IMPACT OF FORESTRY-II PROJECT ON THE LIVELIHOODS OF FARMERS IN KANO STATE, NIGERIA

By

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NOVEMBER, 2015

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A THESIS SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, AHMADU BELLO UNIVERSITY, ZARIA, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF DOCTOR OF PHILOSOPHY DEGREE IN AGRICULTURAL EXTENSION AND RURAL SOCIOLOGY

DEPARTMENT OF AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY, FACULTY OF AGRICULTURE, AHMADU BELLO UNIVERSITY, ZARIA, NIGERIA

NOVEMBER, 2015

DECLARATION

I declare that the work in this thesis entitled "**Impact of Forestry-II Project on the Livelihoods of Farmers in Kano State, Nigeria"** has been written by me and it is a record of my research work. No part of this work has been presented in any previous application for another degree or diploma at any institution. All borrowed ideas have been duly acknowledged in the text and a list of references provided.

_____ _____

Yusuf Muhammad **ABDULLAHI** **Date**
Student

CERTIFICATION

This thesis entitled "**Impact of Forestry-II Project on the Livelihoods of Farmers in Kano State, Nigeria"** by Yusuf Muhammad **ABDULLAHI** meets the regulations governing the award of the Degree of Doctor of Philosophy in Agricultural Extension and Rural Sociology of the Ahmadu Bello University, Zaria and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This thesis is dedicated to the voiceless-majority of small-scale farmers of the drylands of Nigeria, who are usually the most vulnerable to the consequences of desertification, land degradation and the negative impact of ineffective government-sponsored rural development interventions.

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ABSTRACT

This study evaluated the impact of the Forestry-II Project on farmers' livelihoods in Kano State, Nigeria. The specific objectives were to describe the socio-economic characteristics of the project's target farmers, assess the farmers attitude towards farm forestry, evaluate the farmers stage of adoption of the project's innovations, evaluate the factors influencing adoption of the project's innovations, evaluate the impact of the innovations on the farmers livelihoods and determine the constraints that affected the farmers involvement in the project's activities in the study area. In view of absence of the project's baseline data, a with-and-without approach to impact evaluation was adopted, whereby villages reached (participants) were compared with similar villages not reached (non participants) by the project. Multi-stage sampling technique was used to select 24 villages across the state, as the study population. Data were collected from 101 participants and 100 non-participants, with help of interview schedules and observation, giving a sample size of 201, equivalent to 20% of the study population. The data were analysed using descriptive statistics, two-sample t-test, two-sample Chi-square test, and the Ordinal Logit Regression Analysis. The average age (45yrs) and maximum number of dependents (35) of the two groups were similar; while their maximum ages (65yrs & 56yrs) and average farming experiences (26yrs & 23yrs) differ. Both were predominantly male (99.0 % & 100.0%), married (99.0 % & 98.0 %), live on farming (86.0% & 92.0%) and had a positive attitude towards farm forestry. However, the participants had more access to extension agents (43% & 25%) and larger farms (2.9Ha & 2.1Ha) respectively. The respondents' stages of adoption of the project's innovations vary. Majority (47%) of the participants were at the *adoption* stage, while most (62%) of the non-participants lagged at the *awareness* and *interest* stages, showing a significant, X^2 (3, N=201) = 25.356, $p<0.05$, relationship between participation in the project and the respondents stages of adoption. The respondents adopted boundary plantings, private and communal woodlots, and scattered farm plantings representing 45% of the innovations recommended by the project. The main reason inspiring adoption was 'relative advantage of the innovation'; while the socio-economic/institutional factors influencing adoption were found to be: cooking fuel, years of schooling, age, farm size, land tenure, herd size and primary livelihood source. Livelihood impact of farm forestry was greater for the project's participants than the non-participants. Increases in livelihoods achieved by the two groups averaged 49.00 and 29.60 respectively. Showing the project's participants achieved significantly higher increases in livelihoods than the non-participants ($t=4.596$, $t_{cv}=2.042$, $df=30$, $\alpha=.05$). Therefore the Project has significantly increased the livelihoods of its target farmers. It is also likely that the project has achieved its objective of increasing soil stability and the supply of fuelwood and poles in the study area. The respondents' feelings about-the-project revealed their priorities, fears, challenges and hopes towards this and future similar projects. They preferred orchards and disliked the long gestation of trees. The respondents mentioned 'low participation' among other constraints which affected their involvement in the project; and recommended the provision of 'competent extension agents' among other solutions to the constraints. It is concluded that the Forestry-II Project has improved the livelihoods of its target farmers in the study area. This study has narrowed the existing knowledge-gap on the research problem and addressed several key questions related to it. It is recommended, among other things, that the State's Government should consider the priorities and concerns of the farmers in designing/implementing future similar projects.

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LIST OF ABBREVIATIONS

Abbreviation	Meaning
ADP	Agricultural Development Programme
AFG	Australian Forest Growers
APCU	Afforestation Programmes Coordinating Unit
BUSPH	Boston University School of Public Health
CommGAP	Communication for Governance & Accountability Program
DFID	Department for Foreign and International Development
DOI	Diffusion of Innovations
FADE	Fight Against Desert Encroachment
FAO	Food and Agriculture Organization
FCT	Federal Capital Territory
FDA	Federal Department of Agriculture
FDF	Federal Department of Forestry
FEPA	Federal Environmental Protection Agency
FMARD	Federal Ministry of Agriculture and Rural Development
FME	Federal Ministry of Environment
ICRAF	International Centre for Research on Agroforestry
IDS	Institute for Development Studies
IFPRI	International Food Policy Research Institute
KNAP	Kano State Afforestation Programme
KNUST	Kwame Nkrumah University of Science and Technology
LGA	Local Government Area
MCICT	Ministry of Commerce, Industry, Cooperatives & Tourism

NAC	National Afforestation Committee
NAERLS	National Agricultural Extension and Research Liaison Services
NAP	National Action Programme
NFAP	National Forest Action Programme
NGEX	Nigeria Exchange
NGO	Non-Governmental Organization
OLR	Ordinal Logit Regression
PMU	Program Management Unit
RBDAs	River Basin Development Authorities
SCT	Social Cognitive Theory
SEPAs	State Environmental Protection Agencies
SFD	State Forestry Department
SIT	Social Impact Theory
UNCCD	United Nations Convention to Combat Desertification
USA	United States of America

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

According to oral history, the semi-arid region, comprising the Sudan and Sahel savanna zones of northern Nigeria was once in a state of ecological balance, blessed with abundance of natural forests and diverse plant and animal species. However, like many parts of Africa, ecological disturbance triggered by human population pressure on land, unsustainable exploitation of the natural resources in the forms of land misuse, massive deforestation and overgrazing, led to the elimination of several species of fauna and flora, soil degradation and a gradual deterioration of the environment (Grainger, 1990). As a result of the ecological decline, rain-fed agriculture became unreliable and unpredictable in the region (Odjugo, 2010). Scientists have been intensely discussing the phenomenon and its potential impact on the region's agricultural production, animal husbandry and food security (Odjugo, 2001). This insidious process reached one of its peaks in the great drought of 1972-73 (Grainger, 1990). The 1972-73 drought painted a most glaring picture of the gravity of desertification and climatic change facing the Sudan and Sahel savanna regions of Nigeria and ultimately prompted the Federal Government as well the Governments of the affected areas to device various intervention policies to address the problem (Mustafa, 2003).

In spite of the intervention measures, evidence of increasing desertification in the semi-arid zone of the country compelled the Federal Government of Nigeria to approach the World Bank for assistance in combating the problem. The Bank advanced a loan facility of about $m70.0 U.S. Dollars, to undertake a massive project of afforestation in the

affected areas between 1987 and 1996 (World Bank, 1986). The project, which was grassroots-driven, aimed at achieving protection and restoration through controlling desertification, stabilizing the soil conditions and improving the supply of fuelwood, poles and fodder in the threatened areas (Mustafa, 2003). The project trained and built the capacity of its extension staff and associated personnel on a continuous basis, locally and abroad (KNAP, 1992), and extended farm forestry practices to farmers and other end-users through advisory services, demonstrations, information dissemination, training of target farmers, organization of tree planting groups and provision of material support to participating communities (World Bank, 1997).

In addition to extension of farm forestry practices, the project assisted its beneficiaries on production of tree seedlings, establishment of collective/ private woodlots, establishment of several kilometers of shelterbelts for protection of farmlands and encouraged a more positive attitude towards tree planting and environmental protection in the various communities (Mustafa, 2003; Yakubu, 2003). It was against the above background that this study assessed the impact of the Project's farm forestry extension activities on its target farmers livelihoods in Kano State, Nigeria.

1.2 Problem Statement

The Federal Government of Nigeria and the Government of Kano State have made several attempts to control desertification through afforestation. One of these attempts is the implementation of the World Bank-assisted Nigeria Forestry-II Project, between 1986 and 1996. During the period, the Project extended several farm forestry (or agroforestry) innovations to its target farmers throughout Kano State, with a view to achieving increase in soil stability, soil fertility, soil moisture, supply of fuelwood, poles

and fodder; enhancement of agricultural productivity and encouraging a favourable attitude towards on-farm tree planting among the farmers.

Although the project has been hailed for its numerous outputs; such as number of farm families reached, number of conservations clubs organised, number of tree planting groups organised, number of tree seedlings produced/distributed, number of energy saving stoves distributed to women and number of radio & TV programs aired to the public (KNAP, 1992; FDF, 1997; World Bank, 1997; Mustafa; 2003; Yakubu, 2003; Papka, 2013), information on the medium to long-term outcomes (or impact) of its farm forestry activities on its target farmers livelihoods seemed hard to come-by. Answering this larger question is important and will simplify other sub-questions emanating from it. It'll pave way for understanding the socio-economic background of the project's target farmers, their stage of adoption the Project's farm forestry innovations, the reasons influencing adoption, and their perceptions of the prospects and challenges of implementing the project's activities.

The medium to long-term outcomes of adoption of the project's farm forestry innovations on the target farmers' livelihoods may/ may not match the initial expectations. The social, agricultural, economic and environmental outcomes of adoption of farm forestry innovations on the livelihoods of farmers may be positive, negative, expected or unexpected. In this context assessing the household-level impact of the project's farm forestry innovations on the target farmer's livelihoods becomes important, and it has helped to narrow the existing knowledge-gap on the research problem. From the foregoing, the key questions answered in order to achieve the objective of this study were:

i. What were the socio-economic characteristics of the Forestry-II Project's participant farmers?

ii. What was the attitude of the project's participant farmers towards farm forestry activities?

iii. What was the stage of adoption of the project's farm forestry innovations among its participant farmers?

iv. What were the factors influencing adoption of the project's innovations among its participant farmers?

v. What is the impact of the project's innovations on the livelihoods of its participant farmers'?

vi. What were the constraints that affected the farmers participation in the project's activities?

1.3 Objectives of the Study

The broad objective of this study is to assess the impact of the Forestry-II Project on farmers' livelihoods in Kano State, Nigeria. The specific objectives were to:

i. describe the socio-economic characteristics of the Forestry-II Project's participant farmers;

ii. assess the attitude of the participant farmers towards the project's innovations;

iii. assess the participant farmers' stage of adoption of the project's innovations;

iv. evaluate the factors influencing adoption of the project's innovations among the participant farmers;

v. assess the impact of the project's innovations on the livelihoods of the participant farmers; and

vi. identify the constraints which affected the participant farmers' involvement in the project's activities.

