics of the constructed index does not align along the same value, the indices were therefore categorised using the 'above and below the mean' classification criterion for the two set of respondents;

Upper category ⇨   between the maximum & the mean   ⇨ Favourable

Lower category ⇨   between the minimum & just below mean   ⇨ Unfavourable

The categorisation of the attitudinal scores as given in Fig 5.4 showed that 69.9 percent of the research practitioners had favourable perception, while 30.1 percent of them had unfavourable perception about the use of ICT facilities in their activities. It also showed that 43.7 percent of the extension practitioners had favourable perception while 56.3 percent of them had unfavourable perception about the use of ICTs in their activities.

This infers that most of the researchers had favourable perception while most of the extensionists had unfavourable perception about the use of the ICT facilities in their activities. This might be as a result of the fact that the researchers have better access to the available ICTs that the extensionists. It is believed that their knowledge about use and extent of interaction with the facilities may inform favourable perceptions to their use. This is consistent with the finding of Sampath-Kumar and Kumar (2010), who reported that favourable university faculty members in India have favourable perceptions to the use of ICTs on the basis of consistent use of the facilities.

Table 5.12: Distribution of research personnel by their attitudes to use of ICTs for agricultural and rural development activities

Statements	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
ICT can facilitate the networking of all research activities for easy access to information by all and sundry	52 (71.2)	17 (23.3)	4 (5.5)	0 (0.0)	0 (0.0)
ICT utilisation can facilitate international cross-fertilisation of ideas for better research efforts	45 (61.6)	25 (34.2)	3 (4.1)	0 (0.0)	0 (0.0)
ICT use can facilitate exchange of information between research and extension institutions	40 (54.8)	29 (39.7)	4 (5.5)	0 (0.0)	0 (0.0)
ICT use can incorporate feedback mechanism into research and extension activities	37 (50.7)	27 (37.0)	9 (12.3)	0 (0.0)	0 (0.0)
With ICT, all stakeholders can be incorporated into research and extension services schedule	33 (54.2)	26 (35.6)	12 (16.4)	2 (2.7)	0 (0.0)
Idea of ICT use is elitist; any tangible benefit may not reach the farmers	11 (15.1)	14 (19.2)	15 (20.5)	21 (28.8)	12 (16.4)
ICT use/availability at farmers' end would render extension institution irrelevant	7 (9.6)	4 (5.5)	10 (13.7)	32 (43.8)	20 (27.4)
ICT use will not make extension delivery more effective than it has been	8 (11.0)	13 (17.8)	8 (11.0)	15 (20.5)	29 (39.7)
Cost of ICT acquisition is prohibitive and may never be realisable from government funding	11 (15.1)	12 (16.4)	23 (31.5)	12 (16.4)	15 (20.5)
Cost of acquiring ICT would be much more than benefit that can ever come from its use	4 (5.5)	9 (12.3)	17 (23.3)	18 (24.7)	25 (34.2)

Figures in parentheses are percentages
Source: Field survey (2007)

Table 5.13: Distribution of extension personnel by their attitudes to use of ICTs for agricultural and rural development activities

Statements	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
ICT can facilitate the networking of all research activities for easy access to information by all and sundry.	66 (48.9)	52 (38.5)	16 (11.9)	1 (0.7)	0 (0.0)
ICT utilisation can facilitate international cross-fertilisation of ideas for better research efforts	63 (46.7)	54 (40.0)	18 (13.3)	0 (0.0)	0 (0.0)
ICT use can facilitate exchange of information between research and extension institutions	47 (34.8)	67 (49.6)	20 (14.8)	1 (0.7)	0 (0.0)
ICT use can incorporate feedback mechanism into research and extension activities	37 (27.4)	73 (54.1)	24 (17.8)	1 (0.7)	0 (0.0)
With ICT, all stakeholders can be incorporated into research and extension services schedule	25 (18.5)	64 (47.4)	35 (25.9)	11 (8.1)	0 (0.0)
Idea of ICT use is elitist; any tangible benefit may not reach the farmers	18 (13.3)	19 (14.1)	46 (34.1)	44 (32.6)	8 (5.9)
ICT use/availability at farmers' end would render extension institution irrelevant	6 (4.4)	16 (11.9)	28 (20.7)	66 (48.9)	19 (14.1)
ICT use will not make extension delivery more effective than it has been	17 (12.6)	17 (12.6)	29 (21.5)	48 (35.6)	24 (17.8)
Cost of ICT acquisition is prohibitive and may never be realisable from government funding	21 (15.6)	40 (29.6)	51 (37.8)	19 (14.1)	4 (3.0)
Cost of acquiring ICT would be much more than benefit that can ever come from its use	16 (11.9)	17 (12.6)	49 (36.3)	46 (34.1)	7 (5.2)

Figures in parentheses are percentages
Source: Field survey (2007)

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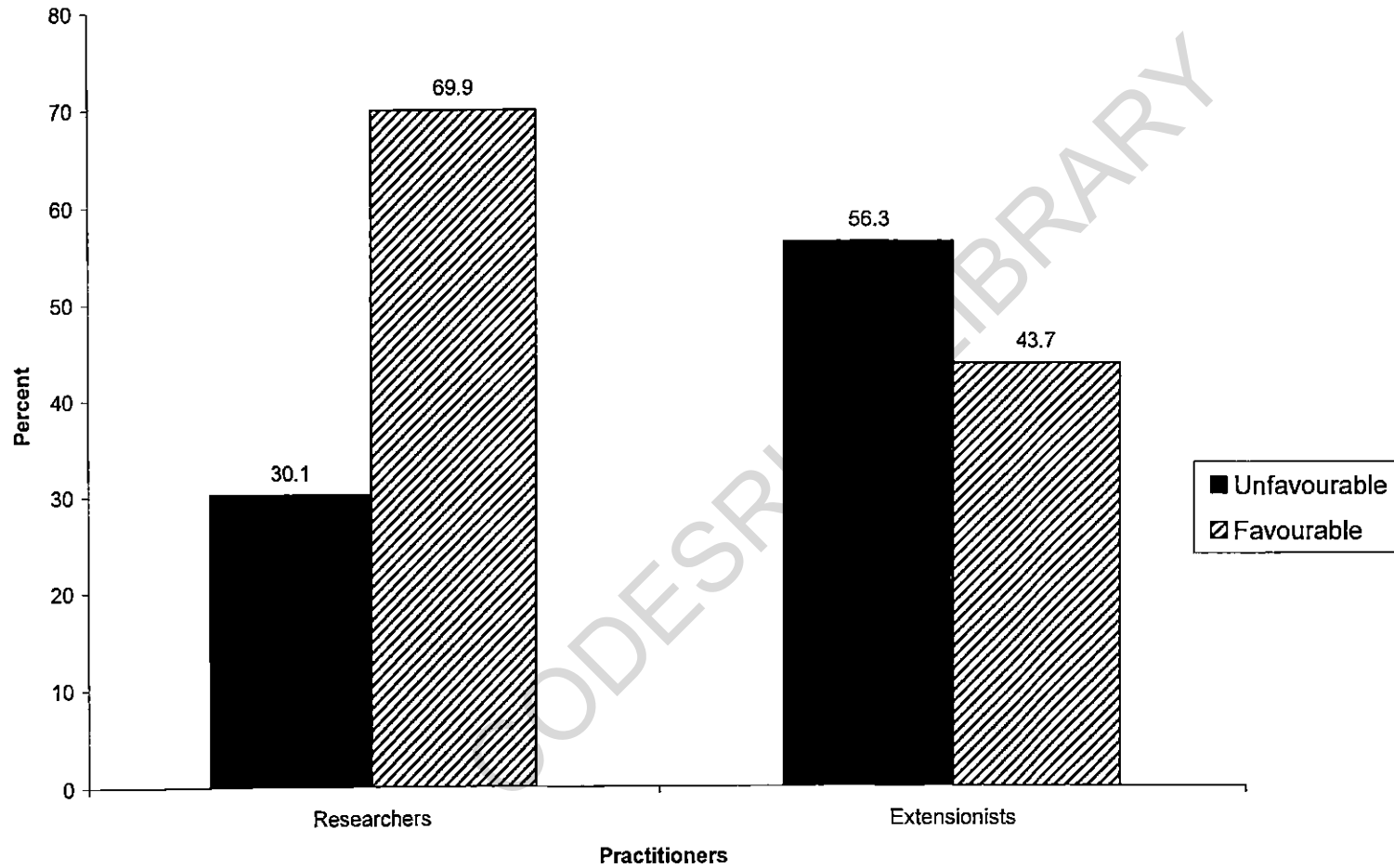
Fig 5.4: Distribution of researchers/extensionists by perception of use of ICTs in their activities

5.2.4 Level of knowledge of the extension and research personnel about the use of ICTs for agricultural information delivery

This objective was pursued by conducting a knowledge test for the research and extension personnel. Their responses were assessed and rated; their knowledge scores had mean of 28.73 and standard deviation of 22.20. Those who scored between 0 and just below the mean were categorised as having low level of ICT knowledge, while those who scored between the mean and the maximum of 75 were categorised as having high level of ICT knowledge.

The distribution of the respondents' ICT knowledge level in Fig 5.5 showed that 24.7 percent of the researchers had low level of ICT knowledge, while 75.3 percent of them had high level of ICT knowledge. It also showed that 65.9 percent of the extensionists had low level of ICT knowledge, while 34.1 percent of them had high level of ICT knowledge.

The finding revealed a disparity between the levels of ICT knowledge among the research and extension practitioners in the country, with more researchers having high knowledge of ICT than the extensionists. This can be traced to the fact that the researchers had better access to the use of ICT facilities that the extensionists as shown in Fig 5.3. The implication of this finding is that even if the facilities are available but without the knowledge of its use, the benefit will not be realised. Schmidt and Stork (2008) opined that access data are not enough to explain the extent of use or willingness to use ICTs; this will likely be significantly influenced by the users' knowledge/skills.

