Analysis and Comparison of the Agricultural Development Programme and University Agricultural Technology Transfer Systems in Nigeria

M.C. Madukwe
E.C. Okoli
S.O. Eze

ATPS Working Paper Series No. 35

Table of Contents

List of Tables and Figures

List of Tables

List of Figures

Abstract

Nigerian agricultural technology transfer policy since political independence emphasized transfer of technical information to farmers using various agro-technology transfer systems. Currently, the Agricultural Development Programme (ADP) and University are the prominent government funded agro-technology transfer systems in Nigeria. This study comparatively analysed technology generation, transfer and utilization sub-systems of the ADP and university in Nigeria. The study covered three out of five agro-ecological zones in Nigeria, namely: Southwest, Central and Northwest. Four states, namely: Benue, Kaduna, Ogun and Osun, were selected on the basis of geographical spread and the presence of universities with agro-technology transfer programmes. The staff of the ADPs and universities in the selected states and farmers served by the two agencies, constituted the research population. On the whole, 524 randomly selected respondents comprising from the ADPs and 160 from the universities made up the sample size for the study. One structured questionnaire for management staff and another for field extension workers; and an interview schedule for farmers, were utilized for data collection. Percentages, mean scores and t-test were the statistical tools adopted in analysing the data.

The findings showed that the ADP had larger staff and wider technology transfer coverage, compared with the university. The organizational structure of the university had at most two supervisory steps, compared with the ADP, which had four supervisory steps. The extension staff of the ADP had better tenets of field agro-technology transfer services compared to the field extension staff of the university with limited field exposure and orientation. The technology transfer staff of the University had better conditions of service and were more committed towards the farmers compared with the ADP, which lacked appropriate staff motivation. ADP had high rate of staff turnover compared with the University, which currently has high selectivity in staff recruitment. University organized agro-technology generation through research efforts in their faculties of agriculture compared with ADP which carried out limited technology generation activities, mostly through on-farm research (OFR) and on-farm adaptive research (OFAR) trials. ADP organized constant and decentralized staff training for field extension workers with poor training facilities, and provided inadequate training incentives to staff, compared to the universities, which provided competitive training incentives to extension workers. The ADP provided information on more agro-technologies and had higher socio-economic impacts on participating farmers, compared with the university. The study recommends restructuring of the ADP and university agro-technology transfer systems, taking into consideration their areas of comparative strengths and weakness. The location of agro-technology services within the university system is strongly recommended of the government contributing funds at different levels.

Published by the African Technology Policy Studies Network, P.O. Box 10081, 00100 General Post Office, Nairobi, Kenya

rinted by Newtec Concepts
P.O. Box 00800, Westlands
14180 Nairobi, Kenya
Tel: 4449849, Fax: 4450399
newtec@bidii.com

ISBN: 9966-916-42-3

Abbreviations and Acronyms

ABU	Ahmadu Bello University
ADP	Agricultural Development Programme
ADPEC	Agricultural Development Project Executive Council
AMREC	Agricultural Media Resources and Extension Centre
AMRECMAC	Agricultural Media Resources and Extension Centre Management Committee
APMEU	Agricultural Project Monitoring and Evaluation Unit
ARMTI	Agricultural and Rural Management Training Institute
BESs	Block Extension Supervisors
BRM	Block Review Meeting
CEC	Cooperative Extension Centre
CRN	Cocoa Research Institute of Nigeria
EA	Extension Agent
FACU	Federal Agricultural Coordinating Unit
FRI	Forestry Research Institute
FVS	Fixed Visit Schedule
HOUs	Heads of Units
IAR	Institute of Agricultural Research
IAR&T	Institute of Agricultural Research and Training
IITA	International Institute for Tropical Agriculture
IKS	Indigenous Knowledge System
LCRI	Lake Chad Research Institute
LGC	Local Government Councils
LRI	Leather Research Institute
MOA	Ministry of Agriculture
NAERLS	National Agricultural Extension Research Liaison Services
NAPRI	National Animal Production Research Institute
NARSs	National Agricultural Research Institutes
NATSP	National Agricultural Technology Support Project
NCRI	National Cereals Research Institute
NFDP	National Fadama Development Project
NIFOR	National Institute for Oil Palm Research
NIHORT	Nigerian Institute for Horticultural Research
NRCRI	National Root Crops Research Institute
NSPRI	Nigeria Stored Products Research Institute

OAU	Obafemi Awolowo University
OFAR	On-Farm Adaptive Research
OFR	On-Farm Research
PCU	Project Coordinating Unit
PFT	Project Facilitating Training
PMU	Project Management Unit
REB	Research - Extension Board
RH	Regional Heads
RRI	Rubber Research Institute
SMS	Subject Matter Specialists
SPATs	Small Plot Adoption Techniques
TOT	Transfer of Technology
TRM	Technology Review Meetings
T&V	Training and Visits
VRI	Veterinary Research Institute
ZEO	Zonal Extension Officer
ZM	Zonal Manager
ZSs	Zonal Supervisors

ATPS Working Paper Series

No.	Title	Publication	Authors
1	The Effect of Economic Reform on Technological Capability		T. Adeboye M. S. D. Bafachwa O. A. Bamiro
2	Methodological Issues in Science and Technology Policy Research		T. Adeboye N. Clark
4	Rehabiliation in the Manufacturing Sector in Tanzania		S. M. Wangwe
5	Agricultural Policy and Technology in Sierra Leone		C. Squire
6	Effectiveness of Agricultural Research Extension in Sierra Leone		A. K. Lakoh
8	Generation and Utilization of Industrial Innovation in Nigeria		O. Oyeyinka G. O. A. Laditan A. O. Esubiyi
9	Irrigation in the Tuli Block, Botswana Water Conservation Techniqes or Optimal Strategies		I. N. Masonde
10	Endogenous Technology Capacity and Capability Under Conditions of Economic Policies of Stabilization and Structural Adjustment		S. E. Chambua
11	Technology and Female-Owned Business in the Urban Informal Sector of South-West Nigeria		R. O. Soetan
12	Technology Innovations Used to Overcome the Problem of Resource Scarcity in Small Scale Enterprises		C. W. Ngahu
13	Financing of Science and Technology Institutions in Kenya During Periods of Structural Adjustment		M. Mwamadzingo
14	Impact of Economic Liberization on Technologies in Enterprises Processing Agricultural Produce		P. Madaya
15	Technology and Institutions for Private Small and Medium Firms		B. Oyeyinka
16	Institutiona Reform, Price Deregulation and Technological Change in Smallholder Agriculture		E. C. Eboh
17	Adoption of Agricultural Technologies by Rural Women under the Women-in-Agriculture Program in Nigeria		D. S. Ugwu
18	Electrical Power Utilities and Technological Capacity Building in Sub-Saharan Africa		Brew-Hammond
19	Investigation into Factors that Influence the Diffusion and Adoption of Intentions and Innovations from Research Institutes and Universities in Kenya		Bwisa, H. M. and Gachui
20	The effects of Economic Reforms on the Quality on the Quality of Technological Manpower Development in Nigeria		H. E. Nnebe
21	Issues in Yam Minisett Technology Tranfer to Farmer in Southern Nigeria		Michael C. Madukwe Damain Ayichi Ernest C. Okoli
22	Technological Respone to Telecommunication Development: A Study of Firms and Instituions in Nigeria		Adeyinka F. Modupe
23	Gender Differences in Small Scale Rice Farmers' Access to Technological Inputs in Enugu State of Nigeria		David Nwoye Ezeh

Dr. M.C. Madukwe and Dr. E.C. Okoli are both Lecturers at the Department of Agricultural Extension, University of Nigeria, Nsukka, Nigeria. Dr. S.O. Eze is a lecturer with the Ebonyi State Agricultural Development Programme Abakaliki, Ebonyi State, Nigeria.

For more information on this series and ATPS, contact:

The Executive Director
The African Technology Policy Studies Network
3rd, Floor, The Chancery,
Valley Road

P.O. Box 10081
00100 General Post Office
Nairobi, Kenya
Tel: 254-2-2714168/092/498
Fax: 254-2714028
Email: info@atpsnet.org
Website: http://www.atpsnet.org

Chapter One

Introduction

This report examined the concept of agro-technology transfer and presents success indices. Features of each of the agro-technology sub-systems (generation, transfer and utilization) are discussed. The agro-technology generation sub-system, ecological distributions of agro-research institutes and universities are presented. The agro-technology transfer sub-system, the historical involvement and organizational structure of different universities, and the Agricultural Development Programme (ADP) are examined. Similarly, the characteristics of the agro-technology utilization sub-system are presented. Two theoretical approaches commonly used in the analysis of agricultural technology transfer systems were examined and eight basic issues for comparative analysis of agro-technology transfer systems were identified using the systems approach.

This is followed by the comparison of the agro-technology generation practices of the ADP and university agro-technology transfer systems based on: the organization of staff, and farmer characteristics; use of agricultural technology packages; and contact methods.

Recommendations and policy options for restructuring agro-technology transfer practices in Nigeria are presented.

The problem

Nearly two decades after independence, in 1960, the Nigerian agricultural technology transfer policy emphasized transfer of technical information on specific cash crops using regional Ministries of Agriculture (MOA) in the north, west and east. The period saw the establishment of agro-research institutes, namely: Institute of Agricultural Research (IAR) in the north; Moore Plantation in the west; and National Root Crops Research Institute (NRCRI), Umudike in the east, to link research and extension services.

With state creation in 1968, the main focus of agro-technology transfer policy was food production through the Federal and states' MOA. It was slow in achieving the desired objectives of agro-technology transfer, because of the bureaucracy. However, it was the sole agency responsible for agro-technology transfer until the 1976 local government reform, which gave some specific agricultural technology transfer functions to Local Government Councils (LGC; Mijindadi, 1983). Some defects of the LGC technology transfer policy include poor job description of staff, lack of mobility and absence of staff training and contacts with farmers (Madukwe, 1996). Further reforms of the Nigerian agricultural technology transfer

policy gave rise, in the seventies, to the involvement of universities and Agricultural Development Projects (ADPs) to transfer agro-technology to farmers.

Initially, five conventional universities namely: Ahmadu Bello University, Zaria; University of Ibadan, Ibadan; University of Ilorin, Ilorin; University of Nigeria, Nsukka; and Obafemi Awolowo University, Ile-Ife, were involved. Later, the university of agriculture policy was initiated in 1988 to amplify the efforts of conventional universities in agro-technology transfer services to farmers. This led to the establishment of the University of Agriculture at Abeokuta, Makurdi and Umudike. In addition, the successes of enclave ADPs at Ayangba, Lafia, Ekiti-Akoko, Gusau, Katsina and Gombe, gave rise to state-wide ADPs in the 1980s. Currently, the ADP and university are the prominent government funded agro-technology transfer systems in Nigeria. This pluralistic approach to government participation and funding in the transfer, has the potential for duplication of effort and waste. Beyon (1998) noted that African countries spend between 10 and 20 times on agro-technology transfer compared to developed countries.

An agricultural technology transfer system has identifiable organizational structure linked to institutionalized source of new agro-technologies and independent staff with appropriate channel for disseminating research information to end users (Madukwe, 1995). A viable agricultural technology system has technology generation, transfer and utilization sub-systems with notable indices of success.

The success indices of a viable transfer system include: constant creation of technical knowledge, extension staff training and contacts, harmonious existence with other agencies, orienting technologies towards utilization and provision of information on necessary farm inputs (Mijindadi, 1994; Swanson,1997). The study considered the university and ADP as agro-technology transfer systems and comparatively analysed the two systems using a systems approach. The systems approach recognizes three sub-systems necessary in implementing a viable agricultural technology transfer system, namely: technology generation, transfer and utilization.

The question that arises is as to what extent ADP and university have developed these indices to justify their operation. The ADP used the training and visits (T & V) strategy which focuses on improving the knowledge and skills of small holder farmers, using technology testing and transfer techniques on state-wide coverage. On the part of the university, emphasis has been on generating relevant agricultural technologies within the faculties of agriculture and using available resources to transfer these technologies to the farmers at selected farming communities. What comparative advantages exist between the university and ADP in agro-technology transfer practices to the farmers? What were the practices adopted by the university and ADP in sourcing research information, implementing staff training and contacts? What social and economic changes among the farmers could be attributable to each of these systems and what differences exist between farmers served by the two systems? What methods were employed by the ADP and university in persuading farmers to use improved technical packages? What policy lessons could be learned from the approaches of the university and ADP systems to enhance agricultural technology transfer process in Nigeria?

Purpose of the study

The overall purpose of this study was to comparatively analyse the agro-technology transfer systems of the ADP and university in Nigeria. Specifically, the objectives were to:

(1) compare the agro-technology generation and transfer practices of university and ADP,
(2) compare the socio-economic impacts of the agro-technology transfer systems of university and ADP, and
(3) identify necessary policy issues to ensure the effectiveness of the agro-technology transfer process in Nigeria.

Chapter Two

Literature Review

Literature is organized under agricultural technology generation, transfer and utilization sub-systems.