1.4 Justification of the Study

Often project impact assessment has been viewed as an adversarial process. In such cases, it is assumed that the exercise is primarily used to provide a "thumbs up" or "thumbs down" about a project. As a result, it has all too often been considered by

project directors and coordinators as an external imposition that is threatening and not very helpful to project staff (Westat, 2010). This need not be the case. Rather, assessing the impact of projects contributes to knowledge base and help understand what worked and why. A frequently expressed opinion about the Forestry-II Project is its list of outputs, but often no mention of its outcomes (if any) on its beneficiaries' livelihoods. A report of systematic evaluation of the project's impact on its beneficiaries livelihoods appeared hard to come by. There are several benefits of assessing the project's impact on the beneficiaries livelihoods. Apart from comparing the project's objectives against the options used in achieving them and the outcomes on the beneficiaries' livelihoods, this study generated fresh knowledge on the research problem, that can be valuable for decision making by the Federal as well as the Kano State's Government, and the general public. The study has added to the existing knowledge-base on the research problem by revealing the extent of farmers involvement in the project's farm forestry activities; factors that determined their involvement, outcomes of their involvement, and the various constraints that affected the project's beneficiaries involvement in its activities. The findings can assist in designing appropriate policies towards addressing the prevailing issues relating to farmers involvement in farm forestry, within the overall context of combating desertification and achieving sustainable ecological balance and agricultural productivity in the study area. In general the study's contributions to knowledge are a source of valuable information for guidance for decision makers, researchers, and planners of similar future interventions in the study area or elsewhere.

1.5 Research Hypotheses

The following hypotheses were tested in the null form:

i. There is no relationship between the respondents' socio-economic characteristics and their stage of adoption of the Project's innovations.

ii. There is no difference in livelihood impact of farm forestry innovations between the Project's participants and non-participants.

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview of Afforestation Policies and Programmes in Nigeria

2.1.1 National policies

2.1.1.1 The National Policy on Environment

Under the current national policy on environment, the constituent elements on afforestation and combating drought and desertification, within the framework of the National Policy on Environment, include the following (FME, 2013):

i. Development of a National Action Programme to Combat Desertification and mitigate the effects of drought.
ii. Integrating public awareness and education on causes and dangers associated with drought and desertification.
iii. Strengthening of national and state institutions involved in drought and desertification control programme.
iv. Promoting sustainable agricultural practices and management of water resources including water harvesting and inter-basin transfers. Encouraging individual and community participation in viable afforestation and reforestation programmes using tested pest and drought-resistant and/or economic tree species;
v. Encouraging the development and adoption of efficient wood stoves and alternative sources of energy.
i. Establishing drought early warning systems. Involvement of the local people in the designing, implementation and management of natural resources

conservation programmes for combating desertification and ameliorating the effects of drought.

iii. Intensifying international cooperation and partnership arrangements in the areas of training, research, development and transfer of affordable and acceptable environmentally sound technology and provision of new and additional technical and financial resources; Inventorizing degraded lands, and implementing preventive measures for lands that are not yet degraded or which are slightly degraded.

iv. Adopting an integrated approach to address physical, biological and socio-economic aspects of desertification and drought;

v. Intensifying cooperation with relevant inter and non-governmental organizations in combating desertification and mitigating the effects of drought;

vi. Strengthening the nation's food security system;

vii. Establishing, reviewing and enforcing cattle routes and grazing reserves.

2.1.2 Institutional framework

2.1.2.1 The Federal Environmental Protection Agency (FEPA)

The establishment of FEPA by Decree 58 of 1988 was probably the most far-reaching initiative undertaken by the Federal Government of Nigeria for the purpose of addressing the multifarious environmental problems (drought and desertification inclusive) and protecting the Nigerian Environment. Government further demonstrated its commitment to environmental issues through Decree 59 of 1989, which increased the powers given to FEPA by government. The decree provided legal backing of the Agency was with a broad mandate and specific powers of sanctions in the

implementation of the National Environmental Policy. By Law, FEPA is therefore the apex institution for all issues relating to afforestation and environmental protection. The Federal Environmental Protection Agency also facilitated the establishment of State Environmental Protection Agencies (SEPAs) in the 36 states of the Federation and the Federal Capital Territory (FCT). The State Environmental Protection Agency has mandate for addressing all environmental problems (including afforestation, drought and desertification) at the state level (FME, 2013).

2.1.2.2 The Federal Ministry of Environment (FME)

The creation of the Federal Ministry of Environment, in June 1999, was viewed as a laudable initiative and seen as an attestation of the top priority accorded to environmental issues, by the Obasanjo Administration (FME, 2002). The Ministry was established to co-ordinate various environmental efforts and tackle environmental degradation issues vigorously. In line with its mandate, the ministry designed and implemented policies on erosion control, ecosystem rehabilitation and forestry development in various parts of the Nigeria; and recorded several achievements.

2.1.2.3 Forestry Administration

Forestry is administered in the country at the three tiers of government i.e. Federal, State and the Local Government Areas. The primary role of Federal Department of Forestry (FDF) is to formulate National Forest Policy. It also plays an advisory role to the State Forestry Department (SFD), supports execution of Federally-funded projects and is responsible for relations with International Development Agencies. The SFDs manage the Forest resources at the state level. They also superintend over revenue generation from the Forestry Sector in the states. The roles of LGAs differ from North

to South. In the south they have virtually no responsibility for managing the Forest resources, while the contrary is the case in the North (FME, 2013).

2.1.2.4 Convention to Combat Desertification

Nigeria signed the Desertification Convention on the 31st October, 1994 and ratified same on the 8th July, 1997 thereby qualifying the country as a Party to the convention with effect from 6th October, 1997. As part of the implementation strategies, a National Co-ordinating Committee to combat desertification control in 1993 was established with Secretariat at the then FEPA. The committee, which comprises of representatives of line Ministries, Agencies, relevant research Institutes, and Non-governmental Organizations (NGOs), has responsibility for coordinating the implementation of the convention to combat Desertification. It must be noted that most states of the Federation have legislation relating to environmental protection, such as edicts on bush burning and deforestation (FME, 2013).

2.1.3 Sectoral programmes

In Nigeria, several sectoral and multi-sectoral programmes have been put in place over the years on afforestation and combating the problems of drought and desertification. A brief review of some of these programmes attempted from the 1970s-1990s is given below:

2.1.3.1 National Forest Action Programme – 1997

Formulated in 1997, NFAP is one of the more recent programmes which evolved through articulated planning and involvement of all stakeholders in the Forestry Sector. Unfortunately, the NFAP has not proceeded to the implementation phase. Prior to its

formulation, the forestry Sector did not have a separate policy. What obtained was an encapsulation of the National Forest Policy within an overall "Agricultural Policy for Nigeria" which was published in 1988 under the aegis of the Federal Ministry of Agriculture. Subsequently the policy reform packaged in the NFAP encouraged government to set up two committees: namely the National Committee on Review of Forestry and Wildlife Legislation and the National Forest Policy Review Committee. The first finalized a bill for consideration by the National Assembly while the second visited some Southern African countries and Malaysia to put in proper perspective its input to the new National Forestry Policy. The NFAP succeeded in changing the perception of policy makers and planners that Forestry does not contribute much to the economy. This was possible by the awareness created through their membership of NFAP committees. Furthermore the NFAP succeeded in reviving the Forestry Sector by providing individual and group training opportunities to both the formal and informal Forestry sector. Each state also has in place a Forest Action Plan, which serves as guide for its Forestry development initiative. Another important success recorded was the institutionalization of dialogue between the stakeholders in the Forestry Sector as a prelude to programme design. To a large extent, current thinking in Forestry Circle has moved to Bottom-up approach in Programme design.

2.1.3.2 Community Woodlots Programme – 2002

To address fuelwood deficit and the protection of fragile ecosystems, 10-hectare pilot woodlots have each been developed in Bauchi, Zamfara, Adamawa and Kebbi states.

2.1.3.3 Sand Dune Stabilization Programme – 2002

In an effort to stabilize moving or active sand dunes, a Trial Sand Dune Stabilization Project has been completed in Dukku, Kebbi State, using check-board technique. This is being replicated in Borno, Jigawa, Kano, Sokoto, Yobe and Zamfara states.

2.1.3.4 Integrated Sustainable Model Village Development Programme – 2003

Three Villages were identified in Adamawa, Katsina and Jigawa States for the pilot phase of the programme. This programme would involve the participation of local communities, for addressing desertification at the Grassroots. The project's proposal was also submitted to the UNDP for funding.

2.1.3.5 National Action Programme to Combat Drought and Desertification – 2003

A National Action Programme (NAP) prepared by the Federal Ministry of Environment, in line with Nigeria's membership of the United Nations Convention to Combat Desertification (UNCCD), to combat desertification. The Programme's main objective is to develop long-term strategies that focus on improved productivity of land and natural resources to improve the living conditions of the rural populace. The NAP has been adopted as a policy document for drylands management in the country.

2.1.3.6 The "Great Green Wall" Programme – 2004

An international NGO accredited to the United Nations World Summit on sustainable development, known as Fight Against Desert Encroachment (FADE), is spearheading this programme. FADE operates in collaboration with agencies in Nigeria and Africa, and has formed partnerships with public and private sector actors, like NGOs, in order to share best practices in preventing further destruction of Africa's human and economic

capital and is solely committed to the prevention and control of environmental degradation with more emphasis on desert encroachment and desertification. The programme's vision is to conquer the drylands in the frontline states of Nigeria and Sub-Sahara Africa where desertification and desert encroachment is relevant by playing a leading role in prevention and control of environment degradation, so that it will no longer be a threat to the existence of life and vegetation.

FADE planned to achieve its mission through campaign for environmental awareness, sustainable and environment-friendly agricultural practices, with a view to eliciting local action as well as from world bodies, in order to stem the further destruction of beneficial natural resources by the Sahara and its resultant ecological, social and economical fall-outs (FADE, 2009). FADE's local content and commitment had the following elements:

i. International Environmental Education and Training
ii. Environmental management
iii. Capacity building
iv. In-House training and mentoring programs.
v. Result based management
vi. Monitoring and Evaluation of DRG-MDGs projects & programs
vii. Shelterbelt creation and design in frontline states in Nigeria (the "wall of trees" programme.

The "green wall" project started in 2004, and is currently being implemented in the frontline states of Kebbi, Sokoto, Zamfara, Katsina, Jigawa, Kano, Yobe and Borno, in

partnership with state governments and the communities, to rehabilitate the environment. According to a recent news report, Nigeria's Ministry of Environment, is monitoring its implementation will soon forward a report to the federal government on the activities and achievements of the project (FMI, 2013).

2.1.3.7 Shelterbelts and afforestation Programme 2004, revived in 2013

The programme aims at establishing a green-belt stretching from the north-west to the North-east of Nigeria, for which 33 standard plant nursery centers', out of the 50 earmarked, have been established in the 19 northern states and the FCT. The council's secretariat is housed in the federal ministry of Environment, while overall guidance for the programme is provided by an Inter-Ministerial Committee for the Implementation of the Shelterbelt Programme (ICISP), known as the National Council on Shelterbelts and Afforestation (NCSA). The council was re-established in the early part of February 2013, with the pledge to speedily tackle all issues regarding ecological problems in the country. First set up in January, 2004, the council became dormant with the coming on-stream of the "Great Green Wall" initiative in 2005. It became dormant because its afforestation functions were carried out by the Presidential Afforestation Initiative, mandated to carry out the "Great Green Wall" programme, which is now desirous of urgent attention in view of the time – lag since its inception," (FMI, 2013).

2.1.4 Lessons from the afforestation programmes

Despite the various national efforts discussed above, desertification continues to be a serious problem in the drylands of Nigeria. Some of obstacles hindering these efforts include the top-down approach to environmental resource management, frequent policy

shifts, inappropriate technology and the neglect of indigenous technology in natural resource use and management (FME, n.d.).

2.1.4.1 Top-down approach

Environmental conservation strategies in Nigeria have been top-down, with limited consultation between and among the various stakeholders. Such strategies usually turn out to be at variance with the basic needs of the people. Resource users and other stakeholders commonly have no access to the decision-making process, hence cannot influence decisions that directly affect them and their resources. Most farmers are marginalized by the process of development and alienated from their productive bases. This has made them to become more vulnerable to environmental hazards of drought and desertification.