The low level of ICT knowledge of the extension practitioners is an indication of their limitation to disseminate information using the robust facilities enabled by the ICTs. Given the fact that they have primary responsibility for information dissemination, it is important that these practitioners be adequately trained and enabled as advocated by UNDP (2001) such that their institutions can act as important identifiers and promoters of new initiatives, especially when they have a good understanding of ICT potential.
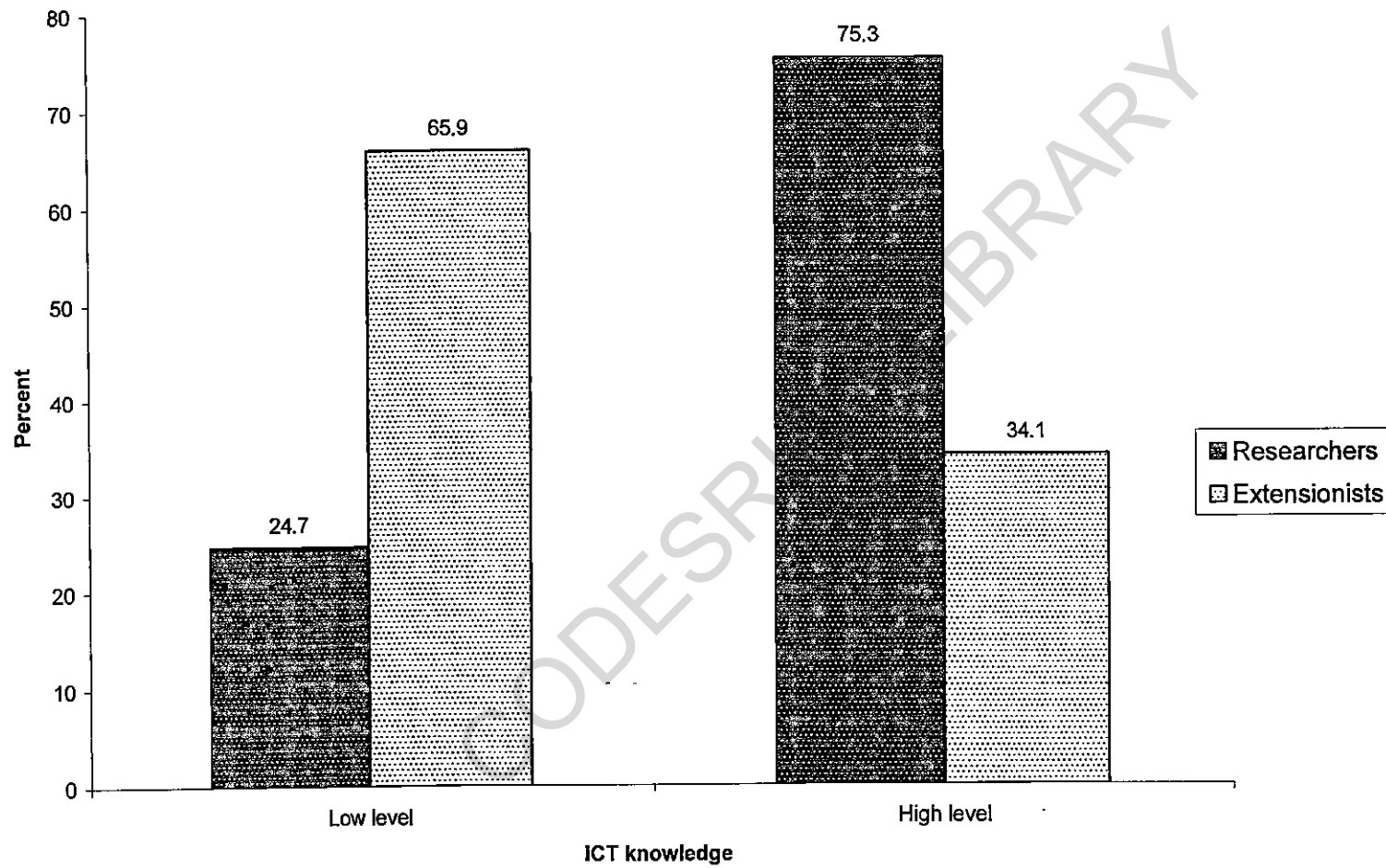
Fig 5.5: Distribution of research and extension practitioners by level of ICT knowledge

5.2.5 Extent of use of ICTs in the current extension delivery strategy

Available ICTs

This objective was achieved by first finding out the ICT tools that were available to the research/extension practitioners. They were asked to indicate the facilities that were available. The distribution of the responses by the researchers and extensionists are as shown in Table 5.14.

Researchers – The responses of the research practitioners revealed that 57.5 percent of them indicated that radio was available, 52.1 percent indicated that television was available, 30.1 percent indicated that video was available and 9.6 percent indicated that video CD was available. It also showed that telephone was available to 50.7 percent of the researchers, multimedia projector was available to 45.2 percent of them, CD-ROM technology to 6.8 percent and 34.2 percent indicated that intra/internet technology was available.

Extensionists – The responses of the extension practitioners showed that 63.7 percent of them indicated that radio was available, 57.0 percent indicated that television was available, 15.6 percent indicated that video was available and 7.4 percent indicated that video CD was available. It also showed that telephone was available to 56.3 percent of the researchers, multimedia projector to 14.1 percent of them, CD-ROM technology was available to 2.2 percent, and 8.1 percent indicated that intra/internet technology was available.

This showed that radio and TV were the mostly available ICTs to the research/extension practitioners and recently telephone. This is in consonance with the finding of Arokoyo (2003) that radio and TV had been the major ICTs used in agricultural extension delivery in Nigeria.

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Table 5.14: Distribution research/extension personnel by the available ICT facilities

Available facilities	Researchers	Extensionists
Radio	42	86
	(57.5)*	(63.7)
TV	38	77
	(52.1)	(57.0)
Video	22	21
	(30.1)	(15.6)
Video CD	7	10
	(9.6)	(7.4)
Telephone	37	76
	(50.7)	(56.3)
Multimedia Projector	33	19
	(45.2)	(14.1)
CD-ROM Technology	5	3
	(6.8)	(2.2)
Intra/internet	25	11
	(34.2)	(8.1)

Figures in parentheses are percentages
* Multiple responses
Source: Field survey (2007)

Extent of use of available ICTs

The practitioners were also asked to state their extent of use of the available ICT facilities. The responses were assessed on a 5 point scale, which was collapsed to a three-category response for easy reporting.

Researchers – The research personnel's responses as indicated in Table 5.15 showed that 43.8 percent of them used radio regularly and 23.3 percent never used it. It also showed that 37.0 percent of the respondents used television regularly and 38.4 percent never used the facility. For cinema as an ICT tool, 9.6 percent of them used it regularly, 27.4 percent do not use it regularly and 63.0 percent do not use it at all.

The research practitioners also showed that 60.3 percent of them used newspaper regularly. The distribution also showed that 1.4 percent of them used fax regularly, 23.3 percent do not use it regularly and 75.3 percent of them do not use it at all.

Their responses also reveal that 28.8 percent of them used fixed phone regularly, 15.9 percent do not use it regularly and 57.2 percent do not use the facility at all. It also showed that 63.0 percent of them used mobile phone regularly, 13.5 percent do not use it regularly and 31.7 percent do not use the facility at all. Distribution also revealed that 23.3 percent of the research practitioners made use of multimedia projector regularly, 41.1 percent do not use it regularly and 35.6 percent of them do not use it at all.

The practitioners' responses also show that 21.9 percent of them used video regularly, 37.0 percent do not use it regularly and 52.9 percent do not use it at all. For computer, 47.9 percent made use of it regularly, 28.8 do not use it regularly and 23.3 percent do not use the tool at all. The distribution also revealed that use of CD-ROM technology was regular for 6.8 percent of the researchers, not regular for 27.4 percent of them and not used at all by 65.8 percent of the practitioners.

Research practitioners' ICT use distribution also showed that 47.9 percent of them used the internet regularly while 37.0 percent do not use it. Also, 28.8 percent used organisation e-mail regularly and 43.8 percent do not use the facility at all. So also, 21.9 percent of the researchers used the organisation website regularly and 50.7 percent do not use it at all. In line with this, personal e-mail as an ICT tool was used regularly by 60.3 percent of the research practitioners and 31.5 percent of them do not use it at all. Equally, 90.4 percent of the research practitioners do not use personal website at all.

Extensionists – The extension personnel's responses as indicated in Table 5.16 showed that 65.9 percent of them used radio regularly and 17.0 percent never used it. It also showed that 44.4 percent of the respondents used television regularly and 21.5 percent never used the facility. For cinema as an ICT tool, 0.7 percent of them used it regularly, 25.2 percent do not use it regularly and 74.1 percent do not use it at all.

The extension practitioners also show that 37.8 percent of them used newspaper regularly and 25.9 percent of them do not use it at all. The distribution also showed that 84.4 percent of them do not use fax at all. The responses also reveal that 25.9 percent of them used fixed phone regularly and 61.5 percent do not use the facility at all. It also showed that 51.9 percent of them used mobile phone regularly.

Distribution also revealed that 11.9 percent of the extension practitioners made use of multimedia projector regularly and 70.4 percent of them do not use it at all. The practitioners' responses also show that 11.9 percent of them used video regularly and 59.3 percent do not use it at all. For computer, 26.7 percent of the extensionists made use of it regularly and 53.3 percent do not use the tool at all.

The distribution also revealed that use of CD-ROM technology was regular for 2.2 percent of the extensionists and not used at all by 89.6 percent of the practitioners. Extension practitioners' distribution also showed that 10.4 percent of them used the internet regularly, while 68.9 percent do not use it at all. It also showed that 6.7 percent used organisation e-mail regularly and 79.3 percent do not use the facility at all. So also, 7.4 percent of the extensionists used the organisation website regularly and 80.0 percent do not use it at all. In line with this, personal e-mail as an ICT tool was used regularly by 12.6 percent of the extension practitioners and 68.1 percent do not use it at all. Equally, only 3.0 percent of the extension practitioners used personal website regularly.

Index of use

An index of use was derived, on the basis of responses of the researchers to the use of the ICT tools, in order to determine the extent of use of the various ICTs. The index of use of the various ICTs revealed that researchers mostly used in the order: newspaper, mobile phone, personal e-mail, computer, radio, internet, television, multimedia projector, organisation e-mail, video, fixed phone, organisation website, cinema, CD-ROM technology, fax and personal website. The index also revealed that radio was the mostly used ICT by the extensionists, followed by television, mobile phone, newspaper, computer, fixed phone,

video, personal e-mail, multimedia projector, internet, organisation e-mail, organisation website, cinema, fax, CD-ROM technology and personal website.

This finding showed disparity in the ICT formats used by agricultural researchers and extensionists in the country. Fig 5.6 highlights such disparity, which revealed that the researchers use the digital ICTs more than the extensionists. However, the first two mostly used ICTs by the extensionists concurred with the tools most of the farmers have access to. This mean that the there can be easy transmission of information from the extensionists to the farmers on the basis of uniformity of available media.

Generally, the practitioners use the ICT tools in their activities to seek and disseminate information. Radio, television, video, cinema, newspapers, mobile phones, computer, e-mail and internet are used in the two modes, that is, to seek and disseminate information; fax and CD-ROM technology are basically used to seek information; while multimedia projector and websites are used to disseminate information to different categories of audience. The ICT tools that have been used by the Nigerian agricultural extension system to disseminate information to the farmers are radio, television, video and cinema (Arokoyo, 2003). According to him, at the inception of the agricultural development programme (ADP), the communication equipments used to get across to rural people were radio, mobile video vans and television. Later on, dissemination through radio and the television grew with the growth of the programme.

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Table 5.15: Distribution of research personnel by frequency of use of ICTs

ICT tools	Regularly	Not regularly	Not at all	Index of use
Radio	32	24	17	120.5
	(43.8)	(32.9)	(23.3)	
TV	27	18	28	98.6
	(37.0)	(24.6)	(38.4)	
Cinema	7	20	46	46.6
	(9.6)	(27.4)	(63.0)	
Newspaper	44	19	10	146.6
	(60.3)	(26.0)	(13.7)	
Fax	1	17	55	26.1
	(1.4)	(23.3)	(75.3)	
Fixed Phone	21	16	36	79.5
	(28.8)	(21.9)	(49.3)	
Mobile Phone	46	14	13	145.2
	(63.0)	(19.2)	(17.8)	
Multimedia Projector	17	30	26	87.7
	(23.3)	(41.1)	(35.6)	
Video	16	27	30	80.8
	(21.9)	(37.0)	(41.1)	
Computer	35	21	17	124.6
	(47.9)	(28.8)	(23.3)	
CD-ROM Technology	5	20	48	41.0
	(6.8)	(27.4)	(65.8)	
Internet	35	11	27	110.9
	(47.9)	(15.1)	(37.0)	
Organisation e-mail	21	20	32	85.0
	(28.8)	(27.4)	(43.8)	
Organisation website	16	20	37	71.2
	(21.9)	(27.4)	(50.7)	
Personal e-mail	44	6	23	128.8
	(60.3)	(8.2)	(31.5)	
Personal website	0	7	66	9.6
	(0.0)	(9.6)	(90.4)	

Figures in parentheses are percentages
Source: Field survey (2007)

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Table 5.16: Distribution of extension personnel by frequency of use of ICTs