Agricultural technology generation sub-system

Agricultural technology has remained a viable tool for improving the productivity of the agricultural sector in Nigeria. Thus, a major step in the improvement of food production in Nigeria has been the increase in the number of the national and international agro-research institutes from 3 in 1963 to the current 18. Agro-technology generation in Nigeria is carried out by National Agricultural Research Institutes (NARIs) with mandate in arable crops, forestry and tree crops; livestock; fisheries; extension and training; and processing and storage.

According to Okon (1998), the aim of agro-technology generation is to address better techniques of land development, crop and animal management and achieve higher yields. Thus, agricultural technology generation system is aimed at providing modern technology and facilities to communities (Bolade, 1990; Eziator, 1990 and Njoku, 1991). According to Ayichi (1995), agricultural technology involves the application of mechanical, chemical and biological inputs such as tractors, fertilizers, agro- chemicals, livestock breeds, high yielding crops, storage and processing facilities, to improve food production.

Technology generation is influenced by determination of need,and research and management of technology generating institutions (World Bank, 1994). Previous research reports blamed ineffectiveness in technology generation on conventional research activities operated in Nigeria. Which have poor consideration of farmers' problems, skill and scale of operation and financial status and orienting of research to journal publication (Zaria et al., 1994). In developing countries such as Nigeria, the acute lack of collaboration between the social and biological scientists on farming system research (FSR), has limited research efforts in generating relevant technologies (Van den Ban and Hawkins, 1992). The net effect of FSR adopted as a policy in the activities of the agricultural technology generation sub-system is the evolvement of technologies best suited to existing farming system and accepted by farmers (Asiabaka, 1998).

According to Blum (1991), most research efforts in technology generation in developing countries are wasted due to their inadequate orientation to farmers' needs and utilization. Farinde (1996), added that the bureaucracy domiciled in the Ministry of Agriculture and Natural Resources, under which research

institutes operate in Nigeria, contributes to the inability of research into meeting technology needs of farmers. In the 1990s, emphasis on agricultural technology generation has shifted from euphoria of spectacular results to appropriateness of these technologies to the existing farming system. An agricultural technology is considered appropriate, if it provides a cost-effective level of productivity and has minimal effects on the environment (McNamara, 1990; Okigbo, 1991). According to Platt (1989), a critical issue to the appropriateness of technologies is in developing them at local levels using skills and perception of the people who live in the rural communities. Presently, technology generation sub-system in Nigeria experiences poor and uncertain funding, frequent government administrative changes and lack of policy initiative in research.

According to Vengara and McDicken (1990), technologies which are capable of improving food productivity at farm level should evolve from well funded autonomous research sub-system, so as to provide timely solution to priority problems of farmers. Farmer-driven research effort must be based on policy setting, utilization of research personnel, continuous flow of information and evaluation of its activities (ISNAR, 1984). The technology generation efforts should be oriented towards social desirability, economic feasibility and existing practices of the farmers as a priority (Monu and Omole, 1983; Farinde, 1996).

Technology generation in Nigeria results from the national agricultural research system, namely; university faculties of agriculture and veterinary medicine including universities of agriculture, and international and national agricultural research institutes, which operate in Nigeria. The objectives of the research institutes are impressive, but the issues of establishing a workable relationship between institutional technology design and indigenous knowledge system (IKS), constitutes a critical issue in technology generation in Nigeria. A workable relationship between institutional technology generation and indigenous knowledge system is largely desired to enhance orientation of technologies towards utilization and overall participation of farmers in extension systems (Rajasekaran et al., 1993). This is necessary to achieve compatibility of technologies to farmers' practices and overall suitability to field needs. Several studies such as those of Igodan and Adekunle (1993), Rolings and Pretty (1997), and Anyanwu (1997a), have highlighted the need for indigenous knowledge in generating appropriate technologies and overall sustainability in food production.

Agricultural technology transfer sub-system

There is a problem of choice of the right type of agricultural technologies and methods with which to communicate relevant technologies to small scale farmers. To enhance adequate food production in Nigeria, demands that farmers should be reached with appropriate technologies that are economically viable and culturally acceptable (Sokoya, 1998). Utilizing appropriate methods in reaching small scale farmers with relevant agricultural technologies in order to improve their knowledge, skill and overall attitude towards agricultural productivity, is agricultural technology transfer. According to Farinde (1996), technology transfer involves complex processes consisting of diverse structures, and relationship of inter-dependent factors and related variables, aimed at enhancing adoption of innovations.

Agricultural technology transfer constitutes a crucial sub-system in implementing any agro-technology process. Effective technology transfer involves organizing of personnel in a hierarchy, staff training and contacts, and adopting of appropriate communication process. According to Ogolo et al., (1994), effective communication is a pre-condition for feedforward and feedback mechanisms, necessary for sustainable agricultural technology transfer. Agricultural technology transfer as a communication technique requires a two-way directional information movement, which involves six elements, the source, message, channel, receiver, effects and feedback (Chinaka, 1993). Thus, effectiveness in technology transfer involves well articulated communication elements in the transfer process (Obinne and Anyanwu, 1991). In other words, effective integration of communication elements, enhances sustainability in communication of ideas and consequent transfer of agricultural technology to farmers.

Asiabaka (1998), added that formal arrangement of staff in the transfer of agricultural technology, enhances participatory approach in which farmers' views are represented and practical orientation in which efforts are focussed on immediate problems of farmers. Chuta (1992), blamed inadequate organization and overall ineffectiveness of Nigerian agro-technology transfer systems on low and unsuitable qualifications of personnel operating in the system. According to Madukwe (1995b), most administrative staff in Nigerian agro-technology transfer organizations, have little training in basic issues of administering agro-technology transfer process.

Organization of activities in any agricultural technology transfer system demands a chain of administrative commands, which largely depend on legal basis of operation (Adebayo, 1995). A legal base is required in order to define a number of programmes, determine qualification of personnel, manner of entry and exit, discipline, training and conditions of service (Madukwe, 1996). Legal basis indicates a policy document establishing the technology transfer system. Such policy document spells out the structure, budget, level of autonomy and clients.

Effective technology transfer system places emphasis on simplicity in the structure of transfer organization in terms of the relationship existing among staff of the organization. Basically, we have vertical and horizontal relationships between staff of a technology transfer organization. Whereas vertical relationship indicates top down and bottom up relationship among staff of the organization, horizontal relationship depicts relationship between staff at the same level in an organization. Effective vertical relationship requires well-articulated horizontal staff relationship. Thus, inadequate horizontal relationship of extension staff would largely limit meaningful vertical structure and overall efficiency in implementing technology transfer.

Previous studies by Uwakah (1985) and Ijere (1992), have blamed delay in transfer of agricultural technologies and overall lack of adoption of recommended agro-technologies on inadequate budgetary allocation and absence of autonomy. Autonomy indicates degree of independence necessary in establishing efficiency and sustainability in implementing agricultural technology transfer.

Agricultural technology utilization sub-system

Agro-technology transfer programmes are directed towards farmers with diverse social, educational, political and economic needs (Obibuaku, 1986). Studies by Titilola (1994) and Igbokwe (1995), identified socio-cultural and economic characteristics of farmers, as factors influencing farmer participation and adoption of agricultural technologies in Nigeria.

Socio-cultural characteristics of farmers include, family size, farm size, social organizations, value orientation, belief system, prevailing norms, educational background and attitudes of farmers towards change and material well being (Jibowo, 1992; Sene, 1994). According to Ijere (1992) and Nweze (1995), economic characteristics of farmers include: income status, labour availability, internal resource mobilization, investment rate, saving potentials and marketing pattern. Husain et al. (1993) blamed inadequate adoption and ineffectiveness of most agro-technology transfer programmes on lack of consideration of the socio-cultural practices and technology incompatibility with the economic status of farmers. Ayichi (1995), added that the impact of any agricultural technology transfer system could be measured on the basis of extent of changes in the socio-cultural and economic characteristics of the farmers.

Impacts are enduring changes in the social and economic conditions of farmers, which have resulted from project effects (Obiechina and Otti, 1985; Ladele, 1991). Some related studies like those of Ogunbameru (1986) and Agwunobi (1993), reported that farmer participation in planning and project implementation, enhanced greater socio-economic impacts. They concluded that training of farmers facilitated adoption of recommended practices.

The impacts of any extension system relate to improvement in the socio-cultural and economic characteristics of the farmers, such as increases in farmers' income and improvement in overall standard of living. Earlier impact studies identified increases in the levels of participation in programme planning, hectare of land cultivated by farmers, positive changes towards agriculture and greater access to social services, as success indicators (Aihonsu, 1992).

Chapter Three

Methodology

Conceptual framework

Two theoretical approaches commonly employed in the analysis of agricultural technology transfer systems are: transfer of technology (TOT) and systems approaches. The TOT model posits a linear relationship between knowledge creation, exchange and user sub-systems. Traditionally, the TOT model involves a vertical one way directional communication, featuring technology generation, exchange and utilization sub-systems. The model is biased towards knowledge creation rather than knowledge users. Thus, knowledge creation commonly deals with those problems that are considered relevant to researchers' interests, rather than orienting research efforts towards utilization. In other words, new technologies are constantly generated by knowledge creation sub-system and given to knowledge exchange sub-system, for transfer to knowledge user sub-system.

The TOT model puts little emphasis on co-ordination between the technology generation and transfer sub-system (Asiabaka, 1998). The situation permits only feedback from knowledge user to knowledge creation sub-systems through knowledge exchange sub-system. This is a major defect of the this model. It neglects the role of both general and agricultural education as synergistic factors, enhancing the potential value of newly acquired agricultural knowledge. The approach also neglects the central impact, which policy making or the disastrous effects of its lack, has on the agricultural knowledge system.

The systems approach seems to correct the imbalance inherent in the TOT model. It was introduced for the analysis of agro-technology transfer system by Nagel (1980). The approach was further amplified by Swanson and Claar (1983), Lionberger (1986), Rolings (1988a, b) and Blum (1989).

The utilization of the systems approach for the analysis of agricultural technology transfer systems is based on the assumption that interactions exist between technology generation, transfer and utilization sub-systems. The situation permits direct linkages and feedback across sub-systems interface. In other words, there are linkages between technology generation, transfer and utilization sub-systems, as well as direct linkages and feedback between technology generation and utilization sub-systems. This is schematically represented in Figure 1.

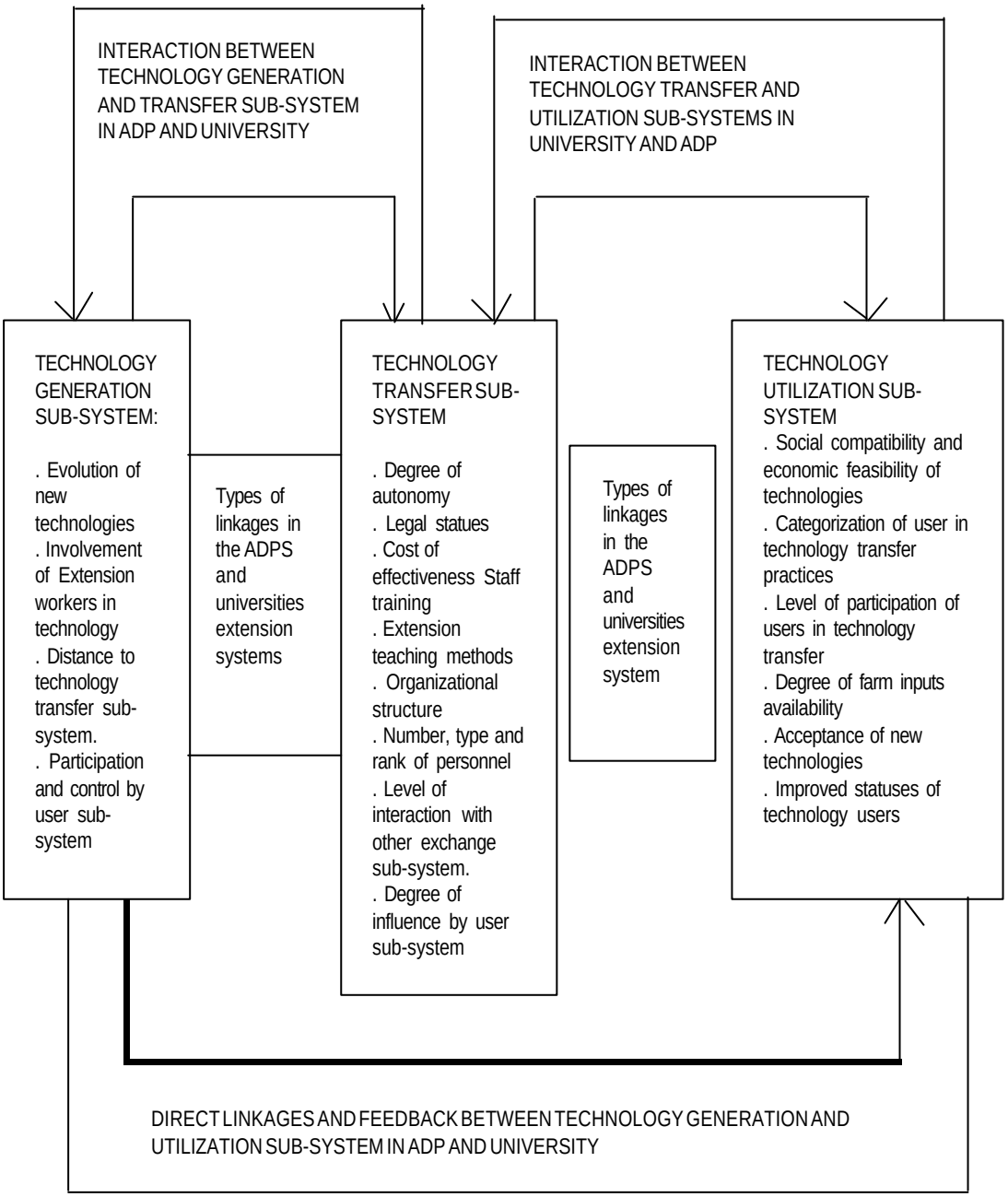

Figure 1: Conceptual framework for a comparative analysis of ADP and university technology transfer system.