2.1.4.2 Frequent policy shifts

Efforts to combat deforestation and desertification have been adversely affected by frequent shifts in policy by government. Such policy shifts have been observed to be, as frequently as leaders-come-and-go and such shifts are dictated by the country's economic fortune or misfortune. Most of the programmes examined in Section 4 have been affected by these changes. A good example is the River Basin Development Authorities (RBDAs), which was an attempt to develop the country's water resources for multi-purpose use to combat desertification as well as mitigate the negative consequences of drought in this zone. The RBDAs have since the 1970s witnessed a number of policy shifts and bodies have undergone a number of re-organization exercises. Thus RBDAs expanded from 3 in 1973 to 11 in 1976 and to 18 in 1984, further reduced to 11 in 1986 following the economic reforms of the early 1980s, which

culminated to the adoption of the structural adjustment programme (SAP). As a result, subventions to RBDAs were reduced to the barest minimum while subsidies on diesel, petrol, engine oil and farm inputs, notably fertilizers, tractor hiring services, herbicides, pesticides and improved seeds were withdrawn. In addition, farmers were expected to fully pay for all the infrastructural services enjoyed by them, including water, which has led to a hike in water charges, especially irrigation fees. All these indicate a non-coherent approach to the management of the water and agricultural resources (FME, n.d.).

2.1.4.3 The use of inappropriate technology

The Federal Government's response to the Sudano-Sahelian droughts of 1972-74, and the accompanying ecological and human disasters was the adoption of medium and large scale irrigation. However, this has exacerbated rather than ameliorated the hazards of desertification and drought in Nigeria as it has increased income inequality as well as inequality of access to the productive resources. Technological manipulation of the environment in form of irrigation often produces new hazards such as salinity, water-borne diseases, weed infestation, and accentuates animal, human and plant diseases. In Nigeria, construction of upstream dams has meant loss of productive base as well as productivity for the down-streamers as witnessed by the construction of the Tiga dam in Kano that is now depriving the water users in Hadejia of access to water. Also in the South Chad Irrigation Project uncontrolled land clearing had exposed much of the area to intense desertification process, which is worsened by the recession of the lake (FME, n.d.).

2.1.4.4 Neglect of Indigenous Knowledge (IK)

A major lesson from the previous efforts is that the lack of incorporation of indigenous knowledge poses a serious problem to adaptation of recommended amelioration measures by the people. It has been argued that rural people's knowledge is often superior to that of outsiders. Examples can be found in mixed cropping, knowledge of the environment, abilities to observe and discriminate, and results of rural people's experiment. Rural people's knowledge and modern scientific knowledge are complementary on their weaknesses. Combined, they may achieve what neither would alone. Farmers and herders in the drylands of Nigeria have always existed in a precarious balance with the harsh and inhospitable environment, dominated by risk and uncertainty. They have, evolved over the years some traditional response mechanisms of coping with such risk and uncertainty in managing their environment. Emphasis should therefore be on building on existing knowledge and capacity.

2.1.4.5 Sectoral approach

The sectoral approach adopted was not been able to tackle the multi-dimensional problem of deforestation and desertification. The approach caused the relevant Ministries and Agencies to operate in a compartmentalized fashion. There was also a high degree of overlapping and duplication of efforts due to poor coordination.

2.1.4.6 Inadequate finance

The magnitude of desertification problem in Nigeria requires funds that are far in excess of what is currently allocated by government. This meant that the finances allocated so far have not been able to have any significant impact in combating desertification. The

lessons learnt from past efforts as stated above need to be taken into consideration in the formulation and implementation of the National Action Programme on Desertification.

2.2 Overview of the Nigeria Forestry-II Project

2.2.1 The project's inception

The project's staff appraisal report indicated that it was identified in March 1983, prepared in June 1984 and appraised/approved for take-off in 1986 (The World Bank, 1986). Thus it took off in 1986 after an agreement was reached between The World Bank and the Federal Republic of Nigeria, for a loan facility of about US $71million, payable over 20 years, including five years of grace, at standard variable interest rates (The World Bank, 1986).

2.2.2 The project's components, beneficiaries and duration

The Nigeria Forestry-II had Project three components - a) afforestation program, b) forest management program and c) program management, training, policy analysis, and research (Figure 2.1). The three components were implemented in nine states, over a ten year investment period (1987 to 1997), while net impact of investment in farm forestry component is expected to become positive beginning from the 16^{th} year after commencement (World Bank, 1986). The afforestation component, comprising farm forestry and shelterbelt activities (49% of base project cost) was conducted in the middle and northern regions, whiles the Forest Management Program (35%), was implemented in the middle and southern regions.

Assistance for management training, policy analysis, research and studies made up the remaining costs (16%). The Project's beneficiaries were the Federal Ministry of Agriculture, Water Resources and Rural Development and the nine Participant State

Governments namely Bauchi, Benue, Borno, Kaduna, Kano, Ogun, Ondo, Plateau and Sokoto (World Bank, 1986).

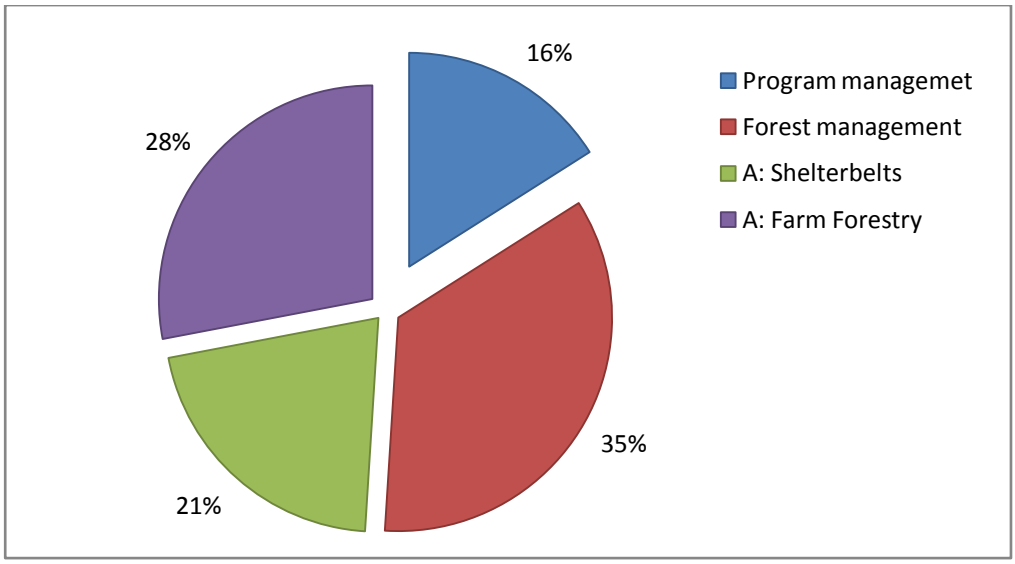


Figure 2.1: The Forestry-II Project's Components as Percent of Base Cost
Source: World Bank (1986).

2.2.3 The project's objectives

According to World Bank (1986) the primary objectives of the Forestry-II project were to support the efforts of the Federal Government and State Governments to: a) strengthen the structural base of the forest sector through improved policies, revenue collection systems, training and research; b) stabilize soil conditions in threatened areas and improve the supply of fuelwood, poles and fodder by supporting farm forestry and shelterbelt activities; and c) increase the supply of industrial wood by improving the management of existing, high-priority plantations and by establishing new plantations.

2.2.4 The project's targets and partners

The targets of the Farm Forestry program were – *soil stabilization* and *supply fuelwood*. The expected results from afforestation (comprising investments in shelterbelts and farm forestry), were (World Bank, 1986):

i. stabilize soil conditions and enhance soil moisture and nutrient content, benefitting agricultural productivity;
ii. increase the supply of fuelwood, poles, fruit and fodder,
iii. improve the management of existing plantations and help establish new plantations, increasing the availability of industrial timber,
iv. While the support for management, training, policy initiatives, research and studies would greatly strengthen the structural base of the sector.

The principal risks identified were: smallholder acceptance of the farm forestry program, and the ability of the Federal and State Governments to provide their share of funding (World Bank, 1986). The extension, monitoring and research programs were carefully designed to limit the risk of failure and minimize the annual funding requirements of the program.

2.2.5 The project's mode of implementation

In order to achieve its objective of meeting the urgent need to stabilize soil conditions in the study area, the project's farm forestry extension activities embarked on dissemination of different types of farm forestry practices in the study area. The activities took place on a state-wide basis, taking into account different risk/reward profiles associated with different ecological zones and population densities within the

state. Farm forestry extension activities were intensified in the drier part of each the affected states, but were also spread to cover the rest of the state.

The extension strategies designed to encourage tree planting and maintenance on farmlands include:

i. nursery development to provide sufficient seedlings of various types;
ii. efforts by agricultural extension staff to encourage and advise farmers on tree planting, protection and maintenance; and
iii. A mass media campaign to increase farmer awareness of the need for and benefits of additional tree cover.

The global objective was to involve about 250,000 farm families which represent about 10% of the farm families in the participating states. These families together farm an area of some 750,000 ha (World Bank, 1986).

2.2.6 The rationale for farm forestry

The Bank's Staff Appraisal Report indicated that farm forestry was chosen because it is a low cost solution to stabilizing soil conditions since it offers a much greater scope for tree planting, with each farmer contributing through his planting efforts, than if the states had to incur the costs of direct planting. The design of the component carefully addresses the issue of farmer willingness to take up and maintain seedlings. The project provided for the close involvement of the agricultural extension staff of the Bank-supported Agricultural Development Projects (ADPs) which either exist or would soon exist in each state. ADP extension staff worked closely with State Forestry Department

(SFD) extension staff and the farmers to ensure that the seedlings were delivered at the correct time and that farmer receive adequate information on planting, care and maintenance. The ADPs also helped in the preparation and distribution of media messages throughout each state stressing the importance of tree planting to soil protection and as a source of fuel, poles, fodder and income. Land tenure wasn't a major issue as the customary laws provide for land-rights to be vested in individuals with the right of transfer through sale or inheritance (The World Bank. 1986).

2.2.7 Farm forestry practices extended to farmers by the project

2.2.7.1 The farm forestry practices

Extension of farm forestry practices to farmers was considered a principal vehicle to be used by the State in its effort to control desertification and ameliorate the environment for optimum natural resources production (MAHF, 1989). Based on this belief the project extended several models of farm forestry to farmers across the state between 1987 and 1997, with the primary aim of integrating tree crops into farm lands, with no rigid method, all depending on the farmer's need (MAHF, 1989). The following were the major farm forestry models recommended to the farmers:

Table 2.1: Farm Forestry Practices Recommended to Farmers by the Project

	Practices	**Purpose**	**Examples of Tree Species Used**
1	Private nurseries	Production of tree seedlings	*Anacardium occidentale*
2	Communal nurseries	Production of tree seedlings	*Acacia nilotica*
3	Scattered farm tree plantings	Soil improvement	*Acacias*
		Fuelwood	*Eucalyptus sp.*
		Fodder	*Albizzia spp*
		Fruits	*Mangifera indica*
		Shade	*Azadirachta indica*
		Edible leaves	*Phoenix dectilifera*
9	Border planting	Boundary protection	*Eucalyptus*

10	Wind breaks	Wind erosion control	*Eucalyptus*
11	Homestead plantings	Shade	*Delonix regia*
12	Roadside plantings	Aesthetic value	*Khaya sengalensis, Senna siamea*
13	Natural regeneration plots	Caution farmers on utilization of natural vegetation cover on farm lands. To help resuscitate the ecological balance of an area. Participants taught basic tending operations	*Acacia*
14	Individual woodlots	To provide much needed forestry products e.g. poles, fuelwood, etc.	*Eucalyptus sp.*
15	Communal woodlots	Similar to individual woodlot	*Eucalyptus sp.*
16	Orchards	Integration of economic/ fruit trees into crop land for food and income	*Mangifera indica*

Source: MAHF (1989).

2.2.7.2 Tree species tried by farmers

The farm forestry program's participants were trained to raise and maintain tree seedlings in their local nurseries. This provided a solid foundation for the program. A total of 185,000 seedlings were produced in 1989 alone in 38 nurseries in various locations across the state (MAHF, 1989). The tree species tried in the farmers' nurseries were highlighted below (Table 2:2).