ICT tools	Regularly	Not regularly	Not at all	Index of use
Radio	89	23	23	148.8
	(65.9)*	(17.0)	(17.0)	
TV	60	46	29	122.9
	(44.4)	(34.1)	(21.5)	
Cinema	1	34	100	26.6
	(0.7)	(25.2)	(74.1)	
Newspaper	51	49	35	111.9
	(37.8)	(36.3)	(25.9)	
Fax	6	15	114	19.9
	(4.4)	(11.1)	(84.4)	
Fixed Phone	35	17	83	64.4
	(25.9)	(12.6)	(61.5)	
Mobile Phone	70	14	53	114.2
	(51.9)	(10.4)	(39.3)	
Multimedia Projector	16	24	95	41.6
	(11.9)	(17.8)	(70.4)	
Video	16	39	80	52.7
	(11.9)	(28.9)	(59.3)	
Computer	36	27	72	73.4
	(26.7)	(20.0)	(53.3)	
CD-ROM Technology	3	11	121	12.5
	(2.2)	(8.1)	(89.6)	
Internet	14	28	93	41.5
	(10.4)	(20.7)	(68.9)	
Organisation e-mail	9	19	107	27.5
	(6.7)	(14.1)	(79.3)	
Organisation website	10	17	108	27.4
	(7.4)	(12.6)	(80.0)	
Personal e-mail	17	26	92	44.5
	(12.6)	(19.3)	(68.1)	
Personal website	4	7	124	11.2
	(3.0)	(5.2)	(91.9)	

Figures in parentheses are percentages
* Multiple responses
Source: Field survey (2007)

Fig 5.6: Distribution of the ICT tools by index of researchers and extensionists' use

Level of ICT use

The index of extent of use of ICTs was categorised into two based on the index mean at 27.95 thus; the respondents who scored between 0 and 27.94 were categorised as low level, while those who had between 27.95 and 61 were categorised as high level. Distribution of the respondents according to this categorisation in Fig 5.7 showed that 79.5 percent of the research practitioners fell within the high level category of ICT users, while 20.5 percent of them were in low level category of ICTs users. Also, 38.5 percent of the extensionists fell within the high level category of ICT users, while 61.5 percent of them were low level users of ICTs. This highlights the disparity in the level of use of ICTs by the different set of agricultural information managers in the country, with more researchers being high level users, and more extensionists being low level users.
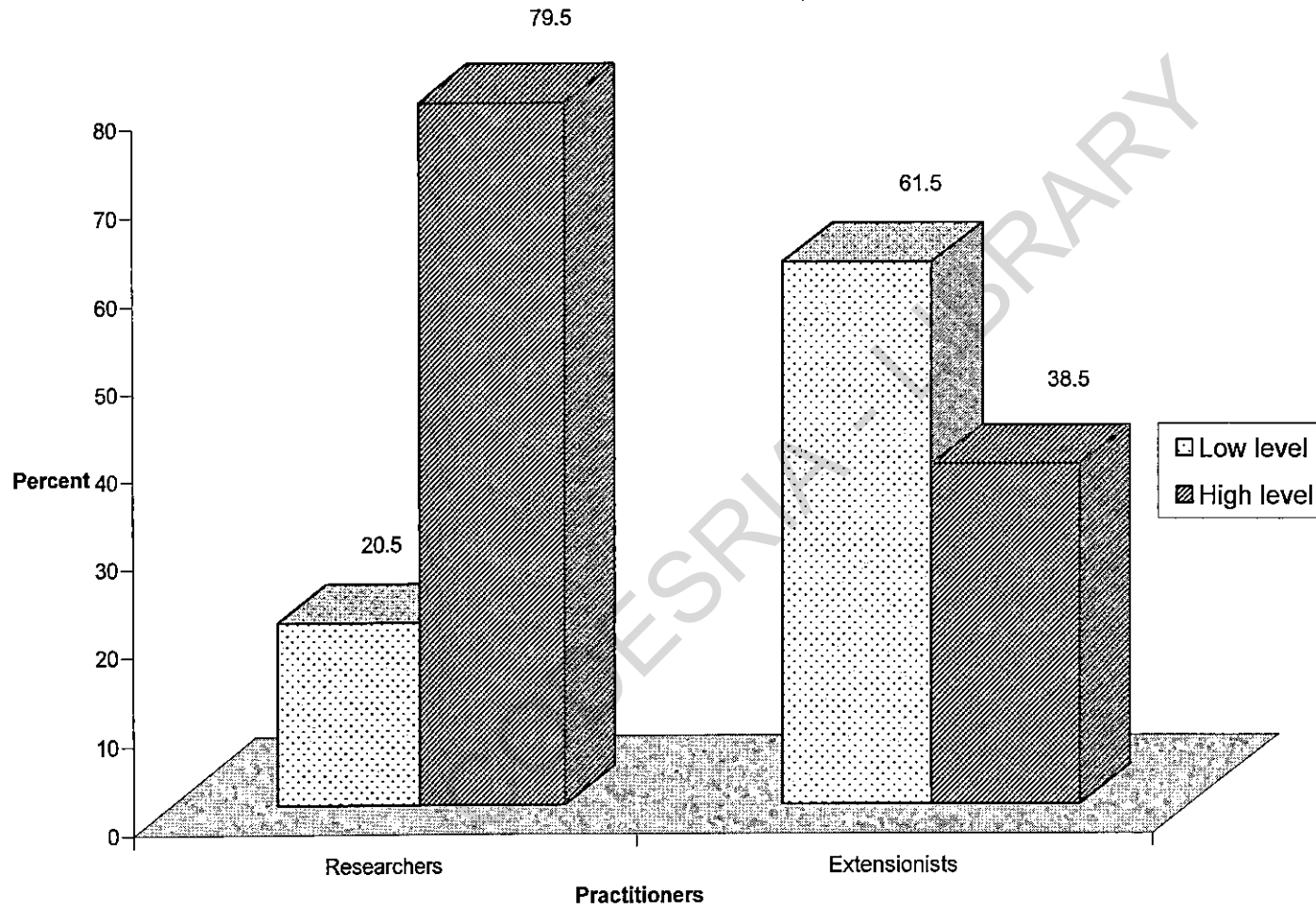
Fig 5.7: Distribution of practitioners by level of ICT use

Extent of access to digital ICTs

This objective was pursued further by assessing the extent to which the research/extension practitioners have access to computer and internet facilities. This assessment was based on the fact that computer and communication systems between computers constitute the hub of digital ICT facilities (CTA, 1999). Responses are as given in Table 5.17

Researchers – The results show that 53.4 percent of the researchers had access to the use of computer on a daily basis, 19.2 percent had access thrice-a-week, 5.5 percent seldom had access, while 2.7 do not have access at all to the use of computer. This showed that most of the respondents had appreciable access to the use of computer.

In terms of official access to computer, 15.1 percent of the researchers indicated that computer was provided on one-per-staff basis while 60.3 percent indicated that one or two is provided per department. This showed that the respondents had limited access to the use of computer officially.

In terms of access to internet connection, 1.4 percent of the researchers had access at their homes, 54.8 percent had access at their offices while 34.2 percent had access to the internet at cyber cafes. This showed that most of the researchers had access to the internet, though mainly at their offices.

The researchers' responses to the uses to which they put the ICT facilities in a multiple response format showed that 26.0 percent used computers to update information, 52.1 percent access personal e-mail accounts, 38.4 percent of them access official e-mail messages, 60.3 percent search the web for resources, 15.1 percent chat with friends, 17.8 percent upload information onto official website, while 4.1 percent access and update personal websites. This showed that searching for web resources and checking personal e-mail were the activities that most researchers do on the internet.

Extensionists – The results show that 19.3 percent of the extensionists had access to the use of computer on daily basis, 8.1 percent of them also had access on weekly basis, 23.7 percent seldom have access, while 33.3 do not have access at all to the use of computer. This showed that most of the extension practitioners do not have appreciable access to the use of computer.

In terms of official access to computer, 17.0 percent of them indicated that one or two was provided per department while 43.7 percent indicated that none was provided to them officially. This shows that the respondents had very limited access to the use of computer officially.

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In terms of access to internet connection, 17.0 percent of the extensionists had access at their offices, 36.3 percent had access to the internet at cyber cafes while 45.2 percent of them do not access to internet at all. This shows that most of the extensionists do not have appreciable access to the internet, while the cyber cafés are the dominant access points to them.

The extensionists' responses to the uses to which they put ICT facilities, in a multiple response format, showed that 11.9 percent update information on computers, 15.6 percent access personal e-mail accounts, 21.5 percent of them access official e-mail messages, 16.3 percent search the web for resources while 5.2 percent access and update personal websites. This shows that most of the extension practitioners do not use the ICTs appreciably compared to the researchers.

Table 5.17: Distribution of the practitioners by access to computer and internet

Access factors	Response options	Researchers	Extensionists
Average period of computer use	Daily	39 (53.4)	26 (19.3)
	Thrice-a-week	14 (19.2)	10 (7.4)
	Twice-a-week	7 (9.6)	11 (8.1)
	Once-a-week	7 (9.6)	11 (8.1)
	Seldom	4 (5.5)	32 (23.7)
	Not at all	2 (2.7)	45 (33.3)
Official access to computer	One per staff	11 (15.1)	0 (0.0)
	One/two per department	44 (60.3)	76 (56.3)
	None is provided	18 (24.6)	59 (43.7)
Access to internet connection	At Home	1 (1.4)	2 (1.5)
	At the Office connection	40 (54.8)	23 (17.0)
	Only at Cyber Cafes	25 (34.2)	49 (36.3)
	Not at all	7 (9.6)	61 (45.2)
Uses to which ICTs are put	Update of information on the computer	19 (26.0)*	16 (11.9)
	Accessing personal e-mail account	38 (52.1)	21 (15.6)
	Access official e-mail for messages	28 (38.4)	29 (21.5)
	Search for web resources	44 (60.3)	22 (16.3)
	Chat with friends	11 (15.1)	5 (3.7)
	Upload information onto official website	13 (17.8)	11 (8.1)
	Access and update personal website	3 (4.1)	7 (5.2)
	Total	73 (100.0)	135 (100.0)

Figures in parentheses are percentages

* Multiple responses

Source: Field survey (2007)

Constraints to ICT use

The objective was pursued further by assessing practitioners' constraints to use of ICTs in their duties.

Researchers – The results in Table 5.18 show that 35.6 percent of the research practitioners indicated non-provision of computers as a serious constraint and 30.1 percent do not see it as a constraint. That the computers provided were not enough was perceived by 45.2 percent of them as a serious constraint, 20.5 percent were indifferent about it and 15.1 percent do not see it as a constraint. That other ICT facilities were not provided for use was seen as a serious constraint by 32.9 percent of the research practitioners, 31.5 percent were indifferent about it and 28.8 percent do not see it as a constraint. On the issue that other ICT facilities that may be provided were not adequate; 26.0 percent of them saw this as a serious constraint and 35.6 percent do not see it as a constraint. Inability to operate the computer was seen as a serious constraint by 6.8 percent of the practitioners, 23.3 percent of them saw it as a mild constraint, 34.2 percent were indifferent about it and 35.6 percent do not see it as a constraint. That work schedules were not adaptable to ICT use was seen as a serious constraint by 12.3 percent of the research personnel and 38.4 percent do not see it as a constraint at all.

Extensionists – The results in Table 5.19 show that 40.0 percent of the extension practitioners indicated non-provision of computers as a serious constraint and 15.6 percent do not see it as a constraint. That the computers provided were not enough was perceived by 35.6 percent of them as a serious constraint, 34.1 percent were indifferent about it and 11.1 percent do not see it as a constraint. That other ICT facilities were not provided for use is seen as a serious constraint by 34.1 percent of the extension practitioners, 48.9 percent were indifferent about it and 11.9 percent do not see it as a constraint. On the issue that other ICT facilities that may be provided were not adequate; 28.1 percent of them saw this as a serious constraint, 42.2 percent were indifferent about it and 11.9 percent do not see it as a constraint. Inability to operate the computer was seen as a serious constraint by 27.4 percent of the extension practitioners, 34.8 percent were indifferent about it and 20.7 percent do not see it as a constraint. That work schedules were not adaptable to ICT use was seen as a serious constraint by 14.1 percent of the extension personnel, 60.0 percent were indifferent about it, and 18.5 percent do not see it as a constraint at all.