The schema suggests mutual interactions and linkages between the major sub-systems as a pre-condition for successful implementation of agricultural technology transfer systems. In other words, the schema posits users' influence in technology generation and participation in technology transfer practices, as well as involvement of technology transfer personnel in technology generation. Earlier research reports indicated that in a successful agricultural technology transfer system, technology users form part of a research team and participate in technology transfer activities (Ajala and Madukwe, 1992).

The schema posits eight basic issues for consideration in the comparative analysis of agro-technology transfer systems of the ADP and university in Nigeria, namely:

(1) sources of new technologies,
(2) degree of linkages between technology generation, transfer and utilization sub-systems,
(3) extent of users' influence on technology generation and participation in technology transfer practices,
(4) level of technology transfer workers' involvement in technology generation and management of field trials,
(5) degree of autonomy in the technology generation, transfer and utilization sub-system,
(6) number, type, ranks and distribution of extension personnel,
(7) degree of staff training and contacts with clients system, and
(8) level of social compatibility and economic feasibility in technology generation and transfer programmes.

The schema suggests that a successful technology generation involves variables such as field driven technology evolution, technology transfer workers' and farmers' participation in technology generation and a social distance span between technology transfer sub-systems. In addition, a successful technology transfer sub-system depends on issues such as legal status, organizational structure, budgets, autonomy of service and qualifications of staff. Also in significance is the staff training, teaching methods, level of interactions with other exchange sub-systems and degree of user influence over transfer activities.

Similarly, a successful technology utilization sub-system involves issues relating to social compatibility and economic feasibility of technologies, categorization of users in technology transfer, level of participation of users in technology transfer and degree of input availability. Levels of acceptability of new technologies and socio-economic characteristics among technology users in terms of improved productivity, income levels, and desired changes in knowledge, skills and attitudes towards extension programmes are also important. We argue that agro-technology transfer is an interactive process involving researcher, farmer and other key operators in agricultural development. The acid test of the success of agro technology transfer systems of the ADP and university is the extent to which their operations approximate the indices of a successful agricultural technology transfer system.

Study population

Nigeria is politically administered under a 36 state structures and a federal capital territory, Abuja. There are 37 ADPs, one in each of the 36 states and the federal capital territory, Abuja. In addition, there are seven federal universities with agricultural technology transfer programmes. The seven federal universities include Ahmadu Bellow University, Zaria; University of Agriculture, Abeokuta; University of Ibadan, Ibadan; University of Ilorin, Ilorin; University of Agriculture Makurdi; Obafemi Awolowo University, Ile-Ife; and University of Agriculture, Umudike. All the ADPs and universities staff, and farmers in their operational areas, constituted the target population.

Sample size

The study selected four states, namely Benue, Kaduna, Ogun and Osun. Their selection was based on the existence of universities with agro-technology transfer outreach programmes and geographical spread. Both the universities and ADPs in the selected states were comparatively investigated. From each university, the director of the agro-technology transfer unit and three departmental staff; one from research and two from agro-technology transfer (extension services), were selected. At field level, 12 agro-technology transfer workers and 24 farmers from each of the universities, were randomly selected. Thus, a total of 64 university agro-technology transfer workers and 96 farmers served by the universities, were randomly selected.

At the headquarters level of each of the state ADP, the directors of three core sub-programmes, extension, technical and rural institution development, and one support sub-programme, administration, were involved. At the zonal level, three zones were selected per state, the Zonal Manager (ZM) and Zonal Extension Officer (ZEO) of each zone were selected. Three Subject Matter Specialists (SMSs) per zone (Agronomy, Women in Agriculture, and Livestock) were selected.

At the block level, six Block Extension Supervisors (BESs) and six Extension Agents (EAs) (made up of one EA per block), were selected per zone. At the farmers' level, 36 farmers per state (made up of 12 farmers per zone, that is, two farmers per selected EA), were randomly selected. Thus, 55 extension staff and 36 farmers per state ADP were involved in the study. A total of 220 extension workers and 144 farmers served by the ADP were involved in the study.

Thus, a total of 524 respondents made up of 284 extension workers and 240 farmers, constituted the sample size for the study.

Data collection

Data were obtained from both primary and secondary sources. The primary sources include interview with ADPs and universities staff as well as farmers served by the two agencies. Two sets of questionnaires, one for management staff and the other for field workers, were used to collect data from workers of both

agencies. Secondary data were derived from assessment of documented materials on agricultural technology transfer practices of the agencies.

The management staff questionnaire measured organizational structure of the ADP and university, specific extension programmes, how programmes were initiated, frequency of implementation, input-output relationships, and funding, monitoring and evaluation. Section A of both extension staff questionnaire and the farmer interview guide, measured issues comparing technology generation in ADP and university, and involvement of extension workers in technology generation, and the influence of users in technology generation. Section B measured autonomy, legal status and structure of extension services, staff training contacts, and qualification, and farmers' participation in technology transfer practices of the ADP and university. Section C investigated variables relating to type and number of technologies transferred to the farmers, input provision, method of communication adopted in transfer process and socio-economic characteristics of farmers. Assessment was also made under section C to determine farmers' evidence of expansion in farm holdings and use of agro-technology packages.

Data analysis

The information collected was analysed using percentages (based on the proportion of total respondents indicating an opinion to a question), mean scores,(average of the scores of individual responses to particular question on a 1-5 continuous scale), standard deviation and group t-test. The biodata of respondents and overall organizational structure of the ADP and university, were analysed using percentages. Sections A and B, which compared the means for agro-technology generation and transfers, respectively, were analysed using group t-test at 5% probability for significance. Finally, section C which compared the extension systems of the ADP and university on socio-economic indices of the agencies and participating farmers, was analysed using percentages.

Chapter Four

Results and Discussion

The findings are presented as follows:

(1) features of the agro-technology transfer systems,
(2) comparison of agricultural technology generation, and sub-systems transfer, and
(3) comparison of socio-economic characteristics of ADP and university.

Features of the agro-technology transfer systems

In this section, information is provided on:

(1) ecological distribution of agro-research institute in Nigeria,
(2) involvement of university in agro-technology transfer, and
(3) features of the ADP agro-technology transfer system.

Ecological distribution of agro-research institute in Nigeria

The Federal Government of Nigeria divides the country into five agro-ecological zones. The agro-ecological zones of Nigeria are southeast, southwest, central, northwest and northeast.

***Southeast zone*:** The zone consists of nine states, Abia, Akwa Ibom, Anambra, Bayelsa, Cross River, Ebonyi, Enugu, Imo and Rivers. Two research institutes are located in the southeast zone, National Root Crops Research Institute (NRCRI), Umudike; and Nigeria Stored Products Research Institute (NSPRI), Port Harcourt. Also, five federal universities with faculties of agriculture are located in the southeast zone. These universities which are involved in agro-research activities include: University of Nigeria, Nsukka, University of Uyo, Uyo; University of Calabar, Calarbar; Federal University of Technology, Owerri, and Federal University of Agriculture, Umudike.

***Southwest zone*:** The zone consists of eight states, Lagos, Ogun, Osun, Oyo, Ondo, Ekiti, Edo and Delta. The agro-research institutes located in the southwest ecology include: Institute of Agricultural Research and Training (IAR&T) Ibadan; National Institute for Oil Palm Research (NIFOR), Benin; and Cocoa

Research Institute of Nigeria (CRIN), Ibadan. Others include: International Institute for Tropical Agriculture (IITA) Ibadan, Nigerian Institute for Horticultural Research (NIHORT) Ibadan; Forestry Research Institute

agro research activities in the southwest zone. The universities include University of Ibadan,Ibadan; Obafemi Awolowo University, Ile-Ife; Federal University of Technology, Akure; and University of Agriculture, Abeokuta.

***The central agro-ecology zone*:** The central agro-ecology zone consists of the Federal Capital Territory, Abuja; Plateau, Niger, Nassarawa, Kogi, Kwara, Benue and Taraba states. The central zone has research institutes, National Cereals Research Institute (NCRI), Badeggi; Veterinary Research Institute (VRI), Vom; and Agricultural and Rural Management Training Institute (ARMTI), Ilorin. Also, federal universities with faculties of agriculture in the central agro-ecology zone include University of Ilorin; and University of Agriculture, Makurdi.

***Northwest zone*:** States within the northwest zone include Sokoto, Kebbi, Zamfara Katsina, Kaduna, and Kano. Research institutes located within the northwest are National Animal Production Research Institute (NAPRI), Shika-Zaria; Leather Research Institute (LRI), Kano; National Agricultural Extension and Research Liaison Services (NAERLS), Zaria; and IAR, Zaria. The federal universities located within the ecology, which engage in agricultural research activities are Ahmadu Bello University (ABU), Zaria; and Usman Dan Fodio University, Sokoto.

***Northeast zone*:** This zone consists of Borno, Yobe, Jigawa, Bauchi, Gombe and Adamawa states. The Lake Chad Research Institute (LCRI), Maiduguri has the responsibility of linking research and extension services in the northeast zone. Three federal universities, University of Maiduguri; Abubarkar Tafawa Balewa University, Bauchi; University of Technology, Yola, are involved in the agro-research activities in the northeast zone.

Involvement of university in agricultural technology transfer

The idea of involving universities in agricultural technology transfer services could be traced to the attempt by British universities establishing educational programmes outside the campus to assist farmers benefit from research efforts of the university (Obibuaku, 1983). However, the practical step to involve universities in organized agro-technology transfer services was by Cambridge University in 1876 and Oxford University in 1878. The approach under British system was to give organized lectures under universities' supervision to associations of men and women on the results of universities research efforts (Ogunfiditimi and Ewuola, 1995). In the United States of America, involvement of universities in agro-technology transfer services commenced with passing of three legislative acts between 1862 - 1914, to link research, educational institutions and informal educational orientation. The issue of agro-technology transfer in the American universities system was aimed at incorporating adult education, agricultural extension, nutrition, home economics and mass communication in the educational programmes of the universities. To implement this, the cooperative extension services were formed in each state in association with the Land Grant Colleges, and farmers were granted land by the Nigeria Federal Government, to operate under the advisory services of the major universities (Obibuaku, 1983).

In Nigeria, universities' involvement in agricultural technology transfer came into existence in the early seventies. The universities technology transfer system in Nigeria was modelled along the cooperative extension system of the United States (Ogunfiditimi and Ewuola, 1995). The approach involves the faculties of agriculture of universities utilizing research reports of their academic departments and their independent staff, in implementing agro-technology transfer to selected farming communities. In the past, five conventional universities, Ahmadu Bello University, Zaria; University of Ibadan, Ibadan; University of Nigeria, Nsukka; University of Ilorin,Ilorin; and Obafemi Awolowo University, Ile-Ife; were involved.

Currently, the Isoya Rural Development Project of the Obafemi Awolowo University, Ile-Ife; Badeku Rural Change Project of University of Ibadan, Ibadan; and the Agricultural Research and Extension Complex of the Ahmadu Bello University, Zaria, have persisted in agro-technology transfer services to farmers in Nigeria. In addition to the functional conventional universities, the universities of agriculture located at Abeokuta, Markurdi, and Umudike assist in agro-technology transfer services to farmers in Nigeria. The universities' approaches to agro-technology transfer differed among the universities, including the universities of agriculture.

In Obafemi Awolowo University (OAU), the Isoya Rural Development Project is a unit responsible for implementing agro-technology transfer services to the farmers. The Isoya Rural Development Project is in the Department of Agricultural Extension and Rural Sociology, but headed by separate staff below the rank of a Director. The head of the Isoya Rural Development Unit reports directly to the Head, Department of Agricultural Extension and Rural Sociology (Figure 2).