Table 2.2: Tree Species Tried in Farmers Nurseries

	Scientific name	**English name**	**Local name**	**Planting Method**
1	*Azadirachta indica*	Neem	Maina	Nursery
2	*Eucalyptu Spp.*	Eucalypts	Turare	Nursery
3	*Parkia biglibosa*	Locust Bean	Dorawa	Indigenous
4	*Dalbergia spp*	Dalbergia	Makarfo	Nursery
5	*Khaya senegalensis*	Mahogany	Madaci	Nursery
6	*Acasia nilotica*	Acasia	Bagaruwa	Nursery
7	*Acasia senegal*	Gum Arabic	Dakwara	Nursery
8	*Anacardium occidentale*	Cashew	Kanju, Kashu	Nursery
9	*Mangifera indica*	Mango	Mangwaro	Nursery, direct
10	*Casshuarina equisetifolia*	Whistling Pine	Kasharina	Nursery, ornamental
11	*Psidium guajava*	Guava	Goba	Nursery, direct
12	*Tamarindus indica*	Tamarind	Tsamiya	Nursery, direct
13	*Senna simea*	Cassia	Kashiya	Nursery
14	*Delonix regia*	Flamboyant	Fanshana	Nursery
15	*Phonix dectilifera*	Date Palm	Dabino	Nursery
16	*Moringa olifera*	Moringa	Zogale	Nursery
17	*Albizzia lebbeck*	Albizzia	Filfil	Nursery, hedge
18	*Dedonea viscosa*	Jos Privet	Filfil	Nursery, hedge
19	*Lawsonia inermis*	Indigo	Lalle	Nursery, hedge
20	*Carica papaya*	Pawpaw	Gwanda	Nursery
21	*Meleleuca leucodendron*		Maleluka	Nursery

22	*Vitis vinifera*	Grapevine	Inabi	Nursery
23	*Punica gratum*	Pomegranate	Ruman	Nursery
24	*Annona squamosa*	Custard Apple	Fasadabur	Nursery
25	*Ficus thonningi*	Ficus	Chediya	Nursery
26	*Ficus polita*	Ficus	Durumi	Nursery, shade, fruit
27	*Ficus polytphyalla*	Ficus	Gamji	Nursery, Shade, gum
28	*Thevitia nerrifolia*	Gaboje	Gamboji	Nursery, hedge
29	*Citrus spp.*	Citrus	Lemo	Nursery
30	*Tectona grandis*	Teak	Tik	Nursery
31	*Adansonia digitata*	African Baobab	Kuka	Nursery
32	*Diospyrus mespiliformis*	Diospyrus	Kanya	Nursery
33	*Acasia albida*	-	Gawo	Nursery
34	*Gmelina arborea*	Gmelina	Malina	Nursery
35	*Ziziphus jujuba*	-	Magarya	Nursery
36	*Ficus carica*	Fig	Baure	Nursery
37	*Musa sapientum*	Banana	Ayaba	Nursery

Source: MAHF (1989).

2.2.8 The project's achievement

According to an internal evaluation report by The World Bank, the Forestry-II Project has achieved its objectives of strengthening the structural base of the country's forestry sector, increasing the supply of industrial wood, and stabilizing soil conditions in parts of northern Nigeria; and these were enumerated in detail as (World Bank, 1997):

i. Collaboration with the ADPs and operation of the UAES.
ii. Directly reached 330,000 farm families, about 168% of the target of contact farmers, with advice on tree planting and maintenance.
iii. Created Awareness among some 70% of the population in the project area on the importance of trees through media and annual tree planting campaigns.
iv. About 4,882 ha of woodlots were established by individual farmers and communities to protect their farms and increase fuelwood and fodder supply.
v. Number trees left standing in farms was higher than the three per hectare estimated at appraisal (opinion of Project staff), but no sufficient data to confirm if it is significant.

vi. Women were also organized into groups to produce seedlings, plant orchards and woodlots, and fabricate and use improved wood-burning stoves.

vii. Over 3,500 stoves were distributed among the rural women in the project area.

viii. Production of 130.9 million seedlings, as against the revised target of 49.2 million, with the private sector involvement accounting for about 10% of the production. About 112 million seedlings (95%) produced in the project nurseries were distributed to farmers.

ix. Established a total of 2,083 km of shelterbelts (target was 1,718 km) to protect 41,660 Ha of farmland. Farmers reported the benefits of the belts to include improved crop yields and the opportunity to incorporate soil fertility enhancing legumes into the cropping system.

2.3 Assessing the Impact of Extension Programmes

2.3.1 What is program impact assessment?

What is program impact assessment? Impact assessment has been defined as an activity intended to determine more broadly whether the program had the desired effects on individuals, households, and institutions and whether those effects are attributable to the program intervention. Attribution in the context of impact assessment relies upon the identification of one or more "counterfactual" scenarios, which attempt to project the evolution of metrics of interest in the absence of the assessed activity. In order to appraise whether net benefits are sufficient, it is generally necessary to quantify their magnitude and distribution. Such analysis may be historical (ex-post) or prospective (ex-ante) (CIFOR, 2014). On the other hand Forestry projects have many different types of impacts on people involved in the project, on the broader economy, on local social, cultural, and political institutions, and on natural resource systems and the environment (Gregersen et al., 1993). In the past, many researchers viewed the subject of impact

assessment in extension programmes as a major challenge of extension (Smith and Straughn, 1983). Sanders (1982) use the term impact study to refer to one designed to provide information about the outcome of an extension service or programme and whether such outcomes can be attributed to the prorogramme or service rather than to some extraneous circumstances. The common thread in several definitions is that impact evaluation tries to determine the net effects of programmes, meaning that, effects from other aspects of the programme environment have been ruled out or explained. Thus the definitions clearly imply that programme effects can be identified, measured and separated from those of other origins. Smith & Straughn (1983) argued that the US cooperative extension may experience difficulty in demonstrating all the three conditions.

2.3.2 Questions to consider while designing program impact assessment

A sound impact study should consider all the key issues at the design stage. Deshler (1997) stressed that at least five major elements should be considered, namely: focus questions, objects or events to be evaluated, data or evidence, analysis and interpretation using judgment perspectives, and judgments, conclusions, or findings of the study. The following discussion, with examples, briefly summarizes some of the key questions that need consideration while designing a farm forestry extension programme impact assessment study:

2.3.2.1 The people involved

One of the fundamental objectives in impact assessments is to identify and assess the changes which take place in the welfare of people affected either directly or indirectly by a project (Gregersen *et al.*, 1993). Meeting this objective implies the need to identify

the people involved and the range of potential environmental, social, economic, financial, and institutional impacts on them due to the project. Identify clearly the relevant groups and people impacted; the key impacts on them, and the priority questions about such impacts that need to be addressed by the assessment. Decisions made by different people concerning their participation in a project depend on their interests, and objectives, and their understanding of how the project will impact them. To insure achievement of desired impacts and to reduce future conflict in a project, the major project related groups with differing views or agendas must be identified and their interests considered.

Table 2.3: Major Project Groups, their Agenda and Potential Effects

Group	**Agenda**	**Influence on Project**
Donor Agency	Make funds available for development in accordance with rules and procedural regulations.	Blueprint designs will be written to obtain approval; as a result, possible implementation problems will be glossed over
National Ministry	Wants to maximize control over resources and how they are used.	Little local involvement in project decision making; little support by governmental agencies directly responsible for project. Implement.
Lower Level Politicians	Want to take credit for project and ensure that existing power structure remains in place	Distribution of project benefits will reflect desires of existing power structure.
Project Staff	Want career advancement and quality of life not offered by rural areas.	Rapid turnover and absenteeism which reduce effectiveness of capacity-building efforts and threaten sustainability of project benefits.
Intended Beneficiaries	Livelihood security; risk aversion; freedom to accept, adapt, or reject interventions	Wait-and-see attitude; need for flexibility; time factor underestimated.
Other Members of Local Population	Threatened by or envious of project activities and benefits; everyday forms of peasant resistance.	Further delays in achieving project objectives.

Source: *Based on Morss and Honadle 1985: 205-206.*

Participation from the local people, e.g., indigenous populations and the rural poor, is a key focus. Furthermore, there should be a consideration of those who can be affected negatively or positively through environmental impacts or externalities, e.g., by

deforestation and loss of biodiversity, or the downstream landusers affected by changes in upstream land use. Morss and Honadle (1985) described the range of individuals and groups, their agendas and the potential influence they may exercise over a project (Table 2.3).

2.3.2.2 Impact on welfare

Decide what impacts on their welfare are important, and, thus, important for the assessment. Some of the new generation forestry project's for example, may generate physical changes, e.g., change in existing forests, creation of new forests (plantations), changes in erosion rates, increased jobs for people, increases in productivity, and changes in farming systems (e.g., through introduction of agroforestry technologies). When such changes are in the natural environment we generally call them environmental impacts. These physical or environmental changes in turn lead to social and economic impacts on people. The point to be emphasized here is that: For the basic physical/environmental changes or impacts to have meaning to most decision makers, they have to be translated into social and economic terms, i.e., impacts on the welfare of people. This does not lessen the critical importance that should be placed on the basic physical-biological impacts of projects. However, when decision makers compare alternative uses of scarce resources, they generally compare the impacts on people, or increases in the welfare of target groups that can be achieved with alternative investments of resources. They have to see physical/environmental impacts in terms of people impacts. Answers to questions about environmental impacts need to be generated before assessing people impacts, because the latter are in most cases a direct result of the former (Gregersen et al., 1993).

Table 2.4: Use and Non-Use Values Associated with Forests

Direct Use Value	Indirect Use Value	Non-Use (or Existence Value
• **Consumptive uses:** commercial/industrial market goods (fuel, timber, pulpwood, poles, fruits, animals, fodder, medicines, etc.). indigenous nonmarket goods and services (fuel, animals, skins, poles, fruits, nuts, etc.). • **Non-consumptive uses:** recreation (jungle cruises, wildlife photography, trekking, etc.). science/education (forest studies of various kinds).	• Watershed protection (protection of downstream areas) • Soil protection/fertility improvements (maintenance of soil fertility, esp. important in tropical regions) • Gas exchange and carbon storage (improvement of air quality, reduction of greenhouse gasses) • Habitat and protection of biodiversity and species (potential drug sources, source of germplasm for future domesticated plans and animals). • Soil productivity on converted forest land (space and soil productivity for agricultural/horticultural crops and livestock).	• People may value a forest or resource complex purely for its existence and without any intention to use the resource in the future. • Many are willing to contribute money, time, or other resources to assist in preserving special endangered species and ecosystems. • These economically manifested existence values may be based upon religious, spiritual, cultural, or other values held by individuals or social groups within a society. Although such values are difficult to measure, they should be recognized in valuing the contributions of forests to human welfare.

Adapted from: Gregersen *et al. (1993).*

Decide what dimensions and measures of welfare are relevant and should be considered; in sum, environmental impact assessments are a critical part of the project development process, and they provide important information. However, such assessments need to go beyond identifying physical and biological changes, by linking such changes to impacts on the welfare of people. Welfare impacts are associated with human values; thus, these impacts generally can be assessed in terms of the values attached to them. Box 2.1 illustrates a classification of the wide array of positive values associated with forests. These values run from monetary measures of market prices associated with direct use of the forest, all the way to qualitative psychological (nonuse) values associated with the mere existence of the forest. In the academic world, a clear distinction generally is made between different types of values, with economists claiming all those that can be

expressed in monetary terms. In the real world, the distinction often is not very clear. In most cases, psychological, social and economic values all need to be considered together.

According to Gregersen *et al.* (1993) the use and non-use values associated with forests can be broadly categorized into three as illustrated in the table below (Table 2.3). Decide what questions about which dimensions of welfare need to be addressed in the assessment. Identifying the Dimensions of Welfare that are of Concern is important**.** Which dimensions and measures of welfare changes are of interest to decision makers in looking at the project under study? With agro-forestry projects of the 1990s, the focus of decision makers is usually on three dimensions, namely (Gregersen *et al.*, 1993):

2.3.2.3 The distributional dimension

Who gains and who loses, and how is local participation in decisions and benefits increased? Included are impacts on different project groups, classified in various ways, e.g., by income classes, by regions or location, at different points in time, by gender, age, occupation type and so forth. The classifications that are relevant will depend on the particular project situation and the institutional environment in which it exists.