An index of the constraints assessment was derived from the responses and was categorised to low and high severity based on the criterion of above and below the mean (15.22). The distribution of the practitioners by the categories is as given in Fig. 5.8. The

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results show that 60.3 percent of the researchers perceived the constraints as being of low severity, while 39.7 percent assessed them as being of high severity. Also, 49.6 percent of the extensionists perceived the constraints as being of low severity, while 50.4 percent of them perceived them as being of high severity.

This implies that more of the extension practitioners perceived the constraints to use of ICT as being severe more than their research counterpart.

Table 5.18: Distribution of research personnel by their assessment of constraints to use of ICTs

Constraints	Serious Constraint	Mild Constraint	Indifferent	Not a Constraint
Computers are not provided	26 (35.6)	14 (19.2)	11 (15.1)	22 (30.1)
Computers provided are not enough	33 (45.2)	14 (19.2)	15 (20.5)	11 (15.1)
ICT tools are not provided	24 (32.9)	5 (6.8)	23 (31.5)	21 (28.8)
ICT facilities are not adequate	19 (26.0)	17 (23.3)	26 (35.6)	11 (15.1)
Inability to operate the computer	5 (6.8)	17 (23.3)	25 (34.2)	26 (35.6)
Work schedules are not adaptable to ICT use	9 (12.3)	6 (8.2)	30 (41.1)	28 (38.4)

Source: Field survey (2007)

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Table 5.19: Distribution of extension personnel by their assessment of constraints to use of ICTs

Constraints	Serious Constraint	Mild Constraint	Indifferent	Not a Constraint
Computers are not provided	54	31	29	21
	(40.0)	(23.0)	(21.5)	(15.6)
Computers provided are not enough	48	26	46	15
	(35.6)	(19.3)	(34.1)	(11.1)
ICT tools are not provided	46	7	66	16
	(34.1)	(5.2)	(48.9)	(11.9)
ICT facilities are not adequate	38	24	57	16
	(28.1)	(17.8)	(42.2)	(11.9)
Inability to operate the computer	37	23	47	28
	(27.4)	(17.0)	(34.8)	(20.7)
Work schedules are not adaptable to ICT use	19	10	81	25
	(14.1)	(7.4)	(60.0)	(18.5)

Source: Field survey (2007)
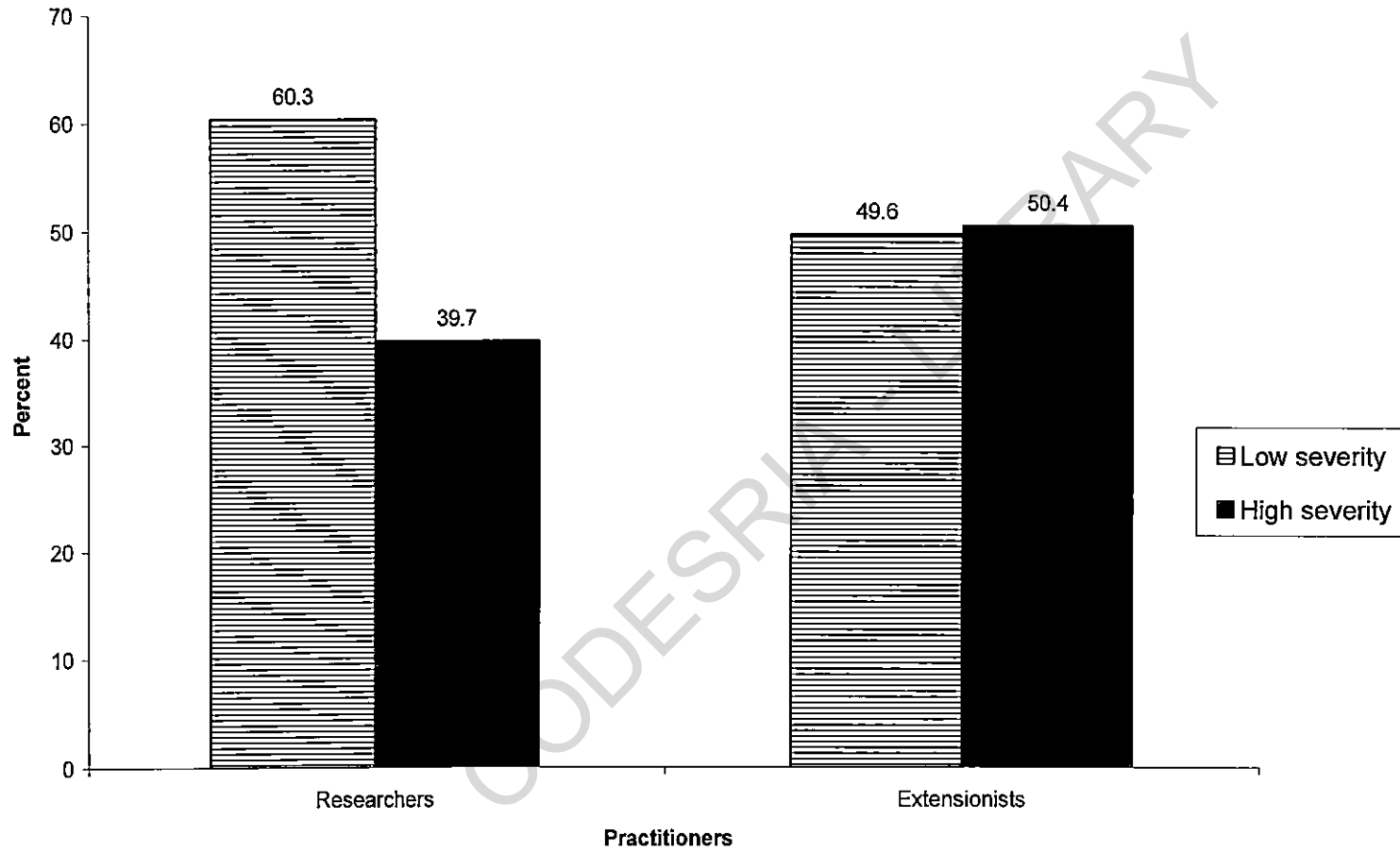
Fig 5.8: Distribution of research and extension personnel by categories of severity of constraint to ICT use

In further pursuit of the objective, determinants of level of ICT use was analysed with some relevant variables, using binomial logit regression model. The independent variables that were entered into the model were sex, grade level, years in service, education, level of computer training, ICT facility availability, official access to ICTs, constraint assessment, level of ICT knowledge, perception of ICT use, perceived importance of ICTs to work schedule and perceptions on sustainable use of ICTs. The analyses were carried out separately for the research and extension personnel respectively. The model for the binomial logit regression is expressed thus:

$$\Pr(y_i = j) = \frac{\exp(X_i\beta_j)}{1 + \sum_j^J \exp(X_i\beta_j)}$$

and

$$\Pr(y_i = 0) = \frac{1}{1 + \sum_j^J \exp(X_i\beta_j)},$$

where for the ith individual, y_i is the observed outcome and X_i is a vector of explanatory variables. The unknown parameters β_j are typically estimated by maximum likelihood.

Researchers - Results of the analysis for researchers as shown in Table 5.20 indicated that level of ICT use is significantly but negatively (t=-2.021; p=0.043) influenced by grade level. This implies that being at higher grade levels lowers the probability to use the ICTs and vice versa. It also showed a significant (t=2.938; p=0.003) influence between level of use and official access to ICTs; implying that having higher level of official access to ICTs increases the probability of using the ICTs more than those without as such access. The analysis also showed that level of ICT use is significantly (t=2.477; p=0.013) influenced by the extent to which the practitioners have favourable perception about sustainable use of the facilities. This implies that having favourable perception about sustainable use of ICTs increases the probability of using the facility more than those who have unfavourable perceptions.

Out of the listed variable, only grade level, official access and perception on sustainable use of ICTs significantly influenced level of use of ICTs. The finding that the senior practitioners do not use the ICT facilities as much as the junior ones might be explained by the fact that the issue of digital ICT use in such institutions is recent; hence the senior practitioners may not have direct responsibilities in information management duties, which require the use of the facilities and hence may not realise the challenge to use it as much as the junior officers with such responsibilities.

Availability of ICTs has experienced phenomenal improvement in Nigeria between 2001 and now. According to NCC (2010), teledensity has risen from 0.73 in 2001 to 54.24 by January 2010. Official provision of ICT facilities is a function of its availability in the country. This also explains its significant influence on the use of the facilities. This implies that expenditure incurred on acquisition of the equipments for the research institutions are judiciously annexed to a significant extent.

The finding that perceptions on sustainable use of ICTs significantly influenced ICT use can be explained by the fact that those who have favourable attitude to the use of the facility would use it if made available. This finding raises hope that if the facility is made available, those who are supposed to champion its use will be willing to do that. The fear of the otherwise occurring was based on an experience reported by Baron (1999) as "technophobia" - an attitude exhibited by feelings of inferiority when it comes to using ICT equipment. This is a real issue to contend with when introducing technology. This context meant that the practitioners, who were supposed to act as ICT-champions, were themselves afraid of the new technologies. Their insecurities caused them to discourage people from using the services for fear they would be asked questions they could not answer.

Extensionists - Results of analysis for the extensionists in Table 5.21 showed that level of ICT use is significantly (t=2.043; p=0.041) influenced by availability of ICT facilities. This implies that availability of ICT facilities to the practitioners increases their probability of its use. It also showed a significant (t=2.625; p=0.009) relationship between level of use and official access to ICTs; implying that more official access to ICTs increases the probability of using the facilities by the practitioners. The analysis also showed that level of ICT use is significantly (t=4.021; p=0.000) influenced by the perception of severity of constraints to use of the facilities. This implies that severity of constraints perception increases the probability of use of ICTs more than among those who have less severe perceptions of the constraints.

Out of the listed variable, ICT facilities availability, official access and assessment of constraints to use of ICTs significantly influenced level of use of ICTs. The finding that severity of constraints assessment have direct influence on the level of use of ICTs can be explained by the fact that identification of the myriads of problems confronting ICT use can only be truly highlighted by those who use the facilities to a reasonable extent. The respondents, who do not use the facilities appreciably, may assess the constraints inadequately as being less severe than they really are. This is in consonance with views of

Sampath-Kumar and Kumar (2010), which assessed the constraints indicated by the university scholars to the use of ICTs in India as being use-related.