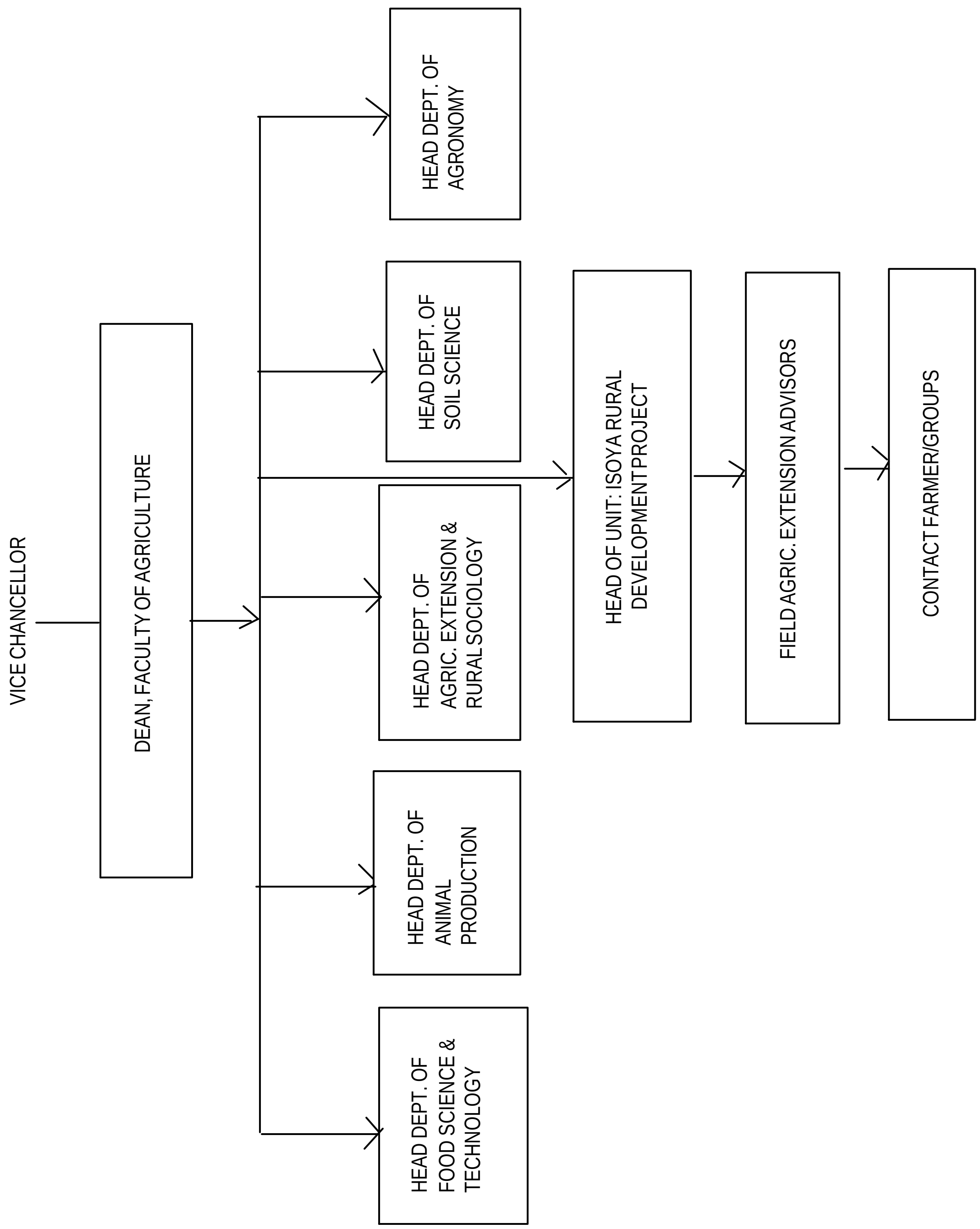

Figure 2: Organogram of Isoya Rural Development Project of Obafemi Awolowo University.
Source: Department of Agricultural Extension and Rural Sociology, Obafemi Awolowo University, Ile-Ife, Nigeria.

The programme of the universities of Agriculture is designed to promote a more democratic and liberalised transfer of agro-technology to farmers. At the University of Agriculture, Abeokuta, the agro-technology transfer programme is implemented by the Agricultural Media Resources and Extension Centre (AMREC), while the Cooperative Extension Centre (CEC) implements similar programmes at the University of Agriculture, Makurdi.

Administratively, AMREC of the University of Agriculture, Abeokuta, consists of a board chaired by the university vice chancellor. Highly placed members of the society outside the university community are also members. Other members of the board are deans of the academic colleges and the Director. Next to the board is the AMREC management committee (AMRECMAC). The Director chairs the AMRECMAC and other members include deans of colleges and the Director of Research and Development Centre of the University. Below the committee are seven relevant programme areas of agricultural technology, crops/forestry, livestock/wildlife/fisheries, post-harvest technology, women in development, training/ demonstration, and development communication and environmental protection, headed by programme leaders.

Sectoral heads, further down the administrative hierarchy, are in charge of crops, forestry, livestock, wildlife, fisheries, processing, storage, utilization, cooperative groups, and adult functional/political education. Also included are groups in extension and farmer training, agricultural shows, education for coping with changes, health and nutrition education, information publicity, audio-visual aids, radio, printing, waterology, and toxicology. The agro-technology transfer services of AMREC are implemented by specialists in crops, forestry, livestock, wildlife and fisheries, and there are also processing, storage, utilization and support services sectors. The administrative structure of AMREC under University of Agriculture, Abeokuta is shown in Figure 3.

Figure 3: Administrative structure of agricultural media resources and extension centre of the University of Agriculture, Abeokuta.
Source: University of Agriculture, Abeokuta.

At the University of Agriculture, Makurdi, the administrative structure of the Cooperative Extension Centre (CEC) includes the Vice Chancellor, who is the Chairman of the Research-Extension Board (REB). Other members of the REB include the Director CEC and deans of relevant colleges. This board is the policy body that supervises the centres activities. The board coordinates the research and extension activities of the centre.

The approved activities of the CEC are grouped into three major programmes, extension services, women in development and development communication. A senior extension officer heads each programme. Furthermore, the agro-technology transfer programmes are implemented through the grassroots and training programmes, which participate in adaptive research and demonstration, extension delivery, workshop and technology, review meetings (TRM).

The women in development sub-programme operates the women in agriculture programme, which implements home economics and workshops programme, and the development communication unit implements audio-visual and publication programmes. The audio-visual programme operates radio, TV, graphic and photography activities; the publication programme is in charge of editorial and printing services. The administrative structure of the CEC is shown in Figure 4.

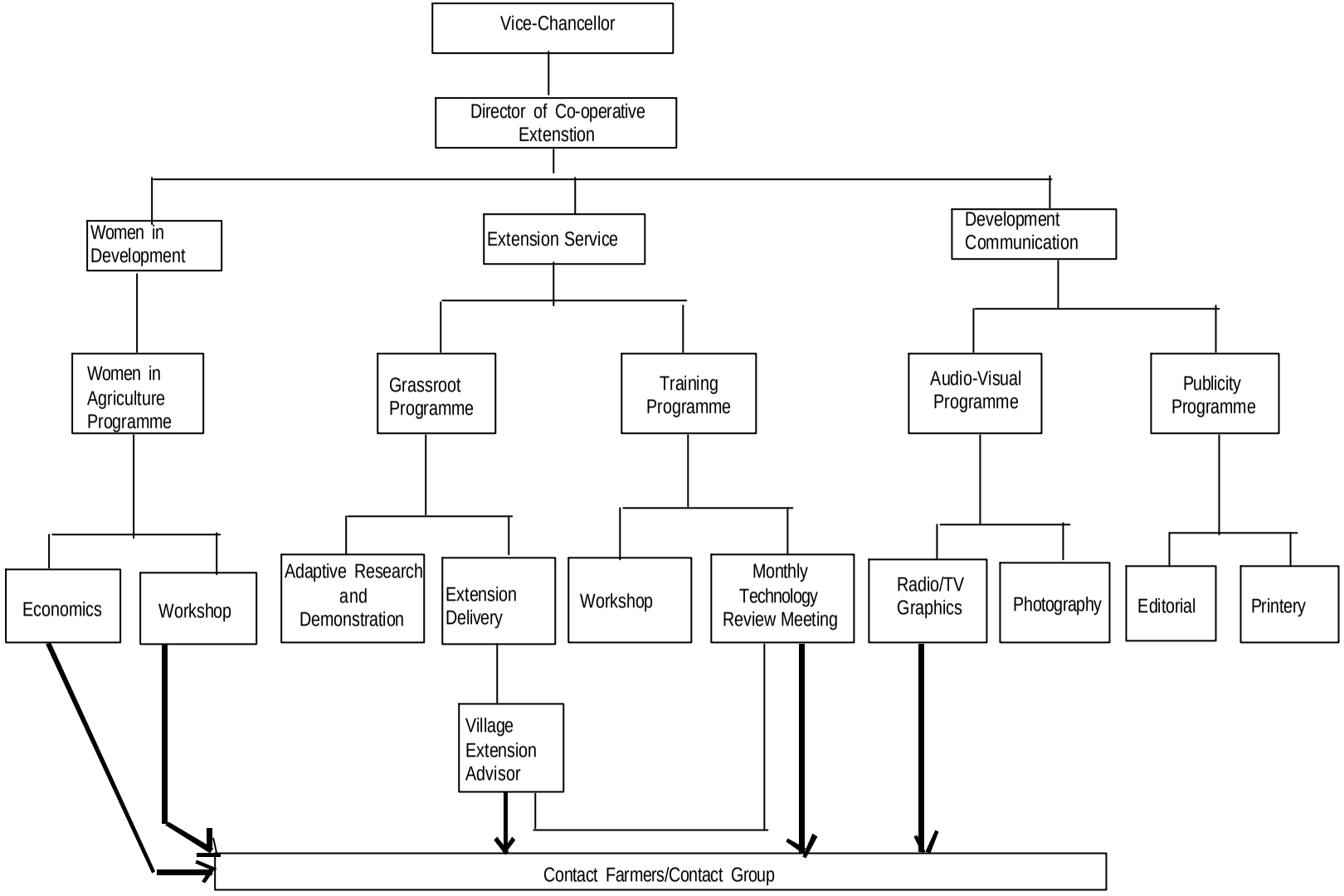

Figure 4: Administrative structure of the cooperative extension centre of the University of Agriculture, Makurdi.

Source: University of Agriculture, Makurdi, Nigeria.

The agro-technology transfer services of the CEC are made available to farmers by officers of the grassroots extension programme; and the other programmes support activities of the grassroots programme. However, the focus of the grassroots agro-technology transfer programme of the CEC is to provide prompt solutions to the farmers' practical problems using research findings of the University of Agriculture, Makurdi.

Features of ADP agro-technology transfer system

The ADP is modelled as a reform of the regulatory, highly bureaucratized office, based on MOA agro-technology transfer system. The operation of ADP is preceded by the enactment of an edict giving it a legal status. An edict is a legal document, which gives formal approval for the establishment and operation of the ADP, as an agro-technology transfer agency in a state. Under the edict establishing each ADP, administrative, staffing, funding, supervisory, monitoring, evaluation and co-ordinating procedures are spelled out as basis for operation.

The system posits that only integrated agricultural and rural development approaches applied simultaneously could reduce the problems of low productivity among the farmers. Its primary focus is the small holder farmer. However, operational technique of the ADP is to raise farmers' productivity, increase total farm output, and improve income levels and standard of living of the small scale farmers. To achieve these primary objectives, the system adopted the features in Figure 5 as follows.