2.3.2.4 The Sustainability or livelihood security dimension

Can the positive changes in welfare be sustained over time? The Brundtland Commission's Panel on Food, Agriculture, Forestry, and Environment developed livelihood security as an integrating concept and defined it as the combination of adequate stocks to meet basic needs, secure access to productive resources, and maintenance of resource productivity on a long-term basis (Food-2000, 1987).

2.3.2.5 The economic efficiency dimension

Such as changes, in total benefits and costs to the nation or region due to the project, measured in terms of people's willingness to pay for things (which may not be equal to what they actually have to pay for things, as explained below); and the relation between incremental benefits and costs (economic efficiency measures such as rates of return, net present worth, and benefit-cost ratios).

Almost any type of physical/environmental change due to a project can be associated with all the three dimensions of project impacts mentioned above. The specific types of physical/ environmental impacts that can be associated with an agro-forestry extension project, and the range of questions that can be asked about them, are almost endless. Such projects impacts occur as hierarchies of impacts. Thus, a change (an increase) in fuelwood supply (output) can impact employment, which in turn can impact health and food supplies, and so forth, ultimately ending with a change in human welfare/satisfaction for one or more groups.

In general, a thorough planning of the assessment is essential. Next to deciding on key issues/questions, a consideration of the assessment's design is also of crucial importance. Issues associated with the design such as the approach, model and methods of data collection/analysis to use are considered. Before choosing a specific method or technique, it is important to consider:

i. the need for adequate specification of questions to be answered in the assessment;
ii. the stage in the project development process at which the questions are being asked; and

iii. the technical and institutional constraints on the overall assessment.

2.3.3 Choosing an impact assessment model

There is a variety of models to use in impact assessment. While approaches may vary, the elements within will be present in one form or another in most impact models. Choosing a model is important because for each, there are different assumptions about what data to collect, how to collect them, and how to make judgments about success. Deshler (1997) described seven major models, as summarized below, which is a sufficient choice for most extension impact evaluation situation studies: (1) expert model, (2) goal-free model, (3) attainment of objectives model, (4) management decision model, (5) naturalistic model, (6) experimental model, and (7) participatory evaluation model:

2.3.3..1 Expert model

This model relies on expert judgement (Eisner, 1983). Usually, documentation is prepared in advance of experts' visits. The experts then interview, analyse documents, and make judgements using their own judgement perspectives or those set as standards by the outside organizations or stakeholders. Typically this type of evaluation brings in a team of experts from FAO or extension systems from several countries to make judgements and comparisons regarding strengths and limitations.

2.3.3.2 Goal-free model

This model assumes that outside evaluators do not know, or need to know, what the programme has intended to accomplish, but that it is the task of the evaluators to uncover what is actually happening relative to farmers' interests regardless of stated

goals and intentions. The focus point is to identify environmental and farming conditions and then to compare these needs with what people are actually experiencing as a result of the extension programme. The gap is then viewed as a starting point for making changes in the programme. An example is an evaluation that describes conditions of indigenous farming groups cultivating fragile hillside soils and comparing these conditions with access to and appropriate content of knowledge from existing extension services. The approach relies heavily on open-ended interviewing and observation by persons who do not have a vested interest in the program (Scriven, 1972).

2.3.3.3 Attainment of objectives model

This approach assumes that the success of a programme can be determined by measuring a programme's outcomes against its objectives. This type of evaluation begins with clarifying measurable objectives and then gathering data that validate the extent to which these objectives have been met. For this model to be credible, an essential feature should be added, namely, the evaluation of the appropriateness of goals and objectives, given the circumstances and needs of farmers. For example, an extension system may have adequately met its objectives of increasing production of maize among large landholders, at the same time it may have neglected to question its lack of commitment to small landholders or tenant farmers. If an attainment of objectives evaluation is anticipated, programmes are often tempted to set goals quite low so that outcomes will be met easily, thus appearing to be successful while ignoring major challenges. The model had the "black box" syndrome by tending to ignore the extension process, thereby failing to explain outcomes (Provus, 1971).

2.3.3.4 Management decision model

The purpose of this model is to provide relevant information as a management tool to decision makers. It assumes that evaluation should be geared to decisions during programme initiation and operation stages to make results more relevant at each particular stage. Participation of stakeholders is central to the process because evaluation should serve their decisions. Sometimes cost effectiveness and operations monitoring are included. One limitation of this model is the tendency for the decisions of major stakeholders to be viewed as more important than those of various types of farmers, especially women in agriculture who may not benefit directly from such an evaluation unless care is taken.

2.3.3.5 Naturalistic model

This model assumes that a programme is a natural experiment and that the purpose of evaluation is to understand how the programme is operating in its natural environment. There is an assumption that programmes are negotiated realities among the significant stakeholders and that evaluation serves this value-laden negotiation (Cronbach, 1981; Guba and Lincoln, 1989). Data should be collected and analysed from multiple perspectives. The outcome of the evaluation is dialogue concerning disagreements about objectives, expectations, problems, opportunities, policies, procedures, and suggested changes in methods or activities. Many positive collaborative changes can be made through this model. The model can also be used as a tool for diagnosing the causes for certain behaviour on the part of some actors of a program (Murphy and Marchant, 1988).

2.3.3.6 Experimental model

The purpose of this approach is to determine whether changes in programme outcomes (learning accomplishments) were due to the contributions of the programme and not just to life's experiences or from other influences. This model asks the question, "Were differences in sustain-able agriculture practice attributable to the programme?" The simplest way to determine causality is between the programme inputs and comparable groups, a group that received the educational treatment and a group that did not. This means that programme accessibility, at least during the experiment, programme consequences is to compare at least two is withheld from those learners who serve as a control group. Because of the nature of human subjects, the ethics of withholding educational services, and the difficulty of controlling for external influences, it is extremely difficult and costly to operationalize this model. It is recommended that this model be used only when major changes are expected or when a major failure is anticipated in pilot efforts where causal claims are central to making major programme investments (Rossi and Freeman, 1982).

2.3.3.7 Participatory evaluation model

The purpose of this model is for extension educators and farmers themselves to initiate a critical reflection process focused on their own activities. This is done through identifying a persistent major situation such as extension's neglect of women in agriculture; subject it to critical reflection, underlying assumptions, habits of mind, and cause and effect expectations; and then after creating new assumptions, change practices and validate or invalidate the results. The model assumes a democratic participatory process along with autonomy on the part of educators and learners at the local level

(Brunner and Guzman, 1989; Greene, 1988). This is a form of participatory action research.

Why use participatory approaches to evaluation? Involving people who are on the receiving end is likely to assure the most efficient allocation of scarce resources and the early identification of ineffective or wasteful use of resources. People on the receiving end are ultimately the best judges of impact, whether benefits have been produced or not (Uphoff, 1989, 1992). Being included in planning, implementation, and evaluation will show farmers that they are regarded as responsible, capable individuals and not simply passive "beneficiaries" or a "target group." Participatory evaluation is self-educating. It can encourage the development of human capacities among farmers. Without participation in evaluation, sustainable agriculture is unlikely. Participatory evaluation also can decrease the paternalistic, directive, impatient, or insensitive relationships among officials, technicians, and farmers by improving staff attitudes toward working with persons having less status and education. Although an initial cost of time is required, participation in evaluation can speed implementation when participants take greater ownership of efforts. Farmers' lack of experience is sometimes said to be an impediment to participatory evaluation, but this need not be an obstacle if the process whereby people gain experience can be planned for and invested in (Uphoff, 1992, p.5). Lack of resources and organizational skills can be overcome. Power differentials, social stratification and cleavages, and personal conflicts do present limitations. However, these obstacles can be reduced by outside actors who can provide spaces for subgroups to express their views for the sake of broader community interests. Officials or NGO staff themselves may present the most formidable obstacle by their paternalism and preoccupation with control. They often feel threatened by people

participation. Organizations tend to replicate in their environments the same attitudes, values, and social relations they exhibit internally. Practicing participatory evaluation internally will provide a model for participatory evaluation that includes farmers. Positive experiences with participatory evaluation can help overcome staff anxiety.

Table 2.5: Ladder of Farmer Participation in Extension Evaluation

Level 5:	Farmers conduct their own evaluation of extension independently of extension and report their findings to policy makers.
Level 4:	Farmers carry out evaluation of extension in cooperation with extension managers and make decisions regarding changes in providing extension services.
Level 3:	Farmers receive evaluation results and other information from extension staff and are asked to give reactions and recommendations for improving extension processes and resources.
Level 2:	Farmers receive information, evaluation summaries, feedback on extension performance from extension staff, but are not asked to react.
Level 1:	Farmers provide data and evidence of their achievements along with their reactions to extension without being involved in planning evaluation efforts.

Adapted: from Arnstein (1969).

2.3.3.8 Sustainability framework approach

Sustainability framework approaches, especially those based on the Sustainable Livelihoods Framework (SLF), are widely used as a basis for impact assessment of rural development projects including for identifying monitoring indicators. There are also modifications to the SLF approach, being used by land-based carbon projects (World Bank, 2000; Schreckenberg *et al*., 2010).

2.3.3.9 SAPA's modified framework

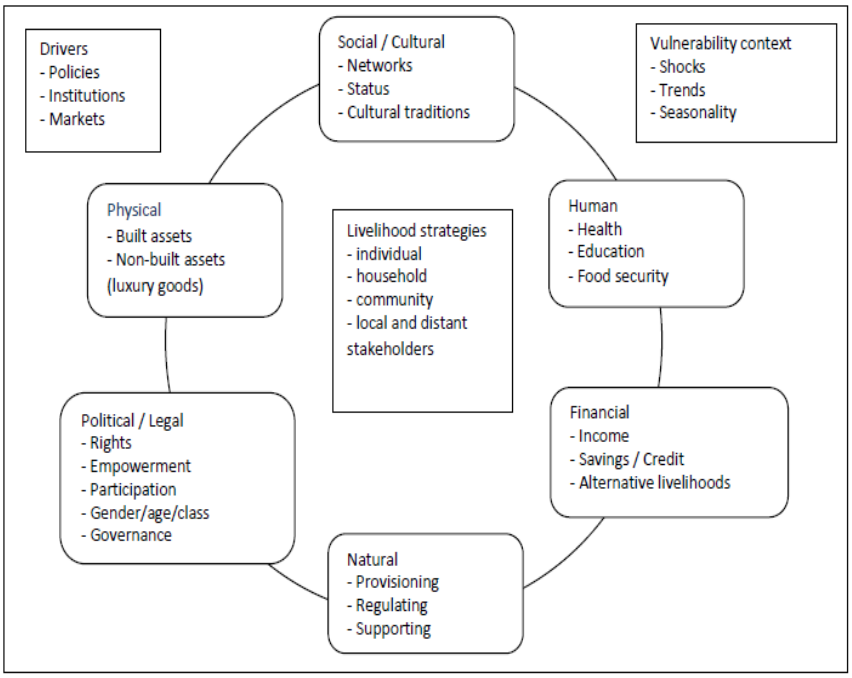
The Social Analysis of Protected Areas (SAPA) Initiative (figure 2.2) is an example of a modification of the original SLF in a way that may be appropriate for land-based carbon projects (Schreckenberg *et al*., 2010). The SAPA approach drew on other sustainability based approaches, notably the World Bank 'Opportunities Framework' for assessing poverty reduction and the Millennium Ecosystem Assessment (MEA). In its 2000

World Development Report, World Bank (2000) proposed a variant of the SLF using elements of rights-based approaches. Their 'Opportunities Framework' focuses on the needs of the poor in three areas:

Opportunity: Expanding the economic opportunities for poor people by stimulating economic growth, making markets work better for the poor, and working for their inclusion, particularly by building up their capital assets, such as land and education.

Empowerment: Strengthening the ability of poor people to shape decisions that affect their lives, and removing discrimination based on gender, race, ethnicity, and social status.

Security: Reducing poor people's vulnerability to sickness, economic shocks, crop failure, unemployment, natural disasters, and violence, and helping them cope when such misfortunes occur. The initiative's approach employs the usual five SLF assets, but 'natural' assets are broken down into provisioning, regulating, and supporting services as in the MEA framework. Cultural services – also included in the MEA framework – are included under 'social' assets. Physical assets are broken down into built assets (e.g. housing) and non-built assets (or luxury goods). A sixth capital, 'political/legal' assets, is derived from the World Bank Opportunities Framework.