Table 5.20: Binomial logit estimation on factors determining researchers' level of ICT use

Variables	Coefficient	t-ratio	p-value
Constant	-8.630	-1.664	0.096
Sex	-1.893	-1.176	0.240
Grade level	-0.729	-2.021	0.043*
Years in service	0.443	0.656	0.512
Education	1.323	1.893	0.058
Level of computer training	0.107	0.030	0.976
ICT facilities availability	0.366	1.342	0.180
Official access to ICT facilities	1.807	2.938	0.003*
Constraints assessment	0.133	1.674	0.094
Level of ICT knowledge	-0.109	-0.522	0.602
Perception of ICT use	0.164	0.282	0.778
Perceived importance of ICTs to work schedule	-0.524	-1.186	0.236
Perception on sustainable use of ICTs	0.303	2.477	0.013*

Sample size = 73	Log likelihood function = -27.919
Chi-squared = 31.770	Restricted log likelihood = -43.804
Degree of freedom = 12	* Level of significance = 0.05

Source: Computed from Field survey (2007)

Table 5.21: Binomial logit estimation on factors determining extensionists' level of ICT use

Variables	Coefficient	t-ratio	p-value
Constant	-2.940	-0.878	0.380
Sex	-0.552	-0.807	0.420
Grade level	-0.356	-1.489	0.137
Years in service	-0.636	-1.831	0.067
Education	-0.283	-0.846	0.398
Computer training	0.704	0.376	0.707
ICT facilities availability	0.343	2.043	0.041*
Official Access to ICT facilities	1.410	2.625	0.009*
Constraints assessment	0.182	4.021	0.000*
Knowledge of ICT use	0.881	0.827	0.408
Perception on ICT use	-0.333	-0.566	0.572
Perceived importance of ICTs to work schedule	0.301	1.704	0.088
Perception on sustainable use of ICTs	-0.288	-0.563	0.573

Sample size = 135	Log likelihood function = -59.666
Chi-squared = 61.539	Restricted log likelihood = -90.436
Degree of freedom = 12	*Level of significance = 0.05

Source: Computed from field survey (2007)

5.2.6 Farmers' willingness to use and pay for ICT mediated information services

This objective was pursued by asking the farmers some questions that border on relevance of communication potential to them, their willingness to use the digital ICTs to access them as well as willingness to pay for the services. Their responses, as given in Table 5.22 revealed that most (78.4 percent) of the respondents found it very relevant that they can send information directly to decision makers, while only 7.5 percent of them are indifferent about the possibility. The result also showed that 83.4 percent of the respondents found it relevant that they can ask experts questions and get answers promptly via the digital ICTs media, while only 6.5 percent of them are indifferent about the potential benefit. Also, 50.8 percent of the respondents know that information on agriculture can be obtained through the computers.

This implied that majority of the farmers can appreciate the effective communication potential of the digital ICT media if made available to them in their bid to fulfil their enterprise information needs. According to CTA (2006), there is a good opportunity for ICT applications and tools to enhance those efforts and yield better analytical results.

In terms of willingness to use the digital ICTs, all (100.0) the respondents will be willing to use the facilities if made available to them. However, 48.7 percent of them will be willing to pay for the service, 20.6 percent are not sure whether they will be willing to pay or not while 30.7 percent of them will not be willing to pay for the services. The categorisation of the farmer-respondents by level of willingness to use the digital ICTs revealed that 75.4 percent of them are most willing to use the facilities, while 24.6 percent of them are least willing to use them. While it can be said that farmers' willingness to use the facilities is a desirable trend, their willingness to pay for the services will enhance sustainability of such projects. Nonetheless, it is believed that when they derive significant benefits from the services, more of them will develop ability to pay (CTA, 2006).

Table 5.22: Distribution of respondents by relevance and willingness to use digital ICTs

Relevance and willingness to use ICTs		Frequency	Percent
Communication potential	**Response options**		
Is it relevant to you that you can	Very relevant	156	78.4
send information to decision	Barely relevant	28	14.1
makers?	Indifferent	15	7.5
Is it relevant to you to have an	Very relevant	166	83.4
avenue to ask experts questions and	Barely relevant	20	10.1
get answers promptly?	Indifferent	13	6.5
Do you know that relevant information on agriculture can be obtained from the computer?		101	50.8
Willingness factors			
If available, would you be willing to access the information through it?		199	100.0
Would you be willing to pay for	Yes	97	48.7
the service?	Not sure	41	20.6
	No	61	30.7
Categories of willingness to use	Most willing	150	75.4
digital ICTs	Least willing	49	24.6
Total		**199**	**100.0**

Source: Field survey (2007)

Factors determining farmers' willingness to use ICTs

The objective was pursued further by examining the factors that determine farmers' willingness to use the ICTs. The categories of farmers' willingness to use ICTs (least willing = 0, and most willing = 1) was entered into a binomial logit equation as the dependent variable, while the independent variables entered are age, sex, marital status, family size, number of enterprises, education, telecentres availability, benefit accruable, number of information sources, access to information, information needs and extent of information availability.

Table 5.23 showed that marital status (t=2.501; p=0.012) significantly influenced willingness to use ICTs; implying that being married increases the probability of respondents' willingness to use ICTs. It also showed that number of information sources available to the respondents significantly (t=2.064; 0.039) influenced willingness to use ICTs. This implies that number of information sources increases the probability of respondents' willingness to use ICTs.

The finding of the positive influence of number of information sources on willingness to use ICTs can be explained by the fact that those who have been patronising multiple information sources will likely appreciate the importance of use of digital ICTs better than those who have been exposed to fewer information sources. This is consistent with the finding of Demiryurek *et al* (2008), who found out that time allocation for agricultural related information is significantly influenced by number of information sources by the dairy farmers.

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Table 5.23: Binomial logit estimation on factors determining farmers' willingness to use ICTs

Variables	Coefficient	t-ratio	p-value	Remark
Constant	-1.385	-0.982	0.326	Not significant
Age	-0.028	-1.539	0.124	Not significant
Sex	-0.623	-1.047	0.295	Not significant
Marital status	1.490	2.501	0.012*	Significant
Family size	0.000	0.744	0.457	Not significant
Number of enterprises	0.219	1.400	0.161	Not significant
Education	0.030	1.071	0.284	Not significant
Telecentre availability	-0.238	-0.394	0.693	Not significant
Benefit accruable	0.000	0.688	0.492	Not significant
Number of information sources	0.267	2.064	0.039*	Significant
Access to information	0.007	0.095	0.925	Not significant
Information needs	0.077	1.357	0.175	Not significant
Information availability	0.011	0.458	0.647	Not significant

Sample size = 199	Log likelihood = -95.298
Chi-squared = 31.549	Restricted log likelihood = -111.073
Degree of freedom = 12	Level of significance = 0.05

Source: Computed from Field survey (2007)

5.2.7 Practitioners' perceptions of the sustainable deployment of ICTs for agricultural information management

This was pursued by taking the research/extension practitioners' responses to attitudinal statements on the issue.

Researchers - Distribution of the researchers' responses in Table 5.24 showed that 46.6 percent of them agreed that access to ICTs will be better achieved through personal than institutional efforts and 30.2 percent disagreed with the statement. Equally, 87.7 percent of them agreed that all categories of practitioners must possess functional skill of computer use to engender ICT strategy. On the idea that development practitioners should be made to publish on ICT media for promotion purposes to pursue sustainable ICT use, 79.4 percent of the practitioners agreed with it and 8.2 percent of them disagreed with the statement.

Furthermore, 86.3 percent of the research personnel agreed with the statement that corporate responsibilities should also include sponsorship of ICT for agricultural development. Also, 63.1 percent of the personnel agreed with the opinion that information users (farmers etc) should pay for services though at subsidised rate and 27.4 percent were undecided about it. Also, 76.7 percent of the research practitioners agreed that youths should be involved in the strategy to facilitate information dissemination through the ICT formats. In the same vein, 86.3 percent of the research personnel agreed that end-users should be involved in information creation at local levels.

The distribution also showed that 87.6 percent of the researchers agreed that choice of ICT equipment to be used should take end-users into consideration and 2.8 percent of them disagreed with the opinion. Equally, 53.4 percent of them agreed that trial-and-error process was required for selection of appropriate ICT strategy while 20.6 percent of them disagreed with the statement. Also, 76.7 percent of the research practitioners agreed that telecom companies must be made to connect rural areas even if it is not profitable to them.

Extensionists - Distribution of the extensionists' responses in Table 5.25 showed that 43.0 percent of them agreed that access to ICTs will be better achieved through personal than institutional efforts while 29.7 percent disagreed with the statement. Then, 74.1 percent of them agreed that all categories of practitioners must possess functional skill of computer use to engender ICT strategy. On the idea that development practitioners should be made to publish on ICT media for promotion purposes to pursue sustainable ICT use, 59.2 percent of the practitioners agreed with it and 7.4 percent of them disagreed with the notion.

Furthermore, 71.8 percent of the extension personnel agreed with the statement that corporate responsibilities should also include sponsorship of ICT for agricultural

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development and 3.7 percent of them disagreed with the idea. Also, 43.7 percent of the personnel agreed with the opinion that information users (farmers etc) should pay for services though at subsidised rate and 28.9 percent of them disagreed with the statement. Then, 61.5 percent of the extension practitioners agreed that youths should be involved in the strategy to facilitate information dissemination through the ICT formats. In the same vein, 71.9 percent of the extension personnel agreed that end-users should be involved in information creation at local levels.

The distribution also showed that 71.8 percent of the extensionists agreed that choice of ICT equipment to be used should take end-users into consideration. Equally, 57.7 percent of them agreed that trial-and-error process was required for selection of appropriate ICT strategy while 10.3 percent of them disagreed with the statement. Also 60.0 percent of the extension practitioners agreed that telecom companies must be made to connect rural areas even if it is not profitable to them.

Table 5.24: Distribution of research personnel by perceptions on sustainable use of ICTs for agricultural information dissemination

Statements	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
Access to ICTs will be better achieved through personal than institutional efforts	17 (23.3)	17 (23.3)	17 (23.3)	18 (24.7)	4 (5.5)
To engender ICT strategy, all categories of practitioners must possess functional skill of computer use	43 (58.9)	21 (28.8)	8 (11.0)	1 (1.4)	0 (0.0)
Development practitioners should be made to publish on ICT media for promotion purposes	19 (26.0)	39 (53.4)	9 (12.3)	6 (8.2)	0 (0.0)
Corporate responsibilities should also include sponsorship of ICT for agricultural development	30 (41.1)	33 (45.2)	10 (13.7)	0 (0.0)	0 (0.0)
Information users (farmers etc) should pay for services though at subsidised rate	18 (24.7)	28 (38.4)	20 (27.4)	6 (8.2)	1 (1.4)
Youths should be included in the strategy to facilitate information dissemination through the ICT formats	26 (35.6)	30 (41.1)	13 (17.8)	4 (5.5)	0 (0.0)
End users should be involved in information creation at local levels	29 (39.7)	34 (46.6)	10 (13.7)	0 (0.0)	0 (0.0)
Choice of ICT equipment should take end users into consideration	35 (47.9)	29 (39.7)	7 (9.6)	1 (1.4)	1 (1.4)
Trial-and-error process is required for selection of appropriate ICT strategy	13 (17.8)	26 (35.6)	19 (26.0)	11 (15.1)	4 (5.5)
Telecom companies must be made to connect rural areas even if it is not profitable to them	32 (43.8)	24 (32.9)	14 (19.2)	2 (2.7)	1 (1.4)

Figures in parentheses are percentages
Source: Field survey (2007)

Table 5.25: Distribution of extension personnel by perceptions on sustainable use of ICTs for agricultural information dissemination

Statements	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
Access to ICT will be better achieved through personal than institutional efforts	17 (12.6)	41 (30.4)	37 (27.4)	31 (23.0)	9 (6.7)
To engender ICT strategy, all categories of practitioners must possess functional skill of computer use	43 (31.9)	57 (42.2)	23 (17.0)	11 (8.1)	1 (0.7)
Development practitioners should be made to publish on ICT media for promotion purposes	18 (13.3)	62 (45.9)	45 (33.3)	9 (6.7)	1 (0.7)
Corporate responsibilities should also include sponsorship of ICT for agricultural development	33 (24.4)	64 (47.4)	33 (24.4)	5 (3.7)	0 (0.0)
Information users (farmers etc) should pay for services though at subsidised rate	18 (13.3)	41 (30.4)	37 (27.4)	34 (25.2)	5 (3.7)
Youths should be included in the strategy to facilitate information dissemination through the ICT formats	36 (26.7)	47 (34.8)	45 (33.3)	7 (5.2)	0 (0.0)
End users should be involved in information creation at local levels	41 (30.4)	56 (41.5)	34 (25.2)	4 (3.0)	0 (0.0)
Choice of ICT equipment should take end users into consideration	30 (22.2)	67 (49.6)	31 (23.0)	3 (2.2)	4 (3.0)
Trial-and-error process is required for selection of appropriate ICT strategy	28 (20.7)	50 (37.0)	43 (31.9)	13 (9.6)	1 (0.7)
Telecom companies must be made to connect rural areas even if it is not profitable to them	43 (31.9)	38 (28.1)	41 (30.4)	13 (9.6)	0 (0.0)

Figures in parentheses are percentages
Source: Field survey (2007)

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The index practitioners' responses was used to categorise them into favourable and unfavourable based on 'above and below the mean' criterion. Fig 5.9 showed that 30.1 percent of the research practitioners had unfavourable attitude, while 69.9 percent of them have favourable attitude to the sustainable use of ICT for agricultural development. Also, 56.3 percent of the extension practitioners had unfavourable attitude to the sustainable use of ICT for agricultural development, while 43.7 percent of them had favourable attitude to it.