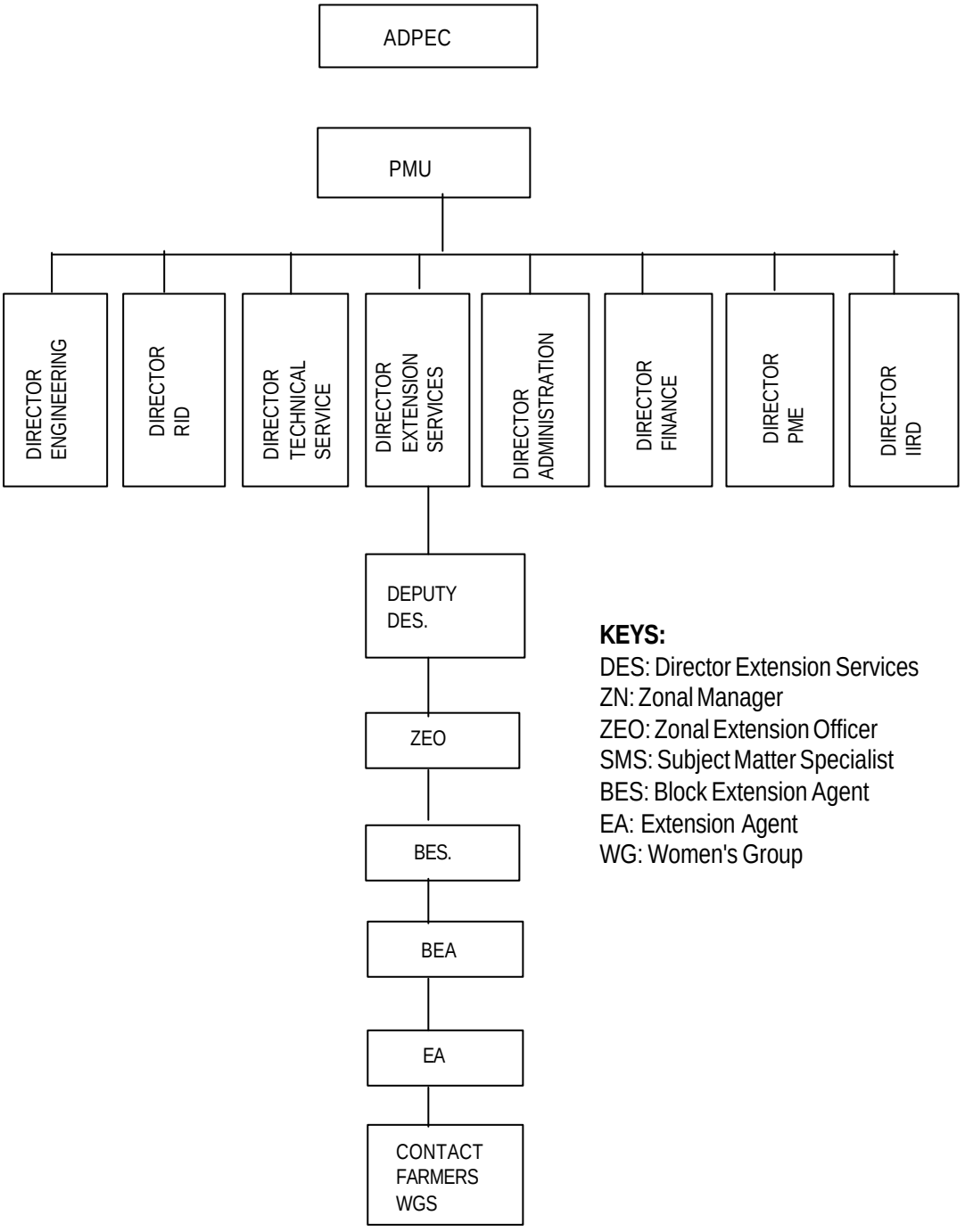

Figure 5: Organogram of ADP agro-technology transfer system.
Source: Project Coordinating Unit (PCU) Federal Ministry of Agriculture, Abuja, Nigeria.

***Vertical structure*:** The ADP in each state is organized for ease of operation, into four levels, headquarters, zone, block and circle supervisory. The headquarters level is responsible for policy articulation, budgeting, staffing, discipline, administrative control, supervision and coordination of extension activities. The ADP is organized into two broad sub-programmes, core and support. The core sub-programmes are extension, technical, engineering services and rural institution development. The support sub-programmes are finance, human resources development, administration and management, and planning, monitoring and evaluation. Administratively, the agricultural development project executive council (ADPEC) oversees activities of the ADP, including workplan, budget approval, senior staff appointment and discipline. The Programme Manager (PM) serves as an administrative head in the ADP and in conjunction with other members of the project management unit (PMU) make workplan and budget proposals, appoint junior staff and promote and discipline the staff. At the headquarters, the PM is the administrative head. Below the headquarters is the zone, which is in charge of six to eight blocks and headed by a ZM. Assisting the ZM in the implementations of the programmes are the ZEOs and a team of SMSs. Next to the zonal level is the block level, which represents an area with similar cropping/ farming pattern. Occasionally, a block corresponds to a political area known as local government council. However, a Block Extension Supervisor (BES) who is in charge of six to eight circles heads the block. The circle is headed by an extension worker called Extension Agent (EA). The job of extension contact with farmers is executed at the circle level by the EA.

***The programme management unit (PMU)*:** One basic step towards achieving effective administrative control and technical command in the ADP is the involvement of a virile PMU in implementation of programmes. The PMU is virtually autonomous in decision-making and project implementation and is constituted by the heads of six to eight sub-programmes and zonal managers, with the programme manager as chairman.

***Instituitionalized on-farm testing and adoptive trials*:** ADP has as linkage mechanisms, on-farm research (OFR); on-farm adaptive research (OFAR) and small plot adoption techniques (SPATs). The OFR is a researcher managed farm testing technique, aimed at testing the result of his laboratory research. It is set up to test the viability of the research results under farm situation. On the other hand, OFAR is a joint management technique between the researcher and farmer. It is implemented to test the adaptability of OFR results under various farm locations/environments. The OFAR also serves as a means of developing and validating new agro-technologies before transfer to the farmers. It enhances farmer participation in technology generation, design and supply services.

Similarly, SPAT is a contact technique. It is a teaching laboratory aimed at enhancing communication on proven agricultural technologies. The SPATS is a demonstration, which is organized by field extension workers at farm level in order to enhance increased knowledge and skill acquisition of the relevant agricultural technologies among the farmers. Necessary farm inputs for implementing SPAT are provided by the farmers, except in situations where such technologies are entirely new in the farming communities.

***Tripartite funding arrangement*:** Funding arrangement in the ADP system involves the World Bank, and Federal and State Governments. From the inception of the ADP system, the funding ratio has

been: World Bank (66%), Federal Government (20%) and State Government (14%). Currently, with the partial withdrawal of the World Bank sponsorship as a lending agency, the ADP has sought to involve local government councils and non-governmental organization (NGOs) in the funding arrangement.

***Regular staff training and contact with farmers on fixed scheduled basis*:** Training is organized as a matter of policy in the ADP, either as external and sponsored by the ADP or in-house. External training is organized in form of workshops, conferences and seminars, either within or outside the country, mainly for management staff and subject matter specialists to update their knowledge and skills. Similarly, in-house training is organized for headquarters, zonal and block levels staff. Headquarters training is organized in form of project facilitating training (PFT) for members of the PMU, workshop and specialized training in selected areas of ADP operations and technology review meetings (TRM).

At zonal level, training is organized for zonal management staff, such as the ZM, ZEO, Zonal Supervisors (ZSs) and a team of SMSs at TRMs, and monthly or fortnightly training for extension workers. At block level, training is organized in form of block review meeting (BRM) for field extension workers, aimed at fine-tuning relevant production recommendations acquired at FNTs and reviewing of field situation activities.

In addition, the ADP system has scheduled contact with farmers under fixed visit schedule (FVS). The FVS is adopted to enhance agro-technology transfer process and technical backstopping, necessary in achieving efficiency of feedback mechanism between farmers and extension workers.

***Provision/maintenance of rural infrastructure*:** In the past, ADP was engaged in the provision of rural feeder roads, boreholes and storage projects, to enhance contacts with farmers. Currently, it has adopted the National Fadama Development Project (NFDP), National Agricultural Technology Support Project (NATSP) and maintenance of existing feeder roads. Under these projects, ADP is required to construct access and fadama roads, wash bores and tube wells, and organize the farmers into groups and associations, aimed at enhancing teamwork among the farmers. This assists the farmers in embracing irrigation agriculture and maintaining basic rural infrastructure located in farming communities.

***Institutionalised monitoring, supervision, and coordinating activities*:** The operations of the extension system of ADP is supported by monitoring, supervizing, and coordinating agencies, such as the agricultural project monitoring and evaluation unit (APMEU), and the federal agricultural coordinating unit (FACU), recently renamed PCU. The APMEU is organized into headquarters and regional offices for ease of operations.

The headquarters offices are headed by Heads of Units (HOUs) and regional offices by Regional Heads (RHs). The APMEU collates and analyses quarterly and annual reports on workplan and budgets, crop yield, and performance evaluation activities on ADP staff. On the part of FACU, emphasis is on monitoring, supervision and coordination of the ADP projects. FACU activities are organized in line with the five

agro-ecological zones in Nigeria with HOU at the national headquarters level and RH at the regional offices.

Comparison of agro-technology generation practices of the ADP and university

The results showed a significant difference ($t = 2.03; p<0.05$) in the levels of autonomy enjoyed by the ADP and university in generating agricultural technologies. The university (0 = 4.26) had greater freedom in generating agricultural technologies than the ADP (0 = 3.54).

Table 1: Differences in technology generation practices between the ADP and university

Technology generation practices	Means indicating level of existence (max.=5)		
	ADP	University	t-cal.
Autonomy in technology generation	3.54 (1.47)+	4.26 (1.19)+	2.03*
Technology generation based on field problem	4.05(0.93)	4.43(1.22)	1.80*
Farmers participate in field research trials	4.00(0.10)	3.52(0.96)	1.78*
Technology generation activities keep pace with current field practices	3.76(1.11)	3.32(1.0)	1.67*
Adaptive research trials are located in farmers' field	3.17(1.11)	2.84(1.17)	1.18
Extension agents participate in field research trials	4.20(1.07)	3.89(1.49)	1.09
Adequate research facilities and incentives to workers	2.84(1.11)	3.15(1.17)	1.18
Distance between technology generation and technology transfer component	2.89(1.26)	2.21(1.36)	2.17*
Farmers co-finance adaptive research trial	1.82(1.17)	1.63(1.14)	0.67

*P < 0.05.

+ Data in parenthesis are standard deviations

Autonomy in technology generation had been identified as a major index of success in agricultural development (Blum, 1991; Madukwe, 1996). Autonomy in agro-technology generation means independence, non-interference in problem identification and uninterrupted technology design and supply services.

The ADP and university differed on the extent to which their technology generation activities were oriented to farmers' field problems (t = 1.80). Orientation of technology generation towards field problems, means directing research activities towards addressing the immediate and pressing field problems of farmers. Such technology generation effort should be cost-effective with minimum adverse effect on farmers' environment (McNamara, 1990). The analysis indicates that ADP's (0 = 4.05) technology generation activities had poorer orientation towards the farmers' field problem, compared to the university (0 = 4.43). One reason for this could be because university research efforts were based or targeted at special problems of known farmers in a geographical location, while the research results implemented by ADP were conducted by research institutes. They provide answers to problems affecting farmers in diverse geographical location, thus making such solutions less targeted to the specific needs of farmers. Orientation of technology generation efforts towards farmers' fields would ensure that new technologies evolve from farmers' field problems. Evolution of technologies from farmers' field problems had been identified as an index of a successful agro-technology generation sub-system (Blum, 1991).

Other areas of differences in technology generation between the agro-technology transfer systems of ADP and university, include levels of farmer participation in field research trials (t = 1.78), and the extent to which the technologies generated kept pace with current field practices (t = 1.67). Farmers' participation in field research trials contributes largely to orienting agro-technologies towards sustaining farmers' interests. This practice ensures that technologies evolve from current field practices and problems. The indication was that farmers participated less in field trials under the university system (0 = 3.52), compared with the ADP (0 = 4.0). It was observed that though farmers participate less in terms of frequency of participation in university field research trials, they were more involved, mostly at the early stages of planning. In the ADP system farmers were called in later in the research process, usually after the technology was developed in the entire process of field testing.

Also, the university differed with the ADP in the physical distance between their agro-technology generation and transfer sub-systems, (t=2.17). The close physical distance between the technology generating and transfer sub-systems could explain why in the university system the technology generated kept pace with field practices. Distance between technology generation and transfer sub-systems had been identified as a major factor influencing the quality and time of providing technologies to participating farmers (Blum, 1991; Madukwe, 1996). The ADPs were located farther from their technology generating research institutes, compared with the universities. It depended on distant research institutes as sources of agro-technology, compared with the universities, which basically sourced relevant technologies from their academic departments.

The physical distance between the locations of the agency for technology generation and technology transfer of any agricultural technology transfer system, could increase the cost and time of providing technical information to the participating farmers. The analysis showed that university technologies would be more available to the participating farmers compared to the ADP, which would involve longer period and higher financial cost sourcing technologies from distant research institutes.

Data showed that the ADP and university did not differ on practices such as locating research in farmers' field (t=1.18); and involving field agents in the management of field trials (t=1.09). Other areas of similarity include: provision of adequate research facilities and incentives (t=1.18); and farmers' participation in financing adaptive research (t = 0.67). Locating adaptive research in farmers' field, demands field agents involvement in research management in order to establish the desired targets. In addition, provision of necessary research facilities and incentives would contribute largely to meaningful involvement of the field agents and overall participation of farmers in financing adaptive research activities. Thus, the analysis indicates that the ADP and university in Nigeria had agricultural technology generation indices identifiable in a successful agricultural technology transfer system. The areas of discrepancies and similarities are policy issues for consideration in harmonising agro-technology transfer practices of the ADP and university in Nigeria.

Comparison of agro-technology transfer practices of the ADP and university

Data (Table 2) indicate similarities between university and ADP in the use of farmers' organizations (t = 0.72), existing local communication channels (t = 0.61), in-house staff training (t = 0.70), demonstration method (t = 1.26), and print and electronic media (t = 1.03) in agro-technology transfer. Involvement of farmers' organizations could enhance employment of existing communication, while adoption of in-house staff training would enhance staff learning and contact strategies necessary in achieving effective agricultural technology transfer to the farmers. Learning by firms and operators of technology transfer agencies, has been identified as the key to effective transfer and diffusion of innovative capability (Mytelka and Tesfachew, 1999).