Source: Reproduced with permission from Schreckenberg, K., Camargo, I., Withnall, K., Corrigan, C., Franks, P., Roe, D. and Scherl, L.M. 2010. Social Assessment of Protected Areas: a review of rapid methodologies. A report for the Social Assessment of Protected Areas (SAPA) Initiative. International Institute for Environment and Development. London, UK

Figure 2.2: SAPA's Sustainable Livelihoods Framework

Indicators can be derived from the various asset categories, although these would need to be prioritized in view of cost considerations (Figure 2.2).

2.3.4 Focusing the impact evaluation effort

What should be the focus of impact evaluation? This question raises the spectre of evaluating everything, which is impossibility. Choices and priorities among many possible questions have to be made. A full range of possible focuses can be represented at least in part by the levels represented below which shows eight major areas of focus for programme evaluation, namely: (i) inputs, (ii) activities, (iii) participation, (iv) reactions, (v) individual change, (vi) organizational change, (vii) community change, and (viii) national change; adapted from (Summers, 1977). Evaluations rarely cover all these areas. Most limit themselves to a combination of items that serve the evaluation

model or the concerns of stakeholders. Narrowing the focus usually begins during planning with the major stakeholders in a programme effort (farmers, extension staff, administrators, and funders) (Summers, 1977):

2.3.4.1 Inputs-resources

Organizational sponsorship and networks; funds; organizational design, facilities, equipment; philosophy, mission, goals, objectives; staff, resource people, volunteers; local and external research knowledge and relevance; cultural, economic, and political context.

2.3.4.2 Activities

Participatory rural appraisal; planning; local knowledge documentation; farmer experimentation; farmer-to-farmer knowledge sharing; farm tours; farmer organizing; master farmer leadership training; farm demonstrations; exhibitions and fairs; residential workshops; marketing analysis; farm policy education.

2.3.4.3 Participation

Farmer access to extension services by social class, gender, and ethnic groups; intensity of face-to-face contacts; extent of media-assisted contacts; type of participation (volunteering, planning, recruiting, learning, experimenting, evaluating); indicators of commitment (attendance, continuity, frequency).

2.3.4.4 Reactions

Testimonials; reactions to the relevance of content; appropriateness of technology, helpfulness, perceived value of educational experience; reputation of the extension provider.

2.3.4.5 Individual change

Changes in knowledge, attitudes, skills; sustainable agricultural practice; change in aspirations, self-image, perspectives; expenditure of effort and money; use of methods, services; invention of appropriate technology; increased production or use of tools; compliance with or opposition to public policy; patterns of communication, career directions, and family relationships.

2.3.4.6 Organization change

Group operation and management; economic performance; technical operation and management; financial operation; group institutionalization and self-reliance, new groups of farmers included, new organization linkages; change in staff performance, new service delivery, new methods used, additional facilities and equipment; cost-benefits improved; new philosophy, purposes, and goals; improved organizational culture.

2.3.4.7 Community change

Changes in administration of justice; health, welfare, and quality of life; fairness in the marketplace; change in human rights, status of women; change in economic and social indicators for poor; change of indicators of sustainable agriculture and natural resource management; change in communication patterns and access to education and news; public o pinion change; fairer distribution of land and other resources; Improved inter-organization relations; evidence of conflict resolution; and cultural practice change.

2.3.4.8 National impacts

This refers to changes or project's impact in terms of political stability, economic fairness, agricultural environmental sustainability, etc. Interviews with these stakeholders are usually conducted at the outset of evaluation efforts, often during the programme-planning process, to identify the programme model or approach and to determine the questions that are central. Stakeholders often do not agree, so priorities, methods, and costs must be negotiated so that the task can be "reality based" and "doable." The key here is to determine the decisions that stakeholders intend to make based on the evaluation findings so that immediate use will be made of the information generated. Evaluation use is not based on the quantity of data, but on its timeliness and relevance to decisions and purpose.

The seven evaluation models described above tend to focus on the different levels shown in Figure 3. For in-stance, the expert model most often focusses on data from inputs, activities, and participation, while the goal-free model tends to focus on individual change, organization change, or community change, ignoring the inputs and activities. The attainment of objectives model usually compares the philosophy, goals, and objectives of inputs to the extent of individual or organizational change outcomes. The naturalistic model emphasizes understanding activities, participation, and reactions as processes that occur within cultural, economic, and political contexts. The experimental model emphasizes causal relationships between inputs and individual or organizational change. The participatory evaluation model emphasizes activities and their relationship to benefits and values to farmers. It also emphasizes participation of farmers themselves in planning the focus, data collection, interpretation, and implementation of action that emerges from the evaluation process.

2.3.5 Selecting the methods for data collection

Which methods are right for the task? The basic rule here is that the selection of methods follows the selection of focus, not the other way around. Each evaluation question must be examined in relationship to what would constitute evidence for answering it. The following brief descriptions of data collection methods, although by no means exhaustive, can be used as a toolkit for a variety of circumstances:

2.3.5.1 Document analysis

Examples include minutes of meetings, correspondence, budget records, workshop notes, participant papers, and newspaper reports, to name a few. These can be treated as data, analysed for content, and summarized in relation to questions, including extent of inputs into the programme; levels of participation, nature of goals and activities, and themes regarding problems, concerns, expectations, and new directions. Themes from documents can be a credible source of information. These documents usually do not reveal participants' motivations or subjective experiences. However, documents often reveal difficulties of programme operation.

2.3.5.2 Observations

Observers can be outsiders or persons who are involved in learning activities. Observers are usually given a short list of items that may include extent of participation and personal interaction, nonverbal indicators of interest or inattention, leadership roles, performance levels, and conflict indicators, to name a few. Both qualitative and quantitative data can be collected. Findings can be reported to the learners as a whole to start a reflective process about what may need to be changed, or they can be used as evidence of successful methods or learning outcomes (Worden & Neumaier, 1987).

Observations of process and outcomes can be recorded by video or photo documentation. These data are very powerful graphic ways of communicating the nature of a programme and its outcomes to sponsors as well as to potential learners. Video records of learners' local knowledge also can be used to help them reflect on strengths and limitations of knowledge.

2.3.5.3 Interviews (key informants, oral histories, and storytelling)

Interviews are probably the most widely used method for programme evaluation, including the evaluation of learning. Interviews with key informants and representative farmers are suited to in-depth explorations of issues. If the questions are standardized, responses can be tabulated numerically to indicate item strength. If questions are open-ended, in-depth unique responses can be generated, which in turn can provide information regarding reasons why the activities are viewed differently by diverse groups of participants. Individual oral histories can inform patterns of practice and the use of extension resources. Storytelling is one of the oldest forms of human social life. Evaluative judgements are usually embedded in stories. Interviews, oral histories, and Storytelling with farmers who are not served is essential to a full picture of extension. Illiterate members of the community can participate fully through interviews, oral histories, and Storytelling, demonstrating that illiteracy does not rule out participatory evaluation.

Group interviews (sometimes called focus groups) can be formed according to geographic locations or by farm type to discuss specific evaluation questions. Sometimes the groups may already exist. At other times new groups may be formed just for the evaluation. The purpose is not only to generate judgements using agreed upon

criteria, but also to uncover unanticipated outcomes, applications, opportunities, and problems to inform future extension efforts. A community can reconstruct its history, chronology of events, crises, turning points, accomplishments, and so forth. Chalkboards, pictures, and drawings can represent milestones or decisions. The art of conducting group interviews can be learned. Many community members have a talent for this and are more likely than agency staff to evoke authentic responses. Subgroups are often necessary to listen to voices that are unlikely to be heard in groups dominated by those with status.

2.3.5.4 Surveys

The survey is a more standardized form of data collection that incorporates a prepared questionnaire. In most parts of the world, surveys of farmers in rural areas must be conducted by interview using interviewers who know the territory, language, and culture of potential respondents. Sometimes surveys can be administered at meetings or public gatherings; however, responses have to be treated as an "opportunity sample," rather than as a "random sample," and therefore generalization of the findings to a larger population is limited. Surveys are often used to evaluate the extent of practice, estimations of production yields, preferences for appropriate technology, and expectations regarding the future. They are best used with homogeneous populations rather than with quite diverse populations because standardized questionnaires are less likely to be sensitive to diversity. Evaluation of unique practices and adaptations of diverse farmer types is best done through interviews and observations.

2.3.5.5 Field visits and tours

There is no real substitute for field visits and tours to provide authenticity and reality to the conditions, limitations, and impacts of extension programmes. Evaluation teams composed of local farmers, extension staff, administrators, funders, and external evaluators provide balance and interactive learning regarding different perspectives. Team members can undertake observations and interviews and learn from each other about their findings during travel. Assignments can be distributed so that special knowledge regarding specific aspects of situations can be gathered. Some team members can focus on economic, social, and cultural aspects, while others focus on technical aspects. Comparing data, analysis and reflection on findings, and insights following field visits can generate a more holistic, balanced evaluation.

2.3.5.6 Documentation of farmer demonstrations

Farm visits, which have been used frequently by extension staff for teaching and the transfer of technology, also can be used for evaluation of appropriate technology. Farmers and local leaders can be taught to conduct their own field trials, thus fostering the pride and dignity of local people who can transfer appropriate technologies through their local languages. When farmers choose their own focus of inquiry, collect and analyse their own data, and come to their own evaluative judgement, they are more likely to adopt and pass on relevant and effective appropriate technologies. World Neighbors NGOs in Bolivia and Peru have developed a standardized means by which farmers engage in site-specific experimental documentation and reporting of crop yield comparisons, using simple calculators (Ruddell, 1994).

2.3.5.7 Village drama and role plays

Asking farmers in farmer association meetings or in village gatherings to create a drama or role play that describes the interaction process of extension staff with the village on a specific practice will reveal a variety of evaluative data on social relationships, relevance of extension knowledge to local knowledge, and historical events that have affected the solutions to farmer problems.

2.3.5.8 Maps

The generation of maps can provide a basis for making judgements about access to extension resources by showing where farmer contacts have been made. Maps also can be made to show the location of sustainable agricultural practices. These facts can be used to evaluate the scope and effectiveness of extension efforts on practices in a region, watershed, or geographic area. When access maps are overlaid with social ranking maps, judgements can be made regarding benefits by social class. Concept maps created collaboratively among farmers and extension staff can provide explanations regarding success and failure of specific programme efforts. Reflections on these maps, which can be drawn on chalkboards or in the sand, can reveal contradictions in underlying assumptions and expectations, which in turn can lead to new experiments. Maps showing before-and-after photographic and remote sensing images can be the basis for evaluative discussion regarding sustainability of farmer and extension staff practices. This is especially relevant to desertification, deforestation, soil erosion, and status of wetlands and wildlife habitat. These data can help direct extension activity to environments that are most at risk, as well as provide evidence regarding extension's positive impacts from collaboration with farmers on sustainable agricultural and natural resource practices.

2.3.5.9 Case studies

In order to understand motivation of farmers or potential extension contacts, case studies of specific types of farmers or farming practices can be undertaken. Comparisons between farmers who have used extension technologies and those who have not are common types of case studies. The typology may be based on geographic regions, soil types, and cultural, age, gender, and economic differences. Case studies are best constructed through repeated interviews over time and often include, in addition to self-report, data from persons who know the subjects well. Oral histories, logs, and journals can also contribute to case study data if farmers collaborate in producing these case studies. Evaluators should guarantee the right to privacy and confidentiality of their sources. Case studies often reveal deterrents to participation, as well as ways participants have overcome deterrents to practice through extension contacts.

2.3.6 Interpreting the findings

In some evaluations, the findings consist of narratives that describe the history of events. In other cases, evaluation findings are descriptions of the way things are without explanations or judgments. In still other cases, evaluations seek to answer questions of cause and effect or the relationships between methods and outcomes. As useful as these findings may be, they do not in themselves help us to judge the worth of programme efforts. How do we know that a programme deserves praise? This can occur only when the findings are judged in relationship to several judgments perspectives, five of which are briefly discussed below.