This means that the researchers had more favourable opinions about the sustainable use of ICT facilities for agricultural development than the extensionists. This might be connected with the fact that the researchers use ICTs more than the extensionists as given in Fig 5.7.
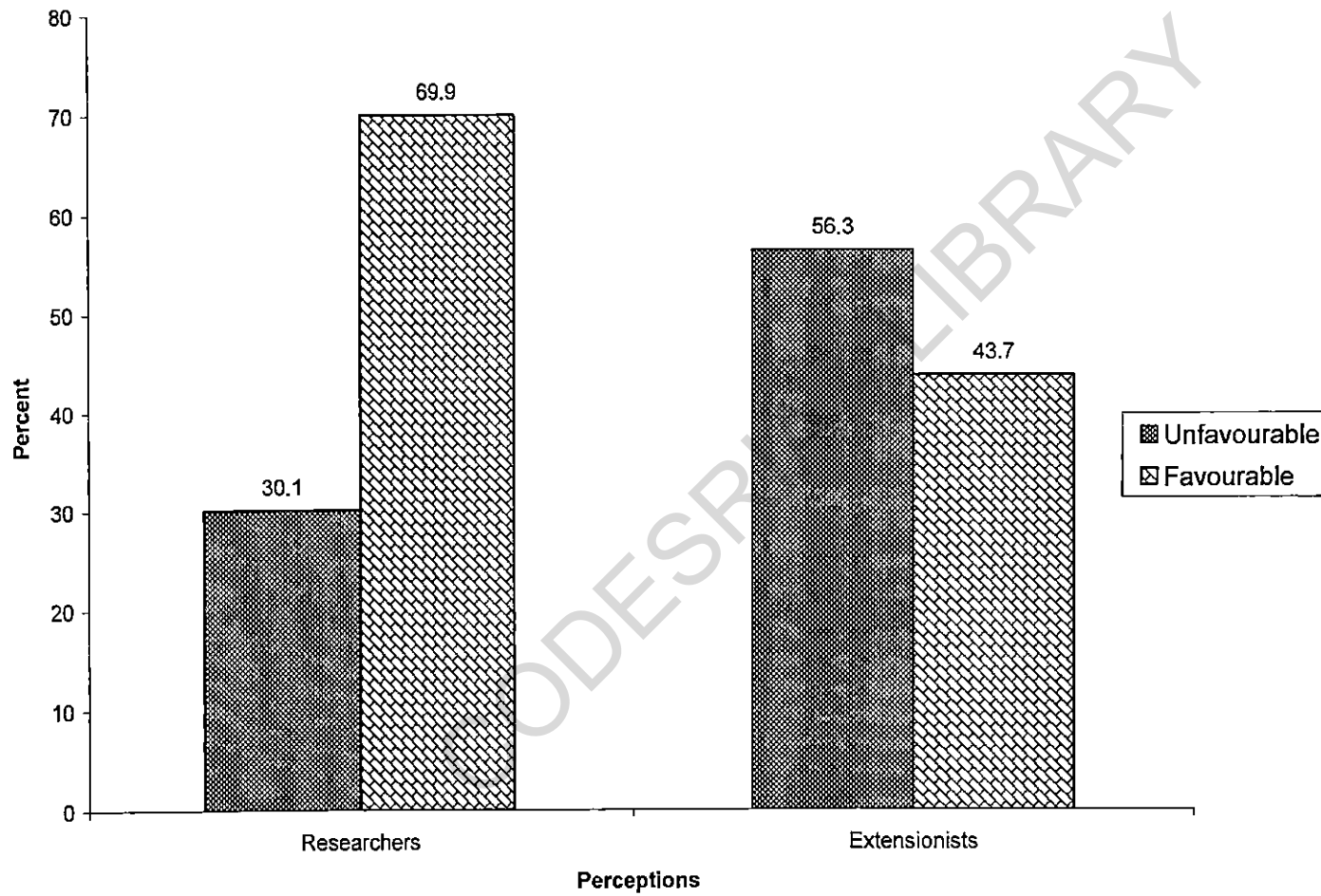
Fig 5.9: Distribution of Practitioners by perceptions of sustainable use of ICTs

5.3 Hypotheses of the study

This section reports the results of data analysis with which the hypotheses of the study were tested.

5.3.1 Tests for relationship between level of knowledge and extent of use of ICT among the research and extension practitioners

The hypothesis was analysed using the Pearson Product Moment Correlations (PPMC).

The result of the analysis shown in Table 5.26 revealed that there is positive and significant relationship (r=0.258; p=0.000) between the practitioners' level of knowledge and extent of use of ICT in their activities. This finding can be explained by the fact that the practitioners who have more ICT knowledge will tend to use the facilities more than those who do not have as much of the knowledge. The implication of this is that if human capital aspects of ICT deployment are enabled through adequate and appropriate staff training on the use of the facilities, the personnel will use the facilities to the extent to which they have access to them. This finding is in line with the position Tella *et al* (2007), who found that lack of skills in the use of ICT equipment and software had resulted in a lack of confidence in utilising the tools. Also, Preston *et al* (2000) found dearth of technical support to be key inhibitor to the use of ICT.

Table 5.26: Pearson Product Moment Correlation analysis between level of knowledge and extent of use of ICT tools among research/extension personnel

	Correlation value	(r)	p-value	Decision
Level of ICT knowledge vs. Extent of use of ICT tools	0.258**		0.000	Significant

** Correlation is significant at 0.01 level (2-tailed)

Source: Field survey (2007)

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5.3.2 Test of relationship between the disposition to use and extent of use of ICTs among the research and extension practitioners

The attitudes of the practitioners to the use of ICT and the level of use of ICTs were entered into the statistics at the ordinal level of measurement; the hypothesis was thus analysed using Spearman (rho) rank correlation.

Results in Table 5.27 showed that there is significant relationship, $r=0.427$; $p=0.000$, between perception of use of ICTs and extent of use of the facilities among the researchers. For the extensionists, however, there is no significant relationship, $r=0.039$; $p=0.653$, between the variables in the hypothesis.

This means that the extension practitioners' perceptions as opposed to that of the researchers, about the use of ICTs do not significantly influence their use of ICTs. This finding can be explained by the fact that even if the extension practitioners have favourable disposition to the use of ICTs, use of the facilities will depend on its availability, which is a different issue from their dispositions. This finding can be supported by the fact that extent of use of facilities depend more on availability of the facilities than perceptions to their use. This implies that those who have favourable perception about the use of a technology may not use it as such. This finding is in consonance with that of Warraich and Ameen (2010), who found that library professionals in Pakistan were satisfied with the use of digital facilities but do not use them at optimal level.

Table 5.27: Spearman (rho) rank correlation analysis between level of use of ICTs and disposition to the use of ICT tools among research/extension personnel

Use of ICTs vs. Perceptions on the use of ICTs	Correlation (r) value	p-value
Researchers	0.427**	0.000
Extensionists	0.039	0.653

** Correlation is significant at 0.01 level (2-tailed)

Source: Field survey (2007)

5.3.3 Test of relationship between socioeconomic characteristics of the farmers and availability of their information needs

The socioeconomic characteristics of the farmers used in the analysis are age, sex, religion, marital status, family size, education, crop production enterprises, livestock production enterprises and other agricultural production enterprises. The farmers indicated their information needs; the count of the information needs (an indication of the extent to which farmers may seek information more than others) was analysed against the selected socioeconomic characteristics of the respondents using Chi-square.

Results in Table 5.28 revealed that age influences availability of information need of the farmers, p=0.036 and the contingency coefficient showed that the strength of the influence is 86.4 percent; religion also influences information needs of the respondents, p=0.004 though the strength of the influence is 49 percent; family size equally influences information need, p=0.056 with a strength of 77.4 percent; education influences information need, p=0.000 with a strength of 55.6 percent and livestock production enterprises significantly influenced information needs of the farmers, p=0.008 with a strength of 34.5 percent. Other listed characteristics that do not significantly influence information need are sex, marital status, crop production and other production enterprises.

The finding that age influences information needs availability of the farmers can be explained by the fact that generational differences between old and young persons can influence differences in access to their information needs. The result showed that the younger farmer-respondents had more of their information needs met than older ones. This is in line with the findings of Demiryurek *et al* (2008), who found that younger farmers dedicate more resources to access information that older farmers. This may be due to the fact that older farmers are less agile and might not be as resourceful as the younger ones.

Religion is a concept that significantly influences people's social capital status and hence access to information (Coleman, 1988); this tend to explain why it influences farmers' information needs. Family size is a serious factor in social capital resources (Coleman, 1994), which is a viable conduit to multiple information sources to family members; this may explain why the variable influences information needs of the respondents.

That education influences information needs may be explained by the fact that those who are more educated are likely to have access to information more than those who are not as educated. Out of the listed agricultural enterprises, only livestock production enterprise significantly influences information need. This finding, among other factors, can be explained by the technical nature of most of the enterprise's practices, which make the practitioners

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more outward in their quest for information. This may explain why it influences information needs of the respondents. CTA, 2006 and Munyua, 2000 have established that one of the obstacles to the use of ICTs in the pursuit of sustainable livelihood is lack of access to education and training.

Table 5.28: Chi-square analysis of relationship between information needs and socioeconomic characteristics of farmers

Socioeconomic Characteristics	Chi-Square Value	p-value	Contingency Coefficient	Decision
Age	587.884	0.036	0.864	Significant
Sex	18.917	0.089	0.295	Not significant
Religion	62.935	0.004	0.490	Significant
Marital Status	40.737	0.270	0.412	Not Significant
Family Size	275.805	0.056	0.774	Significant
Education	89.174	0.000	0.556	Significant
Crop production enterprises	17.444	0.134	0.284	Not Significant
Livestock production enterprises	26.966	0.008	0.345	Significant
Other production enterprises	17.319	0.138	0.283	Not Significant

Source: Field survey (2007)

5.3.4 Test of difference between the dispositions of the research personnel and the extension personnel to the use of ICTs

The index of the perception scores of the two set of practitioners were entered into the independent sample t-test equation to test for difference. The result of the analysis in Table 5.29 showed that there is significant difference, $t=4.370$; $p=0.000$, between the researchers' and extensionists' disposition to the use of ICTs. This implies that the research and extension practitioners differ in their orientations to this construct which may be as a result of differences in their circumstances of access to the use of ICT tools as given in Fig 5.3.