Table 2: Differences in technology transfer practices between the ADP and university

Technology transfer issues	Means indicating level of existence (max.=5)		
	ADP	University	t-cal.
Disseminating technology through farmers' organization	4.03(1.33)	3.34(1.53)	0.72
Categorizing farmers according to needs	3.0(1.20)	3.67(1.3)	2.16*
Orienting extension services to suit client interests	4.02(1.12)	3.67(1.16)	1.87*
Disseminating technologies through farmers' existing communication channels	4.16(0.94)	4.05(0.62)	0.61
Conducting short in-house staff training	3.65(1.48)	3.63(1.34)	0.10
Provision of training incentives to staff	3.39(1.37)	3.42(1.35)	3.33*
Use of demonstration methods	4.39(1.04)	4.05(1.22)	1.26
Use of print and electronic media	3.06(1.31)	2.74(1.10)	1.03
Knowledge of rural dynamics	4.16(1.17)	3.37(1.12)	2.71*

*P< 0.05.

+ Data in parenthesis are standard deviations

Table 2 shows that ADP and university differed in the practice of categorizing farmers for technology transfer (t = 2.16), extension orientation towards clients (t = 1.87) and use of external training for staff (t = 3.75). University system (0= 3.67) significantly used farmer categorization strategy in technology transfer more than the ADP (0 = 3.0). In other words, technology transfer practices of the university were more oriented towards meeting the specific farming needs of farmers than those of the ADP.

Categorization of farmers into groups for technology transfer is an important survival strategy for agro-technology transfer agencies. Categorization meansorganizing farmers according to similar farming patterns and socio-cultural interest for the purpose of transferring agricultural technologies that meet their specific needs. Other areas where the ADP differed from university include provision of training incentives (t = 3.33) and field agents' knowledge of rural dynamics (t = 2.71).

The university system (0 = 3.42) provided higher training incentives to field staff than the ADP (0 = 3.39) and the ADP staff (4.16) had better knowledge of rural dynamics than the university (x = 3.37). Thus, it is suggested that the university system takes complete responsibility for extension staff training, while the ADP utilize their rural orientation and concentrate efforts to contact the farmers. In this regard, the university should strengthen their training arrangement and facilities and the ADP should improve on sponsorship of staff training, and payment of necessary incentives to the field staff.

Comparison of the socio-economic indices of the ADP and university agro- technology transfer systems

Comparison of the socio-economic impacts of the ADP and university agro-technology transfer systems on the organizational, staff and farmer characteristic was carried out using socio-economic indices (Tables 3 and 4).

***Organizational characteristics*:** The ADP had a supervisory to field staff ratio of 1: 8, compared to 1: 6 for the university. The university will make more effective supervision of field staff with the smaller number of field extension staff. The field staff farmer ratio was 1: 200 for the university as against 1: 5000 for the ADP.

Field staff of ADP move through four supervisory levels to get in touch with the head of the programme, while the university counterpart has a direct link with the head of the programme. The more the supervisory levels, the longer the chains of communication and the more relevant agro-technology information could be diluted and distorted between source and end users. Similarly, the university has less outside interference with the organizational procedure and process than the ADP. The university had a stronger linkage between the agro-technology generation and transfer sub-systems (0 = 4.60) than the ADP (0 =2.56).

This situation from the perception of the operators of the two systems is based on factors such as the physical distance between the sub-systems, the age (that is the period of existence of the sub-systems), differences in the qualification of the staff of the sub-systems, and the information technology facilities available for information exchange between the sub-systems. The greater the physical distance between the two sub-systems, the less the level of linkage. Again, the more the differences in age and staff qualifications, the less the differences in information technology between the sub-systems and the level of linkage. Linkage between technology generation and transfer sub-systems has been identified as a necessary ingredient for success in technology transfer.

The agro-technologies transferred and method of transfer used by the university was more compatible with the cultural practices of the recipient environment than that of the ADP. Understanding the needs and aspirations of technology recipients is a basic ingredient not only in developing technologies appropriate to them, but choosing appropriate methods for transferring such technology to them. The university with better trained and experienced technology transfer staff appears better equipped to handle the intricate process of identifying the needs and aspirations of farmers. Again majority of ADP

farmers (87.6%) reported that the ADP system was directed mostly to adults, and that of the university included youths in their programmes.

The agro-technologies transferred by the two systems showed a wider distribution involving crops (23.2%), livestock (19.3%), processing (18.7%) agro-forestry (17.5%) and fisheries (21.2%) for ADP, than the university with a distribution of crops (40.1%), livestock (29.1%) and processing (30.7%). The ADP transferred crop based technologies in the area of yam/maize/cassava/egusi or telferia alternate row intercrop, cassava, rice, maize, sweetpotato and cowpea and the university concentrated on cassava, rice, maize and cowpea. In the livestock area the university concentrated on poultry and cattle and the ADP worked on poultry, cattle, sheep and goat. Most of the universities did not transfer technologies on agro-forestry and fisheries.

In terms of intra-organizational relationship among staff, 63.16% of university, compared with 55.94% of ADP staff, participated in intra-organizational relationship. Intra-organizational relationship patterns of staff are of two forms: vertical which takes place between superior and subordinate and horizontal, which takes place between staff at the same supervisory level. The university had higher intra-organizational relationship than the ADP. Also 42.30% of ADP and 36.05% of university staff were mobile, indicating low level of staff mobility in the two systems. Mobility of technology transfer staff enhances timeliness in implementing agro-technology transfer programmes. The analysis further shows that 17.83% of the ADP and 25.81% of university top management staff received in-house or external training, sponsored by their agencies. Under the ADP system, the field agents had regular in-house training, mainly the fortnightly training sessions. In contrast, the field extension staff of the university did not have similar regular staff training on production recommendations. Adequate staff training had been identified as an enabling factor towards achieving the success of any agricultural technology transfer system (Swanson, 1997).

In terms of cost of providing staff training, the ADP spent Naira (N)6,270 compared with university, which spent N4,677 per staff a year. We recommend that the ADP could leave training to the university due to the comparative advantage of university in the area.

***Staff characteristics*:** Majority of the university (89.5%) and ADP (89.34%) agro-technology transfer workers were males. This indicates inadequate female agro-technology transfer workers in the two systems. This may bias agro technology transfer efforts toward male farmers, when 70% of farmers in Nigeria are females (Anyanwu and Agu, 1996). Inadequate female agro-technology transfer agents have been identified as a limiting factor in transferring agro-technology to female clientele (Sokoya, 1998).

The majority of university staff (53%) and ADP staff (51%) were between 40 and 48 years old, and the next major group, 30% for university and 18% for ADP were 49-59 years old. The university had relatively older staff than the ADP. Similarly, 66% of staff of university had work experience of between 16 and 30 years and 60% of ADP staff had work experience of 6 and 25 years, the latter being a relatively young/ recent agency than the university. The few years of work experience in the ADP could also be a result

of staff turnover caused by poor work condition. The result indicates that agro-technology transfer staff of ADP and university had at least the West African School Certificate, that is 12 years of basic education. About 89% of university and 82% of ADP staff had at least a university bachelors degree. The indication is that staff of the two agro-technology transfer systems possessed relevant educational qualification for achieving the objectives of agro-technology transfer programmes.

Selected socio-economic characteristics of agro-technology transfer staff of the ADP and university are presented in Table 3. The Table shows that a higher percentage of staff of the ADP than the university, owned a personal house, an electricity generating plant and had a better knowledge of rural life. Ownership of a personal house and generating set, is a reflection of the external funding facility which ADP had, prior to this study. However, the superior knowledge of rural life better equips ADP staff for more effective performance as rural agro-technology transfer agents. Again a higher percentage of university staff more than the ADP were classified as having improved nutritional status, owned radio and television, were free from superstitious beliefs, and had additional academic qualification, better promotional prospect and higher technical skills.

Generally, the university system appears to have more positive impact on the socio-economic characteristics of staff than the ADP. The implication is that the university will retain high quality agro-technology transfer staff than the ADP, as it offers better conditions of service.

Table 3: Socio-economic indices of agro-technology staff in the ADP and university system

Socio-economic indices	ADP (%)	University (%)
Own personal house	34.10*	-
Improved nutritional status	30.67	49.26
Electricity generating plant	1.64	-
Radio/television	60.33	86.84
Furnished parlour and bedroom	38.20	40.33
Positive attitude towards jobs	42.11	46.72
Freedom from superstition	22.95	36.84
Improved knowledge of rural life	85.41	48.95
Additional academic qualification	18.20	41.05
Promotional prospects	47.54	80.11
Higher technical skills	57.89	70.49

* Multiple responses

***Farmer characteristics*:** Majority of the university (84.3%) and ADP (92.17%) farmers were males indicating bias of the two agro-technology transfer systems against women.

The majority of farmers with the university (86%) and ADP (78%) were in the active age group of 40 to 60 years. Years of contact of farmers with agro-technology transfer agencies ranged from 1 to 15 for

the bulk of ADP farmers (73.2%) and 6-20 years for the bulk of university farmers (76%). This indicates that farmers with the university system had longer period of exposure to technology transfer influence than farmers with the ADP system. The university system served mostly farmers without any formal education (64%) more than the ADP (40%), which served mostly literate farmers.

Table 4 shows that a comparatively higher percentage of farmers under the ADP own personal houses (75.76%), used modern agricultural equipment (71.79%), were mobile (69.39%), paid their tax (85.29%) and possessed positive attitude towards agro-technology transfer (78.26%).

Table 4: Socio-economic indices of farmers under the agro-technology transfer systems of ADP and university

Socio-economic indices	ADP (%)	University (%)
Furnished personal house(s)	75.76*	54.55
Wrist, table or wall clocks	72.45	42.29
Radio & T.V.	87.32	76.67
Accessibility to pipe-borne water	45.16	52.94
Use of modern agricultural equipment	71.79	53.33
Mobility facilities (cars, motorcycles or bicycles)	69.39	55.32
Better nutritional statuses	97.02	93.04
Membership of farmers organisations	77.20	89.17
Access to farm inputs	74.60	86.01
Prompt payment of tax	85.39	79.13
Accessibility to modern health care	54.31	73.04
Freedom from superstition	70.49	69.61
Positive attitude towards agro-technology transfer services	78.26	42.16
Cultivated additional 0.2-0.5 ha in the last five years	63.00	100.0

* Multiple responses.

A higher percentage of farmers under the university had access to piped water (52.94%), were members of farmers' organizations (89.17%), had access to farm inputs (86.01%), modern health services (73.04%), and in the immediate past five years cultivated additional 0.2 to 0.5ha. of farm land (100%).

Farmers' use of agricultural technology packages

Mean scores were used to determine the extent farmers employed technical packages given to them in their farm operations. Data in Table 5 show that ADP farmers (0 = 4.22) compared to the university farmers (0 = 4.39), generally used crop based technologies, while the university farmers (0 = 3.93)

compared to the ADP farmer (x = 4.12), used less of livestock technologies. The analysis indicates that the bulk of farmers who participated in the activities of the ADP and university, generally used crop and livestock based technologies in their farm operations.

Table 5: Farmers' level of use of agricultural technology packages

Agriculture sub-sector	ADP	University
	Mean (max.=5)	
Improved crops technologies	4.22	4.39
Improved livestock technologies	4.12	3.93
Fisheries	4.48	1.43
Agro-forestry	3.05	1.02
Use of agro-chemicals	3.46	3.71
Storage, processing and utilization technologies	4.10	4.17

Furthermore, the ADP farmers almost had monopoly in the area of fisheries (0 = 4.48) and agro-forestry (0 = 3.05) based technologies. Other areas where agro-technology packages were utilized and agro-chemicals had means of 3.46 for the ADP and 3.71 for the university farmers and processing and utilization with mean of 4.17 for the university, compared to the mean of 4.10 for the ADP farmers. Farmers of the university better adopted the use of agro-chemicals, processing and utilization technologies than farmers of the ADP.

Farmer-contact methods of the ADP and university

Data in Table 6 show the percentage of farmers reporting contact methods adopted by the agro-technology transfer systems of ADP and university. The analysis indicates that ADP used more of personal contact method (78.15%) than the university (63.13). The ADP (62.17) and university (64.05) systems, generally used the demonstration method. Demonstration technique adopted use of trial plots to concretize development of necessary skills among the farmers. Comparatively, the ADP performed better than the university in the use of personal contact method, agricultural shows and field days, and the university used demonstration, rural groups and posters as contact method with farmers. The higher the use of demonstration and personal contacts by field workers, the greater the achievement of any agro-technology transfer system in securing increased awareness, interest and participation of farmers in agro-technology transfer practices.