2.3.6.1 Standard-referenced judgment perspective

Findings regarding a particular extension programme can be compared with examples of excellent achievement by using agreed upon criteria established by experts as "state of the art." For instance, such experts could describe excellence as (1) promotion of sustain-able agricultural practice; (2) recognition of local knowledge and cultural practices; (3) high participation of farmers in appropriate technology generation; (4) high inclusion of farmers from all economic, social, and cultural groups; (5) access of women farmers to extension; and (6) promotion of justice in agricultural policies.

2.3.6.2 Cohort-referenced judgment perspective

Findings from an extension programme evaluation can be compared with similar programmes. For this judgement, we ask how a particular programme or aspect of a programme would be ranked with extension programmes elsewhere. External evaluators are most prepared to do this since they may be knowledgeable about extension practices and impacts elsewhere. This approach is limited because few places are truly similar in extension resources, political and economic contexts, and other handicaps that can affect programme outcomes. However, a failure to make judgments using external cohort comparisons may result in a false sense of achievement and self-satisfaction. Such programmes, when compared, may be mediocre, outdated, poorly conceptualized, and wasteful while being considered excellent or acceptable by local practitioners and their funders.

2.3.6.3 Difficulty-referenced judgment perspective

This perspective takes into consideration the difficulty of what is being attempted when making judgments regarding programme achievement. For example, an extension

programme that is addressing sustainable agriculture in highland areas with few staff members in the midst of revolutionary unrest must be given extra credit for achievements under these difficult circumstances compared with programmes that have a large staff who are helping farmers with relatively rich soil increase their crop production. Difficulty-referenced judgment is the basis for giving higher scores for more difficult dives in Olympic competition. Achievement must be judged relative to difficulty and conditions.

2.3.6.4 Progress-referenced judgments perspective

This perspective on the interpretation of findings gives credit and recognition to progress from past to present. Before-and-after descriptions are essential to making these judgments'. Those who emphasize "base line" data usually want to use it to make progress-referenced judgments.

2.3.6.5 Alternative-referenced judgment perspective

This perspective considers present descriptions of an extension programme in comparison with what could have been accomplished with the same resources used in alternative ways and places or with different people. This perspective asks, "How else could these resources have been spent with better or different results?" For example, would sustainable agricultural and environmental practices be more evident today if funds had been given directly to village groups or farmers' associations for conducting their own participatory action research? Is the present farm visit system better than a distance education system using radio and audio tapes? What would have been the results if all areas of extension programmes had worked more directly with women through their traditional organizations? Sometimes answers to these questions can be

generated by projecting results based on pilot efforts or by alternative approaches that have already been tried in limited form in parts of an extension system. These judgment perspectives also are helpful in evaluation of learning by individual participants themselves. Learners can judge their learning in comparison with expert standards, performance by their peers, their learning handicaps and external difficulties, their own progress from past to present, and what they would have found more important to have learned or done with their time. Often a combination of these judgments provides a balanced evaluation.

2.3.7 Using impact assessment findings for improving extension

Typically, a single report provided to stakeholders neglects the interests of many other participant groups. One solution is to consider the findings, interpretations, and judgments' as constituting a pool from which a variety of reports and styles of reporting can be fashioned to serve specific purposes and different users. Forms of reporting can include formal written reports, written executive summaries, letters to individuals and organizations, exhibits and pictorial displays, video narratives, news reports, news conferences, and public meetings. Stakeholders can then be given the information to which they are entitled in the form that best suits their purposes and best encourages learning. Evaluation is a process of individual and collective learning. We can learn from our successes, but especially from our failures. Korton (1980) calls this "embracing error." Evaluation provides that occasion.

2.4 A Review Literature on Analytical Tools for Impact Evaluations

The need for awareness of data collection methods and analytical tools to use in impact evaluations, in order to assist researchers to plan and implement useful, high-quality evaluations cannot be overemphasized. Anderson (2013) observed that properly

conducted evaluations lead to accountability and learning. Peersman (2014) recommended that data collection methods and analytical tools should be chosen to match the particular impact evaluation design, its key questions and the resources available. Impact evaluations should make maximum use of existing data and then fill gaps with new data. The data collection methods and analytical tools chosen should be selected in such a way that they complement each other's strengths and weaknesses. Before choosing data collection and analytical methods, it is pertinent to be clear about the objectives of the impact evaluation. Once the purpose of the evaluation is clear, a small number of high level key evaluation questions (not more than 10) need to be agreed, ideally with input from key stakeholders; sometimes the questions will have already been prescribed by an evaluation system or a previously developed evaluation framework. Answering the key evaluation questions – however they are arrived at – should ensure that the purpose of the evaluation is fulfilled. Having an agreed set of key evaluation questions provides direction on what data to collect, how to analyse the data and how to report on the evaluation findings.

2.4.1 Selecting analytical tools for impact evaluation

Many impact evaluations use a variety of analytical tools, and the tools may be quantitative, qualitative or a mixture of both. The particular analytic framework and the choice of specific data analysis methods will depend on the purpose of the impact evaluation and the key questions the impact evaluation sets out to address. Peersman (2014, p9-10) described three types of questions and the analytical frameworks that match them as follows:

- *Descriptive questions* require data analysis methods that involve both

quantitative data and qualitative data.

- *Causal questions* require a research design to address attribution (i.e., whether or not observed changes are due to the intervention or external factors) and contribution (to what extent the intervention caused the observed changes).
- *Evaluative questions* require strategies for synthesis that apply the evaluative criteria to the data to answer the key evaluation questions. Defining up front what constitutes 'success' by constructing specific evaluative rubrics (i.e., standards or levels of performance of the programme or policy) provides a basis on which the collected information can be systematically combined to make evidence based and transparent judgements about the value of the programme or policy (also called 'evaluative reasoning'.

2.4.2 Feasibility of tools

According to Peersman (2014, p.8) "once the planning is complete, it is important to check the feasibility of the data collection and analysis methods to ensure that what is proposed can actually be accomplished within the limits of the evaluation time frame and resources". For example, key informants may be unavailable to meet at the time that data are required. It is also important to analyse the equipment and skills that will be needed to use these methods, and assess whether these are available or can be obtained or developed. Any major gaps between what is available and what is required should be addressed by acquiring additional resources or, more realistically, by adapting the methods in line with the available resources.

2.4.3 Tools for analysis of textual and numeric data

Analyzing data in order to summarize them and look for patterns is an important part of

every evaluation. Strategies for the analysis of the data and how the data will be synthesized should be decided at the evaluation design stage, appropriate to the type of evaluation questions and described fully in the evaluation plan. For descriptive evaluation questions, a range of analysis options is available. An adaptation of Peersman's (2014, p9) is used to illustrate how the options can largely be grouped into two key categories: options for quantitative data (numbers) and options for qualitative data (e.g., text) below (Table 2.5):

Table 2.6: Tools for Analyzing and Summarizing Textual and Numeric Data

Numeric Data (*e.g. cost, frequency, physical characteristics, etc*.)	
TOOL	DESCRIPTION
Correlation	A statistical technique to determine how strongly two or more variables are related.
Cross tabulations	Obtaining an indication of the frequency of two variables (e.g., gender and frequency of school attendance) occurring at the same time.
Data and text mining	Computer-driven automated techniques that run through large amounts of text or data to find new patterns and information.
Exploratory techniques	Taking a 'first look' at a data set by summarizing its main characteristics, often through the use of visual methods.
Frequency tables	Arranging collected data values in ascending order of magnitude, along with their corresponding frequencies, to ensure a clearer picture of a data set.
Measures of central tendency	A summary measure that attempts to describe a whole set of data with a single value that represents the middle or centre of its distribution.
Measures of dispersion	A summary measure that describes how values are distributed around the centre.
Multivariate descriptive	Providing simple summaries of (large amounts of) information (or data) with two or more related variables.
Non-parametric inferential	Data that are flexible and do not follow a normal distribution.
Parametric inferential	Carried out on data that follow certain parameters. The data will be normal (i.e., the distribution parallels the bell curve); numbers can be added, subtracted, multiplied and divided; variances are equal when comparing two or more groups; and the sample should be large and randomly selected.
Summary statistics	Providing a quick summary of data, which is particularly useful for comparing one project to another, before and afterwards.
Time series analysis	Observing well defined data items obtained through repeated measurements over time.
Textual Data (e.g. *words, spoken or written, questionnaire responses, interviews and documents*).	
Content analysis	Reducing large amounts of unstructured textual content into manageable data relevant to the (evaluation) research questions.
Thematic coding	Recording or identifying passages of text or images linked by a common theme or idea, allowing the indexation of text into categories.
Narratives	Construction of coherent narratives of the changes occurring for an individual, a community, a site or a programme or policy.
Timelines	A list of key events, ordered chronologically.

Adapted from: Peersman (2014, p10)

For causal key evaluation questions, Peersman (2014, p10-11) summarised the approaches used for causal attribution broadly into three, namely: (a) counterfactual approaches; (b) consistency of evidence with causal relationship; and (c) ruling out alternatives (Table 2.6). Ideally, a mix of these approaches is used to establish causality. For evaluative questions, specific evaluative rubrics linked to the evaluative criteria employed should be applied in order to synthesize the evidence and make judgements about the worth of the programme or policy (Peersman, 2014).

Table 2.7: Data Analysis Approaches for Causal Attribution

Counterfactual approaches	Developing an estimate of what would have happened in the absence of the programme or policy; this implies the use of a control group or comparison group.
Consistency of evidence with causal relationship	Identifying patterns that would be consistent with a causal relationship, and then seeking confirming and disconfirming evidence.
Ruling out alternatives	Identifying possible alternative causal explanations and then seeking information to determine if these can be ruled out.

Adapted from: Peersman (2014, p11)

A powerful tool for both the analysis and communication of the evaluation findings is data visualization (Peersman, 2014, p11). This is the process of representing data graphically in order to identify trends and patterns that would otherwise be unclear or difficult to discern. There are many options to consider, and selecting which type of visualization to use will depend on the nature of the data (e.g., relational, comparative, time-based). In addition, the type of visualization used to facilitate data analysis (e.g., spikes in website traffic related to a social media campaign) may not necessarily be the best type for communication purposes. When communicating data, the visualization may need to be simplified and key areas emphasized in order to attract the attention of readers and stakeholders. The conclusions of the impact evaluation should be firmly grounded in the data and presented in a manner that is transparent and verifiable by

those reading the evaluation report.

2.5 A Review of Research Literature on Farmers and Farm Forestry

2.5.1 Socio-economic characteristics of farmers involved in farm forestry

Farmers' socio-economic characteristics have received immense attention of researchers because they help researchers to analyze and understand the situation of the farmer and the justification behind the farming decisions he/she makes. Characteristics like gender, age, club membership and farming experience were found to be significant factors influencing farmers decisions to try agroforestry technologies (Kwabe, Bigsby and Cullen, 2009). Other factors like educational status, marital status, farm size and family size have also been considered as factors influencing farmers involvement in agroforestry activities (Regmi, 2003).

Research studies have considered average household size and educational status while analyzing farmers socio-economic characteristics (Regmi, 2003; Kwabe, Bigsby and Cullen, 2009). Similarly major occupation, ploughing method, farming experience, previous land use, land tenure type, livestock sales, major crops, non-farm income and previous landuse were among the relevant characteristics considered while analyzing farmers participation in farm forestry extension activities (Hillbur, 2014; Essa *et al.*, 2011; Santacoloma, 2002). Sometimes farmers participating in farm forestry activities are smallholders, resource-poor, practice low-input agriculture (Santacoloma, 2002; Regmi, 2003); and have average holdings ranging from 0.5-0.6 ha (Essa *et al.*, 2011). Some adopters of farm forestry practices cultivate difficult hilly areas that lacked access to social amenities and suffer from low annual rainfall and extensive deforestation (Regmi, 2003); as a result they often spend several hours to collect a load of fodder or

firewood from the forest.