Table 5.29: Independent sample t-test of difference between research and extension personnel's perception of use of ICTs

	Mean	Mean difference	t-value	p-value	Decision
Perceptions on Use of ICTs	Researchers = 39.62 Extensionists = 36.33	3.29	3.700	0.000	Significant

Source: Field survey (2007)

5.3.5 Test of difference in the extent of use of ICT by the research and extension personnel

The extent of use of ICTs by the two set of practitioners was measured from which indices of use were derived. Their indices were analysed using independent samples t-test. The result of the analysis in Table 5.30 showed that there is significant difference, $t=4.370$; $p=0.000$ in the extent of use of the facilities among the research and extension practitioners. This implies that the two set of practitioners differ significantly in terms of their extent of use of ICTs. This might be as a result of disparity in access to ICT facilities as indicated in Fig 5.3, which might be connected to funding of the research and extension agencies in the country. While the agricultural research institutions are funded through regular agriculture ministry budget as academic institutions, the extension institutions are managed as mainstream civil service institutions in their respective states as parastatals (Bukar *et al*, 1997). The days of good funding for the extension institutions had been when the extension system was established and supported by the World Bank.

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Table 5.30: Independent samples t-test for difference between research and extension personnel's extent of use of ICTs

	Mean	Mean difference	t-value	p-value	Decision
Extent of Use of ICTs	Researchers = 34.123 Extensionists = 24.615	9.5085	4.370	0.000	Significant

Source: Field survey (2007)

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1   Summary of major findings of the study

The study showed that the mean age of farmers in the study area was 48.1 years, while most (45.2%) of them fell between age bracket of 41 and 55 years. Most (89.4%) of the farmers were male and most (86.9%) of them were married. Most (31.7%) of the farmers do not have formal education and the average number of years spent in educational institution was 7.1 years. The average family size was 7.28 persons with the majority having between 5 and 10-member households.

Most of the farmers were engaged in crop production enterprises, mostly cultivating maize, cassava and millet/guinea corn. The livestock entrepreneurs among them mostly engage in sheep and goat rearing. The study also showed that most of the farmers were involved in more than one enterprise; most (68.8%) of them had between two and four enterprises.

The mean age of the research/extension personnel was 42 years and most (55.3%) of them fell between the age bracket of 41 and 55 years. Most (86.1%) of practitioners were male and most (89.9%) of them were married. Most (40.9%) of the personnel-respondents had diploma certificates and most (34.6%) of them had learnt the use of computer on-the-job.

The study also showed that there were more personnel (64.9%) involved in extension services at the research/extension institutions in the country. The personnel had an average of 14.55 years of experience, with the modal group having between 7 and 15 years of experience. Information processing was mostly done using books (70.2%) rather than computers (29.8%); and the mostly used ICT by the practitioners were radio and television.

The study's finding revealed that radio, television, newspaper and mobile phones were the ICT tools that are used by substantial proportion of the research/extension practitioners; hence most (40.4%) of the personnel fell in the low level ICT users category. Substantial proportion (31.3%) of the research/extension institutions staffers had regular access outside official access, to the use of computer on daily basis; but most (57.7%) of them had limited access to computer, that is, on one/two per department basis. Most of the practitioner-respondents had access to the internet though at various points such as office, cyber cafés and through private connections. The things which practitioners do most on the web are to search for web resources and access e-mail accounts. As per the constraints to the

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use of ICTs, the study revealed that lack of provision of computer and inadequacy of the provided computers were the only issues most of them considered as constraints.

A substantial proportion of the research/extension practitioners rated the facilities provided for their duties as inadequate. The personnel equally believed that they have achieved minimal level of interaction and feedback from the end-users of their activities. Despite these assessments, most (63.5%) of the personnel-respondents still assessed the current extension strategy as being adequate. Mostly (60.6%) of the practitioner-respondents fell in the poor level of knowledge category; but most (66.8%) of them had favourable disposition to the use of ICTs for the pursuit of agricultural and rural development in the country.

The study found out that 93.5 percent of the farmers had access to radio, 81.9 percent of them had access to television, 43.7 percent had access to magazine and 54.3 percent had access to newspaper. They ranked the ICT tools in order of importance to them thus; radio, television, mobile phone, newspaper magazine and fixed phones in that order. The organisation that provides information to most of the farmers in the country was the agricultural extension agency. Most (59.3%) of the farmers acknowledged that agricultural production information was always available to them, aside others such as agricultural product price, political and community development information, which were also available to a lesser extent. Hence, most of them were in the low level category of availability of their information needs. The farmers ranked agricultural information as the most important one to them, followed by information on agricultural product price and other agricultural marketing information in that order.

Most (55.3%) of the farmers had access to telecentres in their localities and 75 percent of those who had access patronise the centres; and all those who patronised derive benefits from such patronage. Most of those who do not patronise the telecentres do not state any reason, while the most (31.8%) stated reason is that the location is not convenient. The significant benefits derived by most (65.9%) of the farmers were agricultural operation information, political information (51.1%), and social information (47.7%). They rated the important benefits derived thus; agricultural operation information (58.0%), then leisure (10.2%), political information, social gathering and general information.

Most (44.2%) of the practitioners believed that access to ICT facilities would be better achieved through personal than institutional efforts. They mostly (78.8%) agreed that all categories of personnel must have functional skill of computer use to engender ICT dissemination strategy for development. Majority (66.4%) of the personnel-respondents also

agreed that development practitioners should be made to publish on ICT media for promotion purposes in order to achieve ICT content development. Most (76.9%) of the practitioners also believe that corporate responsibilities should include sponsorship of ICTs for agricultural development. Meanwhile, 50.5 percent of them are of the opinion that farmers should pay for information services through the use of ICTs to make the strategy sustainable. Most (66.8%) of the personnel also believed that youths should be involved in the ICT dissemination strategy to make the effort sustainable. Majority (77.5%) of them also opined that the choice of ICT format to be used should take the end-users' circumstance into consideration; and 56.2 percent that trial and error process in required for selection of appropriate ICT tool. Then 65.9 percent of them are of the opinion that telecommunication companies should be made to connect the rural areas even if it is not profitable them. In essence, the finding of the study showed that most (61.5%) of the research/extension personnel have favourable disposition to the sustainable deployment of ICTs for agricultural and rural development pursuits in the country.

The study revealed that research personnel had access to the use ICT facilities than their extension service counterpart. Then, male personnel tend to use ICTs more than their female colleagues. The variables that have no cogent pattern of relationship with personnel's level of use of ICTs are; personnel's ranks, level of computer training, their years of experience and perception to the use of ICTs. The variables that have progressive positive relationship with level of use of ICTs are; personnel's level of education, access to ICT facilities, official access to ICT tools, level of ICT knowledge and personnel's assessment of constraints to use of ICTs.

A multinomial regression analysis, at the medium level, showed that being an extension personnel tend to make the personnel in the low level category of ICT users, while official access to ICT facilities and severity of constraint assessment make the personnel be in the medium category of ICT users. The analysis also, at the high level, showed that being an extension personnel and being in higher grade level tend to make the personnel be in the category of low level users. Then, ICT facilities availability, official access to ICTs, severity of constraints assessment and perception of importance of ICTs to work schedule tend to make a personnel be in category of high level users of ICT.

The study also revealed that most of the farmers are willing to use the ICTs to access information though few of them are willing to pay for such services. It also showed that the farmers that are married were more willing to use ICTs; and so do farmers with more number of information sources. Other farmers' characteristics that do not have coherent trend with

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willingness to use ICTs are sex, age, family size, education, telecentre availability and patronage, benefit accrued and information availability. Binomial logit regression model corroborated the validity of the relationship between willingness to use ICTs and marital status and as well as number of information sources the farmers use.

A Pearson Product Moment Correlation (PPMC) analysis revealed a positive and significant relationship (r=0.258; p=0.000) between personnel's level of use of ICTs and level of their knowledge of ICTs use. A Spearman rank correlation analysis revealed that there is no relationship (r=-0.059; p=0.396) between the personnel's level of use of ICTs and their perception about the use of ICTs.

Chi-square analysis revealed that age (p=0.036), religion (p=0.004), family size (p=0.056), education (p=0.000) and involvement in livestock enterprises significantly influenced information needs of farmers. An independent samples t-test established significant difference (t=4.370; p=0.000) between the research and extension personnel's disposition to the use of ICTs. Another analysis with independent samples t-test showed that there is significant difference (t=3.700; p=0.000) in the use of ICTs by the research and extension personnel.

6.2   Conclusions and implications of findings

The study investigated farmers and research/extension practitioners' characteristics in Nigeria and concluded that:

- The fact that the ICT tools most of the farmers have access to are radio, television, mobile phone, newspaper magazine and fixed phones, which are analogue ICT formats implies a sub-optimal access to ICTs for agricultural information dissemination in the country. The finding that organisation that provides information to most of the farmers in Nigeria is the agricultural extension agency showed a linear flow pattern in agricultural information delivery in the country. Telecentres are also prevalent in farming communities, while agricultural operation information is the most important benefit farmers get from the centres.

- The finding that research practitioners rated available ICT tools more adequate than their extension counterpart showed that there is disparity in the provision of the facilities to the institutions. The fact that most of the (research and extension) practitioners agreed that minimal interaction and feedback is achieved through current delivery methods show the limitation of the information delivery in use.

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- The study's finding that most of the researchers and fewer of the extensionists have favourable perception to the use of ICTs in their information management activities implies the need for other factors apart form provision of the facilities in order engender the use of ICTs for agricultural information delivery in Nigeria.

- The fact that more of researchers and fewer of extensionists have appreciable knowledge of use of ICT tools indicated imbalance in the human capital resources required for deployment of ICTs in agricultural information management in the country.

- The extensionists mostly use radio, television, newspaper and mobile phones while the mostly used ICT tools by the researchers are radio newspaper, phone, computer, internet and e-mail. This implies that the researchers use more of the digital ICT formats than the extensionists, who mostly use analogue ICTs. More of the researchers and fewer of the extensionists are in the high level category of ICT use. Most of the practitioners indicated limitations of infrastructures and logistics as the constraints to the use of ICTs in their activities.

- Most of the farmers appreciated the effective communication potential of digital ICT media. Despite the fact that most of the farmers will be willing to use ICTs to access information, not most of them will be willing to pay for the services.

6.3   Recommendations

1. The use of ICTs in agricultural information dissemination may have to be started from the analogue ICT formats such as radio and television which are available to most of the farmers as well as the practitioners. Also, the deployment of the ICT facilities for agricultural information management has to give adequate cognisance to the agricultural extension agency in the country as the major source of information to most farmers in the country. In the same vein, the concept of access to ICTs through the use of telecentres via private entrepreneurs should be pursued because most of the farmers have telecentres in their localities.

2. Government funding for agricultural information management must assign appropriate importance to the stakeholder institutions, which should remove disparities in the provision of basic facilities to them. This will make the institutions better positioned to fulfil the current needs in agricultural information management in the country.

3. The focus of use of ICTs for agricultural information management must consider other aspects such as attitudinal re-orientation of the practitioners in the use of the facilities in order to achieve effective delivery strategy.

4. The ICT facilities integration into agricultural information dissemination must be accompanied by adequate training of the personnel given the fact that most of them have low level of ICT knowledge.

5. The ICT deployment sustainability strategy that requires that the users pay for services must be pursued but being substantially subsidised at first so that farmers' initial reluctance to pay might not truncate the implementation of the strategy.

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APPENDIX 1

QUESTIONNAIRE
Determinants of Adoption of Information and Communication Technologies (ICTs) for Agricultural Extension Delivery and Rural Development in Nigeria
Researchers and Extension Practitioners

Dear Sir/Ma,

    This questionnaire is designed to solicit information on the above stated topic. I hereby assure you that information collected shall be purely used for academic purpose. Thank you.

Yekinni, O. T.

Name of Institution ....

Socioeconomic Characteristics

a. Sex. Male ( ), Female ( )

b. Age. ....

c. Marital Status   Single ( ), Married ( ), Divorced ( ), Widow ( ), Widower ( ).

d. Practitioner in .... Agricultural Research ( ), Extension Services ( ).

e. Rank ....   Grade Level ....

f. Number of years in service .... (years)

g. Line of activity.   Administration ( ), Research ( ), Documentation ( ), Field survey ( ), Information   Dissemination   (   ),   Others   (please   specify) ....