Table 6: Farmers' perception of contact methods used by the ADP and university

Extension contact methods	ADP (%)	University (%)
Personal contacts of extension agents	78.15*	63.13
Demonstration	62.17	64.05
Agricultural shows	44.25	31.37
Field days	52.05	29.32
Involvement of farmer organizations and rural groups	50.17	60.16
Use of posters	28.16	39.05
Use of radio	9.45	10.06
Use of television	7.06	6.15

*Multiple responses

About 10% of university farmers and 9.45% of ADP farmers reported use of radio and 7.06% of ADP and 6.15% of university farmers indicated use of television as contact methods. The two systems did not use radio and television as major methods of agro-technology transfer. Radio and television have high potential for contacts, because of their suitability to reach a large number of farmers simultaneously and disseminate urgent farm programmes (Anyanwu, 1997). However, the minimal use of radio and television by the ADP and university conformed with the expectation of Osuji (1983), who noted that radio and television were the least used extension-farmer contact techniques in Nigeria.

This study comparatively analysed three sub-systems necessary in implementing a viable agricultural technology transfer system, namely, technology generation, transfer and utilization of the ADP and university in Nigeria. There is a consensus from the study that the agro-technology transfer systems of ADP and university could be accredited with achievement in terms of set goals and operational targets. However, these agencies have not been supported by coherent and targeted agro-technology transfer policies. Harmonization of field technology transfer services based on comparative advantages, is required to achieve a functional agro-technology system in Nigeria. The frequency of the agro-technology transfer activities re-located through earlier organizations to the present ADP, and the number of other organizations that have been called in to undertake agro-technology transfer activities as part of their mandate, has decreased. This is a reflection of the unstable nature of the environment in which agro-technology transfer activities have operated in Nigeria. These changes usually resulted in the movement of staff from one agency to another and in some cases in loss of status and prospect for career development. The university system has had a relatively stable environment with little interference from outside. Based on the analysis, one possible policy option to pursue will be to foster a loose linkage between the two agro-technology transfer systems, such that the university will concentrate on technology design and supply, and the ADP as the implementing arm in the agro-technology transfer process (Figure 6).

Another policy option will be to merge the two systems and situate all government agro-technology transfer efforts in the county within the university system (Figure 7). To pursue this option, we suggest that one university in each state of the federation be designated as an agro-technology transfer centre. With this option, agro-technology transfer staff will become staff of the university responsible for agro-technology transfer in each state of the federation. This arrangement will allow agro-technology transfer staff to enjoy the relatively better condition of service existing in the university. This may help to increase morale, job satisfaction and reduce staff turn-over. With this option, the federal state and local governments can contribute funds and programmes for transfer activities.

Based on the findings of this study the following policy issues are critical in achieving success, irrespective of the options considered. The university should utilize the advantage of better quality research personnel and facilities, to address appropriate technology generation. The crucial technology generation roles of the university could be enhanced by utilizing high staff strength of the ADP in identifying field problems. This could be achieved by constituting the field reports of ADP agro-technology transfer workers into critical inputs for basic research and improving of extension staff training on adaptive research management. The ADP had more field staff evenly distributed than the university and we recommend that ADP takes over responsibility for field agro-technology transfer activities. This will include identification of farmers' problem and adaptive research trials in farmers' field. The university in turn could absorb the ADP as their implementing arm, while concentrating on technology design and supply services and linking with other research institutes on behalf of the ADP.

To take over agro-technology transfer at farmers' level, ADP should identify existing farmers' field problems and subsequently implement adaptation trials and pursue enhanced training of field staff. Considering the comparative advantage of university over the ADP in terms of training facilities, qualities of training personnel and payment of incentives to staff, an agro-technology transfer policy that will allow the university to take over all staff training functions should be pursued.
The ADP should concentrate on increasing sponsorship of staff for training and improving the payment of necessary incentives to staff after training. There will be need to strengthen staff training arrangement of the universities to meet staff training needs. Effective extension staff training under the universities, demands appropriate decentralization and adoption of the zonal and block office arrangement of the ADPs in providing extension staff training. The situation could imply improved logistic support for staff training and increased budgetary allocation to extension, in order to enhance payment of training incentives to trainees.

The gender bias in staffing against women is a serious shortfall of the two systems. This bias against women is also manifested among farmers. There is need to pursue a policy that will substantially increase the number and quality of female agro-technology transfer staff in two systems. This will be one major way of ensuring that the majority of farmers in Nigeria, mainly female, are reached. Similarly, there is need for a policy that will make it mandatory for agro-technology transfer institutions and systems to specifically target their programmes on women.

Chapter Five

Conclusion and Policy Issues

The ADP should evolve an arrangement for using multiple farmer contact methods. Use of group approach and employment of existing rural communication patterns are policy options that should be pursued. This would enhance effective contact and facilitate farmers' participation in agro-technology transfer services of the ADP.

Examined as an agro-technology system, we observe that the linkage between technology generation and technology transfer sub-systems was weak in the system and strong in the university system. The ADP, as an agro-technology transfer system is a relatively younger organization, compared with the cooperating technology generating agencies. Most of the research agencies generating agro-technology for it were established in the 1960s and the cooperating ADPs were established in the 1980s. Our observation points to the difference in age of the agencies as an important issue that reduced cooperation between the sub-systems. The research agencies perceived the ADP as a relatively young and inferior agency to deal with. Consequently, its capability as an agro-technology transfer system to meet with the challenges of establishing new inter-organizational relationship with agro-research agencies, was absent.

In the university system which showed a stronger link between the technology generation and transfer sub-systems, this difference in age did not exist.

Another policy issue which this study is highlighting is the academic qualification differential existing between the two sub-systems under the ADP. Most of the research staff had at least a masters degree and most of the ADP staff had at most a bachelors degree certificate. Most of the technology-generating staff in the cooperating research agencies had comparatively higher academic qualification than technology transfer staff. Most of the ADP staff were apathetic in dealing with the research staff. The

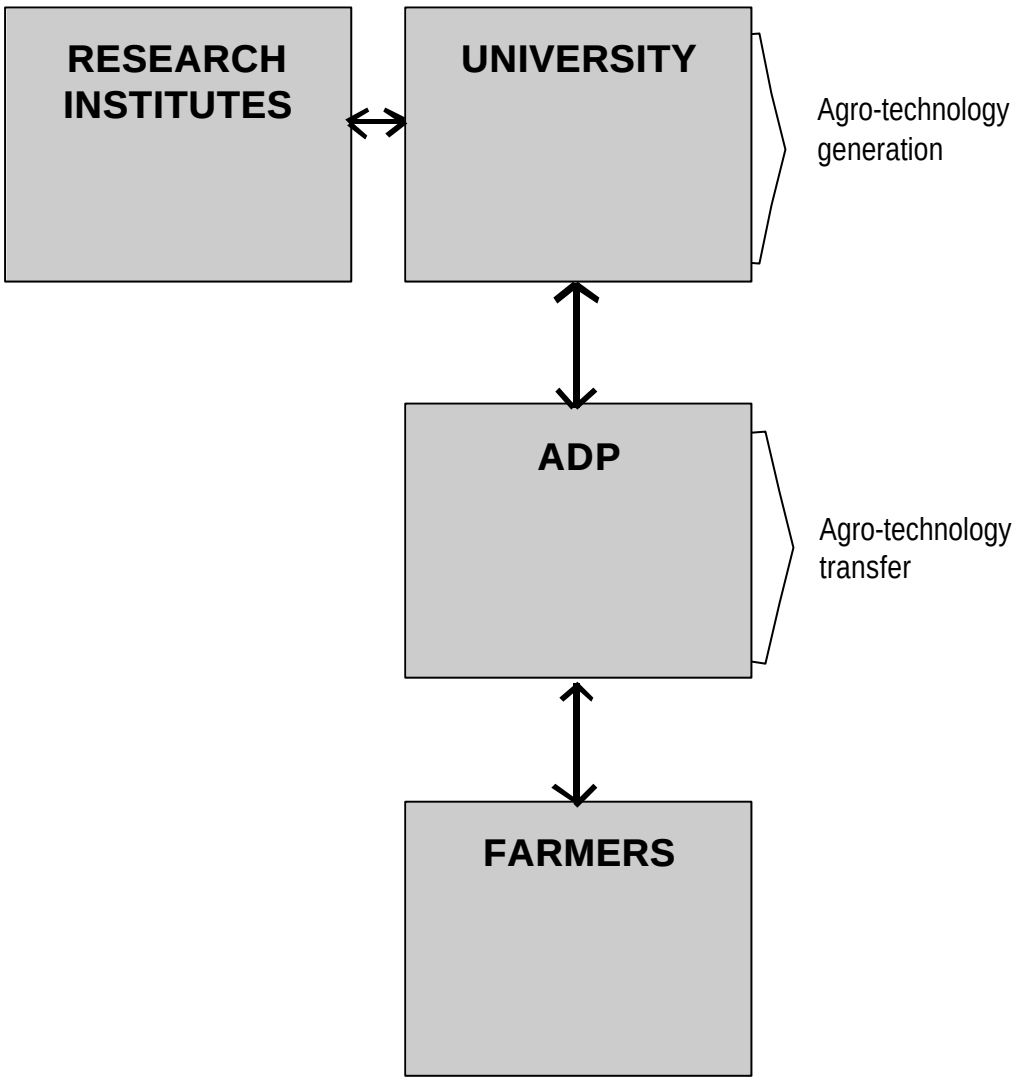

Figure 6: A proposed linkage structure for university and ADP in agro-technology transfer in Nigeria.

ADP staff complained that the research staff see and treat them as people without knowledge. Thus, in developing an agro-technology transfer system the academic qualifications of the staff involved in technology generating and transfer sub-systems, should be harmonized.

One other policy issue that played a role in weakening the link between the technology generation and transfer sub-systems of the ADP was the difference or non-synchronization in the period of funding. The ADP came into existence with liberal external funding from the World Bank at a time when the structural adjustment programme was adversely affecting the capability of the research institutes to generate agro- technology. This set off balance its agro-technology system. A holistic approach to developing or restructuring an agro-technology system, rather than dealing with each sub-system is an important policy option. The growing knowledge-intensity of agro-production of rural farm level should be complemented by agro-technology generating and transfer sub-systems or institutions.

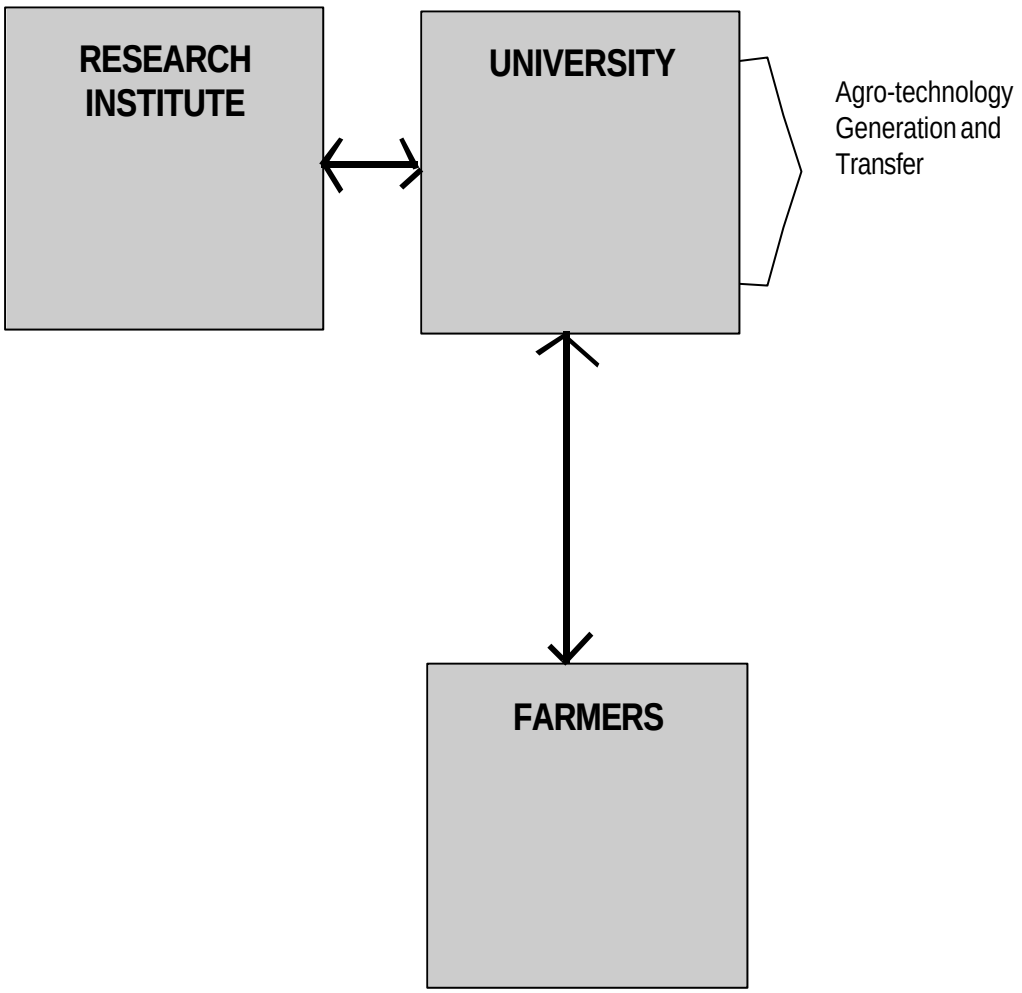

Figure 7: Proposed merge structure for university and ADP in agro-technology transfer in Nigeria.