Academic / IT Background

h. Highest academic qualification attained.   Diploma ( ), Bachelor ( ), Masters ( ), PhD ( ), Others (specify) ....

i. Level of computer training acquired. Degree ( ), Diploma ( ), Taught within the formal education curriculum ( ), Certificate ( ), Learning on-the-job ( ), No training at all ( ).

Current Method of Research and Information Delivery

j. How do you document and store information on your researches? In books ( ), on computer databases ( ), upload to the internet ( )

k. Which of the following information facilities do you use in your dissemination activities? _**Tick as many as are applicable.**_ Radio ( ), Television ( ), Video ( ), Video CD ( ), Telephone/GSM ( ), Multimedia Projectors ( ), CD-ROM technology ( ), Intranet/internet ( ), Others (please specify) ....

l. Assess the current way of research and information delivery. Very good ( ), Just Adequate ( ), Indifferent ( ), Inadequate ( ), Obsolete ( )

m. To what extent are you able to achieve the end-user input into your activities using the current means of communication? Facilitated effective interaction ( ), Minimal level of interaction and feedback attained ( ), No interaction or feedback is achieved ( ).

Access to ICT

n. Level of interaction with computer. Regularly at the office only ( ), Use regularly at home ( ), Use occasionally at the office ( ), Seldom Use ( ), Never used at all ( ).

o. Average period of use of computer. Daily ( ), Thrice-a-week ( ), Twice-a-week ( ), Once in a week ( ), Others ( ) please specify ....

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p. Do you have access to the Internet? Not at all (   ), Only at Cyber cafés (   ), At the office connection ( )

q. What do you usually do on the computer at the office? *Tick as many as are applicable.* Upload/update information onto the official website (   ), Digital update of information on the computer (   ), Access official e-mail for messages (   ), Source for academic resources on the web (   ), Access and update personal website (   ), Check personal e-mail account (   ), Chat with friends (   ) Others (please specify) ....

r. Level of official access to computer. One is provided per staff ( ), One or two is provided for the department ( ), None is provided at the office ( )

s. Adequacy of ICT facility. Just adequate (   ), Not adequate but manageable (   ), Not adequate at all (   )

Availability of ICT for Use

t. Please indicate which of the following ICT formats is available *for official use* as well as their frequencies of use.

ICT formats	Tick	Frequency of Use				
		All the time	Regularly	Occasionally	Rarely	Never
Radio						
TV						
Cinema						
Newspaper						
Fax						
Phone (fixed)						
Mobile phone/GSM						
Multimedia projector						
Video						
Computer						
CD-ROM* technology						
Internet						
Organisation e-mail						
Organisation website						
Personal e-mail						
Personal website						

* For digital documentation of official information and **not** the ordinary computer CD-ROM

Constraints to Availability of ICT for Use

u. Kindly indicate which of the following factors affects the availability of the ICT formats *for official use* in your establishment.

Constraints	Severity of constraints			
	Serious	Mild	Indifferent	Not a constraint
Computers are not provided at the office				
Computers provided are not enough				
Computers provided are not adequate				
I can not operate a computer effectively				
Work schedules are not adaptable to ICT use				

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Constraints	Severity of constraints			
	Serious	Mild	Indifferent	Not a constraint
The ICT formats are not provided at the office				
Others				

Level of ICT Knowledge

v. Please respond to the following as much as you know.

1. One of the following is not an operating system that can be used on a computer. Linux ( ), MS word ( ), Macintosh ( ), Windows ( ), No idea ( ).

2. Which of the following is a browser software? PowerPoint ( ), Adobe ( ), Window Explorer ( ), Netscape ( ), No idea ( ).

3. Identify a presentation package from the following. Adobe PageMaker ( ), Print Artist ( ), MS word ( ), PowerPoint ( ), No idea ( ).

4. Identify one of the following which is **not** a general e-mail domain. Yahoo ( ), Hotmail ( ), Adobe ( ), Gmail ( ).

5. Website materials are usually published in the following formats except. HTML ( ), PDF ( ), PowerPoint ( ), MS word ( ), PageMaker ( ), No idea ( ).

6. To open a PDF file you need this software. MS word ( ), Word pad ( ), MS Paint ( ), Adobe Acrobat reader ( ).

7. To get a picture into the computer you need any of these except. Scanner ( ), Digital camera ( ), Digital video device ( ), Joystick ( ), No idea ( ).

8. If you cannot access a diskette on your computer any of these may have happened. The floppy drive is bad ( ), The diskette is bad ( ), The diskette is not formatted ( ), The file is corrupted ( ), All of the above ( ).

9. If the computer cannot access the hard disk hence cannot boot, you can boot the system by using. A blank new hard-disk ( ), A rewritable CD ( ), OS software CD ( ), Bootable diskette ( ), No idea ( ).

10. A desktop computer switches itself off automatically when you shut down because... It has a special software for that ( ), It is more sensitive to power cut than others ( ), It has an enhanced CRT (monitor) ( ), It uses an ATX casing ( ) It uses a UPS backup ( ), No idea ( ).

Perceptions on the use of ICT for extension of Agricultural Information

w. Kindly respond to the following statements about use of ICTs in your duty

Statements	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
ICT facility can easily network all research activities for easy access to information by all and sundry					
ICT utilisation can facilitate international cross fertilisation of research ideas for better research efforts and discoveries.					
ICT utilisation can facilitate exchange of information between the research and extension institutions.					
The use of ICT can incorporate feedback mechanism into research and extension activities.					
With ICT use, all the stakeholders in agricultural production activities can easily be incorporated into the research and extension service schedule.					
The idea of ICT use is elitist; any tangible benefit may not reach the farmers.					
If ICT is made available at the farmers' end, it would render the extension institution irrelevant.					
ICT utilisation will not make extension delivery more vibrant than it has been.					
The cost required for the use of ICT is prohibitive and may never be realisable given the government's attitude to funding development programmes.					
The cost of making ICT available would be much more than the benefit that can ever come from its use.					
Others					

Importance of ICT to Work schedule

x. Kindly indicate which of the listed ICT formats would be important to facilitate your work schedule.

ICT formats	Very important	Some what important	Not important	Not relevant
Radio				
TV				
Cinema				
Newspaper				
Fax				
Phone (fixed)				
Mobile phone/GSM				
Video				
Computer				
CD – ROM* technology				
Internet				
Organisation E-mail				
Organisation website				
Personal E-mail				
Personal website				
Others				

* For digital documentation of official information and **not** the ordinary computer CD-ROM

Sustainable Use of ICTs for Development Information Dissemination

y. Kindly react to the following statements, which border on issues that may affect sustainable use of ICT for development, via these response options

Statements	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
Access to ICTs by practitioners will be better achieved through personal efforts than expected provision by their institutions					
To engender ICT use, all categories of development practitioners must have basic and working skills of computer as a matter of duty					
Development practitioners should be made to publish on ICT media (e.g. website, TV, radio etc) for promotion purposes					
Corporate responsibilities to development should be made to focus sponsorship of ICT strategies for agricultural development					
Information end-users need to pay for the services though there is need for some level of subsidy					
There is the need to involve some youths at the local level to serve as human interface between illiterate farmers and ICT equipments					
The end-users must be involved in the creation of information at the local levels					
The choice of ICT equipment must take the end-users into consideration in a foremost manner					
There is need for trial-and-error process in the selection of appropriate ICT strategy for development goals					
The telephone companies in the country should be made to 'connect' the rural areas even if it does not make economic sense to them					
Others					

Thank you Sir/Ma

QUESTIONNAIRE
Determinants of Adoption of Information and Communication Technologies (ICTs) for Agricultural Extension Delivery and Rural Development in Nigeria
End-Users (Farmers)

Dear Sir/Ma,

This questionnaire is designed to solicit information on the above stated topic. I hereby assure you that information collected shall be purely used for academic purpose. Thank you.

Yekinni, O. T.

Local Government & State ....

....

Socioeconomic Characteristics

i. Age. ....

ii. Sex.   Male ( ), Female ( )

iii. Religion.   Islam ( ), Christianity ( ), Traditional religion ( ), Others ......

iv. Marital Status. Single ( ), Married ( ), Divorced ( ), Widow ( ), Widower ( ).

v. Family size ....

vi. Agricultural production enterprise   Crop ( ) specify ....

Livestock ( ) specify ....

Others (specify) ....

vii. Number of years in formal educational institutions .... (years)

Experience with Telecentre

viii. Do you have a telecentre in your community? Yes ( ), No ( )

ix. Who is/are custodian of the centre? The Village Chief ( ), The Village Extension Agent ( ), A teacher in the village ( ), An individual ( ), Others (specify) ....

x. Do you patronise the centre? Yes ( ), No ( )

xi. If no why? It is monopolised ( ), I don't like the custodian(s) ( ), the location is not convenient ( ), the managers are not transparent ( ), Others (specify) ....

xii. Have you realised any benefit in using the telecentre? Yes ( ), No ( )

xiii. If yes, specify the benefit(s) you have realised. *Tick as many as applicable.* Political information ( ), Social information ( ), Leisure ( ), Social gathering ( ), Agricultural operation information ( ), Others (please specify) ....

xiv. Kindly specify the most important benefit ....

xv. Were there financial commitments to the maintenance of telecentre?   Yes ( ), No ( )

xvi. If yes, have you been financially responsible to the centre?   Yes ( ), No ( ).

xvii. If No, why?   It is not worthwhile ( ), I am not capable ( ), I do not like such commitments ( )

xviii. Which of the following do you use to obtain information on agricultural and rural development issues? (Tick as many as relevant)

	ICT formats	Tick	Rank in order of importance 1= most important, 7= least important
1	Radio		
2	TV		
3	Video		
4	Phone (fixed)		
5	Phone (mobile)/GSM		
6	Magazine		
7	Newspaper		
	Others		

xix. Do you obtain information from any of these agencies and how often do you do that? Tick as many as relevant

Agencies	Most of the time	Often	Rarely	Never
Agricultural Extension Services				
Agricultural Credit/Cooperative Scheme				
Agricultural Input Dealers				
Non-Governmental Organisations				
Natural Resource Management Organisations				
Others				
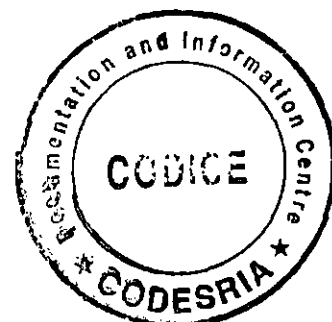
Information Need

xx. Kindly indicate which of the following information is important to you and to what extent have they been available. Please tick as many as relevant

Information	Importance		Availability		
	Tick	Rank In Order of Importance 1= Most important	Always	Rarely	Never
Agricultural Production information					

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Information	Importance		Availability		
	Tick	Rank In Order of Importance 1= Most important	Always	Rarely	Never
Agricultural products price information					
Other Agricultural marketing Information					
Non-Agricultural Marketing information					
Weather information					
Food/Nutrition information					
Health information					
Community Development information					
Education					
Politics					
Religion					
Skill acquisition					
Others					

xxi. Do you find it relevant that you can send information directly to those who make decisions on issues that affect you? Very relevant (   ), Barely relevant (   ), Indifferent (   ).

xxii. Do you find it relevant to have an avenue where you can ask experts questions and get answers promptly? Very relevant (   ), Barely relevant (   ), Indifferent (   ).

xxiii. Do you know that most relevant information you require on agriculture and rural development among others can be obtained from the computer? Yes (   ), No (   ).

xxiv. If the information can be provided, would you be willing to access the information through it?
Yes (   ), No (   ).

xxv. If yes, would you be willing to pay for the service?   Yes (   ), Not sure (   ), No (   )

Thank You Sir/Ma