References

Adebayo, A. (1995). *Principles and Practice of Public Administration in Nigeria*; Revised edition; Ibadan: Spectrum Books Ltd., pp. 18-27.

Agwunobi, C.A. (1993). "Impact of the Shell Petroleum Agricultural Extension Programme on the Participating Farmers in Imo State". *M.Sc. Project*, Department of Agricultural Extension, University of Nigeria, Nsukka, Nigeria.

Aihonsu, J.O.I. (1992). "Group Farming Approach to Food Production and Rural Development: the Experience of Opticom Farm Scheme in Ogun State, Nigeria". In *Rural Development in Nigeria*: *Proceedings of the 6th Annual Conference of the NRSA*, S.S. Olomola and A.C. Nwosu eds., pp.106-119.

Ajala, A.A. and Madukwe, M.C. (1992). "The Relevance of Plant Protection Research in Nigeria to Farmers' Needs". *Bangladesh Journal of Training and Development*; Vol.5 No.1.

Ajayi, A.R. (1996). "Evaluation of the Socio-Economic Impact of the Ondo State Ekiti-Akoko Agricultural Development Project on the Rural Farmers". *Ph.D Thesis*, University of Nigeria, Nsukka, Nigeria.

Anyanwu, A.C. (1997a). "The Role of Extension in Agricultural Credit Administration in Nigeria", *Nigerian Journal of Co-operatives and Rural Development*, pp. 74-79.

Anyanwu, A.C. (1997b). "Appropriate Extension Communication Techniques for Interaction with Rural Farm Women". *Journal of Agriculture, Technology and Education*, pp. 32-34.

Asiabaka, C.C. (1998). "Agricultural Technology Transfer Strategies in Nigeria in the Past Decade". *Paper Presented at the 13th Annual Zonal REFILS Workshop*, Umudike, National Root Crops Research Institute.

Ayichi, D. (1995). "Agricultural Technology Transfer for Sustainable Rural Development". In *Rural Development in Nigeria: Concepts, Processes and Prospects*, E.C. Eboh; C.U. Okoye; and D. Ayichi eds., Enugu: Auto-Century Publishing Company, pp. 126-134.

Beyon, J. (1998). "Financing the Future: Options for Agricultural Research Extension in Sub-Saharan Africa". *Oxford Policy Management*, Oxford, pp. 17, UK.

Blum, A. (1989). *The Agricultural Knowledge System in Israel*. Rehovot, The Hebrew University of Jerusalem, Faculty of Agriculture, Israel.

Blum, A. (1991) "What Can be Learned From a Comparison of Two Agricultural Knowledge System? The Case of the Netherlands and Israel". *Agricultural Ecosystem and Environment*, 33, pp. 325-339.

Bolade, E.O. (1990). "Technological Innovations for Nigeria Fisheries Development: Issues and Analysis". *The Nigerian Journal of Agricultural Extension*; Vol. 5, Nos. 1&2.

Chinaka, C. (1993). "Extension Communication System". *Paper Presented at the Orientation Course for Extension Agents*. Enugu State Agricultural Development Programme, 19-24, April.

Chuta, C.R. (1992). "Comparative Assessment of Training Needs for Agricultural Administrators in Imo and Borno States of Nigeria". *Ph.D. Thesis*, University of Nigeria, Nsukka, Nigeria.

Farinde, J.A. (1996). "Effective Agricultural Technology Transfer: Need for a Model Extension Delivery Body for Sustainable Rural Development in Nigeria". In *Sustainable Development in Rural Nigeria*; *Proceedings of the Eight Annual Ago-Iwoye Conference of the Nigerian Rural Sociological Association*, S. Fola Adedoyin and J.O.Y. Achonsu eds., Ogun State University, Nigeria, pp. 119-131.

Hussain, S.S., Byeric, D. and Heisey, P.W. (1994). "Impacts of the Training and Visits Extension System on Farmers' Knowledge and Adoption of Technologies: Evidence from Pakistan". *Agricultural Economics*, pp. 39-49.

Igodan, C.O. and Adekunle, O. (1993). "Utilization of Indigenous Knowledge in Agricultural Production: the Role of National Agricultural Research System". In *Perspective on Food Security in Nigeria. Proceeding of The Nigerian Rural Sociological Association* (Olomole, A.S. and Nwosu, A.C. eds.).

Ijere, M.O. (1992). *Leading Issues in Rural Development*. ACENA Publishers, Enugu, Nigeria.

ISNAR (1984). *Considerations for the Development of National Agricultural Research Capacities in Support of Agricultural Development*. The Hague, The Netherlands, pp. 20.

Jibowo, A.A. (1992). *Essentials of Rural Sociology*; Gbemi Sodipo Press Ltd., Abeokuta, Nigeria.

Ladele, A.A. (1991). "A Socio-Economic Analysis of the Impact of Agricultural Co-operative Organizations on Rural Development in Nigeria". *Ph.D. Thesis*. University of Ibadan, Nigeria.

Lionberger, H.F. (1986). "Towards an Idealised Systems Model for Generating and Utilizing Information in Modernizing Societies"; In*Knowledge Generation, Exchange and Utilization*, G.M. Beal, W. Disanayak and S. Konoshim eds., Wesview press, Colorado, pp. 105-134.

Madukwe, M.C. (1995a). "Agricultural Extension Systems and Strategies in Nigeria's Rural Development" In *Rural Development in Nigeria: Concepts, Processes and Prospects*, E.C. Eboh; C.U. Okoye; and D. Ayichi eds., Auto - Century Publishing Company, Enugu, pp. 314-320.

Madukwe, M.C. (1995b). "Factors Constraining on-the-Job Training and Farm Visits of Extension Agents in Enugu State". *Journal of Education and Vocational Studies*; 1 (61).

Madukwe, M.C. (1996). "Restructuring Fields Agricultural Extension Services in Nigeria: Issues and Options". In *Sustainable Development in Rural Nigeria: Proceedings of the Eight Annual Conference of the Nigeria Rural Sociological Association*. S.F. Adedoyin and J.O. Aihonsu eds., Ogun State University, Ago-Iwoye, pp. 314-320.

McNamara, R.S. (1990). "African Development Crisis: Agricultural Stagnation, Population Explosion and Environmental Degradation". *Address to the African Leadership Forum*, Lagos, Nigeria, June 21.

Mijindadi, N.B. (1983). "Who Controls Nigeria's Extension Services? The Case of Sokoto State". *The Nigerian Journal of Agricultural Extension*; Vol.1, No. 2.

Mijindadi, N.B. (1994). "Sustainability Issues in Agricultural Technology Transfer in Nigeria, Issues and Priorities for Nigerian Agriculture in the Twenty-First Century". *Proceedings of the Inaugural Conference of the Agricultural Extension Society of Nigeria*, pp. 47-56.

Monu, E.D. and Omole, M.M. (1983). "Adoption of Recommended Farm Practice by Nigeria Cocoa Farmers". *The Nigerian Journal of Agricultural Extension*. 1(2), pp. 43-53.

Mytelka, L.K. and Tesfachew, T. (1999). "The Role of Policy in Promoting Enterprise Learning During Early Industrialization: Lessons for African Countries". *United Nations Conference on Trade and Development Study* No.7.

Nagel, U.J. (1980); "Institutionalization of Knowledge Flow". *Special Issue of the Quarterly Journal of International Agriculture*; No.3.

Nweze, N.J. (1995). "The Role of Informal Finance in Rural Areas of Nigeria". In*Rural Development in Nigeria: Concepts, Processes and Prospects*, E.C. Eboh; C.U. Okoye and D. Ayichi eds., Auto-century publishing company, Enugu, Nigeria, pp. 192-199.

Obibuaku, L.O. (1983). *Agricultural Extension as a Strategy for Agricultural Transformation*, University of Nigeria press, Nsukka, Nigeria, pp. 16-22.

Obibuaku, L.O. (1986). "Agricultural Administration in Africa". *Mimeo*, University of Nigeria, Nsukka , Nigeria.

Obiechina, C.O.B. and Otti, F. (1985). "Socio-Economic Impact of Rice Production Technology on a Rural Area of Anambra State". *Journal of Rural Development and Co-operative Studies*, Vol.1, No.2, pp.132-146.

Obinne, C.P.O. and Anyanwu, A.C. (1991). "Communication Factors Determining Adoption of Improved Cassava Technologies in Small Holder Agriculture". *Nigerian Journal of Rural Extension and Development*, Vol. 1, No.1, pp. 15-23.

Ogolo, M.B.; Adekunle, O.A. and Akinsorotam, A.O. (1994). "Effective Communication in Sustainable Agricultural Technology Transfer by the 21st Century in Nigeria: Issues and Priorities for Nigeria Agricultural Extension in the Twenty-First Century. *Proceedings of the Inaugural Conference of the Agricultural Extension Society of Nigeria*, pp. 69-75.

Ogunbameru, B.O. (1986). "Application of REAP Model in Evaluating Extension Education Programmes: Focus on Borno Farm Mechanization Training Programme". *The Nigerian Journal of Agricultural Extension*, Vol.4, No.1, pp.2-9.

Ogunfidititimi, T.O and Ewuola, S.O. (1995). *The Synthesis of Comparative Agricultural Extension Systems*. Emuni Press Ltd., Ibadan, Nigeria, pp. 87.

Okigbo, B.N. (1991). "The Challenges of Farming Systems Research in Tropical Africa". *Agricultural Systems in Africa*. Vol I, No 1, pp. 7- 16.

Osuji, L.O. (1983). "Institutional Factors Associated with Adoption of New Farm Technologies Among Farmers in Eastern Nigeria". *The Nigerian Journal of Agricultural Extension*; Vol.1, No.2, pp. 45-53.

Platt, Adam (1989). "Introduction and Verification on Household Technologies". In *In Praise of Cassava*, U.D. Kaku eds., International Institute of Tropical Agriculture, Ibadan, Nigeria, pp. 231 .

Rajasekaran, B.; Martin, R.A. and Warren, D.M. (1993). "A Framework for Incorporating Indigenous Knowledge System into Agricultural Extension". *Indigenous Knowledge and Development Monitor*, Vol. 1(31), pp. 21-23.

Roling, N. (1988a). *Extension Sciences: Information Systems in Agricultural Development*. Cambidge University Press, Cambridge, UK.

Roling, N. (1988b). "The Research-Extension Interface: A Knowledge Systems Perspective". *International Service for National Agricultural Research* (ISNAR), The Hague, The Netherlands.

Roling, N. and Pretty, J.N. (1997). "Extensions Role in Sustainable Agricultural Development. In*Improving Agricultural Extension. A Reference Manual.* B.E. Swanson, R.P. Bentz and A.J. Sofranko eds., FAO, Rome, Italy.

Sene, D. (1994)." The Role of Research and Training in Agricultural Extension". In*Agricultural Extension in Africa: Proceedings of an International Workshop*, J.N Wolf ed., Yaounde, Cameroon, pp. 21-28.

Sokoya, O.G. (1998). "Extension in the Service of the Small Scale Farmer in Nigeria: a Participatory Approach for Sustainable Agricultural Extension". *Paper Presented at the 4th Annual National Conference of Agricultural Extension Society of Nigeria (AESON)*. University of Agriculture, Makurdi, Nigeria.

Swanson, B.E. (1997). "Strengthening Research-Extension-Farmer Linkages". In*Improving Agricultural Extension: A Reference Manual*; B.E. Swanson; R.P. Bentz and A.J. Sofranko eds., Food and Agricultural Organization of the United Nations, Rome, pp. 171-180.

Swanson, B.E. and Claar, B.J. (1983). *Technology Development Transfer and Feedback Systems Analysis*, University of Illinois, Illinois, Interparks.

Titilola, T. (1994). "Knowledge System and Sustainable Agricultural Development in Africa: Essential Linkages". *Indigenous knowledge and Development Monitor* , Vol. 2, No, pp. 18-20.

Uwakah, C.T. (1985). *The Agricultural Extension Approach to Rural Development in West Africa*. University of Nigeria, Nsukka, Nigeria, No.2, August, pp. 27-36.

Van den Ban, A.W. and Hawkins, H.S. (1992). *Agricultural Extension*, Second edition. Agricultural University, The Netherlands, pp.7-41.

Vengara, N.T. and McDicken, K.G. (1990). "Extension and Agro-Forestry Technology Delivery to Farmers". In *Agro-Forestry Classifications and Managements*; K.G. McDicken and N.T. Vengara eds., Bangkok, Thailand.

World Bank (1994). *Agricultural Extension in Africa: African Technical Development Series*, World Bank, Washington D.C., USA.

Zaria, M.B; Arokoyo, J.O.; Omotayo, A.M. and Akpoko, J.E. (1994). "Extension Issues and Priorities from a Multi-Sectoral Perspective; Issues and Priorities for Nigeria's Agricultural Extension in the Twenty-First Century. *Proceedings of the Inaugural Conference of the Agricultural Extension Society of Nigeria*, Nigeria, pp. 89-95.