2.5.2 Farmers involvement in farm forestry practices

During the last ten years various strategies have been used in involving farmers in farm forestry research and extension activities. Research results show that the level of farmers of involvement varies from one situation to another. In the southern African region farmers' involvement in farm forestry was facilitated through capacity building, strategic linkages and partnerships, farmer experimentation and seed delivery systems (Oudul *et al.*, 2006). Another study reported that as many as 76% of all farmers in East Gonja District of northern Ghana were involved in farm forestry with help of the facilitative role of the local extension service through awareness creation, provision of financial and technical support, provision of breeding stock of animals, seeds and seedlings of crops and trees respectively, public education, establishment of nurseries and agroforestry farms (Boateng, 2008). In Jenda, Rwanda, farmers involved in agroforestry had preference for woodlots (59%), windbreaks (3%), fruit trees (3%), boundary tree planting (62%), live fences (31%), intercropping or Taungya (5%) and homegardens (28%); while their preferred agroforestry tree species are *Erythrina abysssinica* (100%), *Alnus acuminata* (94%), *Grevillea robusta* (77%) and *Iboza liparia* (72%) (Ekesi *et al.*, 2013).

A recent study found that several farmers are being involved in gum Arabic agroforestry in the Sahelian zone of Borno State, Nigeria. Most of the farmers were attracted to agroforestry by the financial benefit and sourced most of their knowledge of the technology through radio, friends and family members, with the exception of a minority (9.0%) who had contact with extension agents. The study concluded that increasing

farmers' involvement in agroforestry can be achieved through increasing their participation in planning and implementing agroforestry extension programs (Mustapha *et al.*, 2012). A survey of agroforestry programs across the United States found that riparian buffers, windbreaks and forest farming were the practices preferred by farmers in the USA (Jacobson and Kar, 2013).

2.5.3 Factors affecting farmers involvement in farm forestry practices

Some researchers observed that in spite of several years of extension effort towards dissemination (Kwabe, Bigsby and Cullen, 2009); many farmers aren't participating in farm forestry due to various reasons (Jamala *et al*., 2013; Hillbur, 2014). A synthesis of several studies revealed that farmers involvement in farm forestry is not based on the technological advantages of the practices per se, but is rather being influenced by several factors (Ajayi *et al.*, 2003). Therefore a variety of factors influence farmers decision to practice farm forestry. One of these is the economic benefit (Mustapha *et al.*, 2012). Farmers also appreciate the potency of farm forestry systems as a proven alternative for ameliorating the problem of resource degradation and reduction of poverty for smallholder farmers (Arnold, 1999). Other than economic and environmental concerns, farmers practice farm forestry in order to solve the problem of fuelwood scarcity (Shu-aib Jakpa, 2002).

Research findings have revealed a host of other factors that affect farmers involvement in agroforestry. Farmers' willingness to plant trees in their fields can be primarily based on their interests, attitudes and perceptions. While some farmers held the belief that farm forestry reduces arable land and takes too long for the benefits to be realized (Oudul *et al.* (2006); there are also farmers who viewed farm forestry adopters as

superior to non-adopters acknowledging its economic and environmental potentials (Hussain *et al.*, 2012). Some farmers consider only the tangible benefits of farm forestry (Essa *et al.*, 2011), either due to lack of sufficient knowledge or simply ignored the non-tangible benefits such as carbon sequestration, soil conservation and habitat. Availability of household labour, age and financial abilities were identified as important determinants of farmers participation in farm forestry northern Ghana (Boateng, 2008), while the extension approach used and the characteristics of the farm forestry practice were the significant factors in Western Kenya (Place *et al.*, 2005). Other factors such as availability of markets and resources such as personnel and funding, having a dedicated program within an area, and having an active schedule of trainings, demonstrations, and other educational opportunities have also been identified as critical factors affecting farmers involvement in farm forestry programs (Jacobson and Kar, 2013).

Hindrance of field operations and harboring of pests/diseases were found to affect farmers' participation farm forestry (Hussain *et al.*, 2012). Poverty, resource degradation and emigration were also identified as factors affecting farmers participation (Cunha *et al.*, 1994). Researchers concluded that land constraints, property rights, availability of seeds and knowledge-intensive nature of the technology were challenges to widespread uptake of farm forestry technologies in the southern African region (Ajayi *et al.*, 2007). A Rwandan study found that shortages of capital, planting materials, labour and lack of technical advice were the constraints hampering the full impact of farm forestry in the region (Ekesi *et al.*, 2013). Researchers also identified low literacy and inadequate skills and training as the factors affecting farmers' participation in farm forestry (Kalaba *et al.*, 2010; Jamala *et al.*, 2013). An important factor also hindering farmers' participation in farm forestry is its complex process of

adoption. Some researchers argue that unlike that of annual crops and modern agricultural development packages based on chemical inputs, farm forestry technologies require multi-components and multi-years of testing and modification before adoption takes place (Ajayi *et al.*, 2003). Therefore farmers' participation in farm forestry will be affected by the extent to which efforts are made towards overcoming these challenges. The various factors may be broadly categorized as: technology-related factors (e.g. soil type, management regime), household-related factors (e.g. farmer perceptions, resource endowment, household size), policy and institutional context within which the technologies are being disseminated (input and output prices, land tenure and property rights), and geo-spatial factors such as tree species performance across bio-physical conditions, location of village (Ajayi *et al.*, 2007).

2.5.4 Impact of farm forestry practices on farmers livelihoods

Farm forestry practices transfer and dissemination among smallholder farmers has been on-going during the past six decades. Some evidence of success of these on-going efforts appeared few years ago when The World Agroforestry Centre (ICRAF) reported that over 480,000 smallholder farmers in the southern African region practice farm forestry (Kalaba *et al.*, 2010). The success was attributed to the adoption criteria which has been participatory in nature. Studies have documented the impact of adoption of farm forestry systems (e.g. rotational woodlot and boundary planting, improved fallows, fodder banks, processing and domestication of indigenous fruits, domestication of medicinal trees, etc) on farmers livelihoods in Malawi, Mozambique and Zambia reported increase in crop yields, increase in income, increased savings resulting in change of wealth and soil improvement (Oudul *et al.*, 2006; Akinnifesi *et al.*, 2008). These findings closely agreed with the findings of similar studies in northern Ghana

(Boateng, 2008), and western Kenya (Place *et al.*, 2005). Studies in Asia also revealed impact of farm forestry in terms of generating increases in farm income, fuelwood supply, control of pollution and provision of shade (Hussain *et al.*, 2012); and in some cases leading to overall increase in farm income per unit area of farmland, reduced risks, increased production of tree components and less dependency on natural forest for firewood and timber (Essa *et al.*, 2011). A study revealed that CARE's farm forestry extension program in western Kenya increased farmers awareness of the multipurpose potential of agroforestry, expands the available technical options, and strengthened local institutions. The author concluded that the program's 'community-based' extension approach proved more suitable for local conditions than 'commodity-based,' 'training-and-visit,' 'farming systems,' or 'media-based' extension; and encouraged projects to tailor extension design to local circumstances, use community participation to guide extension priorities, and use extensionists as catalysts and 'information brokers'(Scherr, 1992). According to another study the livelihoods impact of farm forestry in central Terai, Nepal included increased social and human capital of the participants, greenery development, protection of the public lands, income generation, and increased physical and natural capital of the people (Yadav, 2008).

Elsewhere the impact of farm forestry systems (shifting cultivation, boundary planting, multipurpose woodlots, improved fallows, windbreaks, home gardens, living fences, scattered trees on croplands' and shelterbelts) on farmers livelihoods have included increase/ diversification of incomes; improvement in food production; improvement in nutritional value; payment of wards' school fees; improvement in health; ability to marry; protection of water bodies and improvement in environmental quality (Shu-Aib Jakpa, 2002). Some farming households affirmed that agroforestry practices led to

increased soil fertility, increased farm income, conserved soil and water, reduced chances of crop failure through diversification, saved time used to collect fodder and fuelwood from forests and helped in maintaining and improving surrounding environment. This was in addition to supply of honey, timber, fodder, firewood, stakes, fruits, charcoal, building poles, and medicines as other agroforestry products produced on their farms (Ekesi *et al.*, 2013).

Farmers are aware of many of the socio-economic benefits of farm forestry. However, various risks which include high input costs, dependency on short-term benefits, competition between trees and crops and lack of education from extension services, hinder them from adopting the technologies (Hillbur, 2014). This implies that resource-poor farmers, most of whom lack adequate financial resources and technical knowledge, may find it extremely difficult to adopt agroforestry. Therefore even if agroforestry may not be a good option for all smallholder farmers, it can for some farmers, increase their resilience and ability to cope with environmental stresses and shocks. Furthermore the agroforestry system can function as a buffer against climatic variability.

2.5.5 Constraints to implementation and success of farm forestry programs

Earlier studies have documented various constraints to smooth implementation of agroforestry technology transfer programs. At the organizational level, the identified constraints include lack of adequate human and financial resources for farm forestry research and extension activities, poor coordination of activities, inadequate availability and quality of germplasm, few collaborative partners, unreliable and incapable personnel, alienation of women and policy issues especially land tenure and (Food-2000, 1987; Oudul *et al.*, 2006; Yadav, 2008; Boateng, 2008).

The farm level factors hindering the implementation and success of agroforestry extension programmes include damage to seedling by animals/humans, and farmer perception of farm forestry (Hussain *et al.*, 2012); and sometimes lack of awareness among stakeholders and farmers (Oudul *et al.*, 2006). Challenges cited in previous studies also include bushfires, insufficient funds/capital, logistics/working tools, land tenure, low manpower/labour, loan repayment/recovery, market for tree products, theft, land tenure and long rotation period of trees (Shu-aib Jakpa, 2002). Other obstacles include the observations that many farmers do not have incomes high enough to afford agroforestry inputs and managing the agroforestry practices (Place *et al.*, 2005; Hillbur, 2014, p7). One solution to this, presented by the study, is support to the farmers in the form of subsidies or loans. Required support would also include fencing material, pesticides and seeds. Farmers are also often dependent on short-term benefits meaning that they do not perceive that they have the time to wait for the trees to grow up. Population growth can also be an obstacle as it reduces the land size for farmers meaning that they might not have the space for planting trees. Other policy implications of the constraints to effective implementation of farm forestry extension programs identified in previous studies, include protection of tree seedlings from animal damage, mobilization of the people/ awareness creation, training, campaigns and networking among stakeholders and policy advocacy (Oudul *et al.*, 2006; Hussain *et al.*, 2012; Mustapha *et al.*, 2012).

One way to enhance the uptake of farm forestry technologies is to target them to their biophysical and social niches, facilitate appropriate policy and institutional context for the dissemination of the technologies, understanding the broader context and dynamics of the adoption process. Ajayi *et. al*,, (2007) suggested that given the strong influence of

policy and institutional contexts, it is important that efforts to scale up farmers involvement in farm forestry should complement farmer training at the farm level with active engagement of policy makers and shapers (advocates) to facilitate policy incentives and regulations that are conducive to and encourage smallholder farmers to adopt farm forestry technologies.

2.6 Concluding Remark

The above review shows the vastness of the subject matter covered and the ample amounts of research literature found. The review provided invaluable information and guidance to this research study. It also revealed the gaps existing in some areas of the subject matter and the need to fill this gap. One of the aims of this study, the first on the research problem, is to narrow the knowledge gap.

CHAPTER THREE

THEORETICAL AND CONCEPTUAL FRAMEWORKS

3.1 Theoretical Framework

This section introduces and highlighted the major theories that guided the study. The purpose was to situate the study within prior theory and research on the problem, guide the selection of appropriate methodology and serve as a roadmap to the study. Of the tentative theories of the phenomena under investigation identified, three were found to be more closely related to the study, these were namely: the social cognitive theory (SCT), diffusion of innovation theory (DOI) and the social impact theory (SIT).

3.1.1 Social cognitive theory (SCT)

Albert Bandura's Social Cognitive Theory (SCT) posits that individuals acquire and maintain behaviour in a social context through the dynamic interaction of the person, the environment, and the behavior itself (Bandura, 1986). The major feature of SCT is its emphasis on social influence, external and internal social reinforcement (BUSPH, 2013). The SCT considers the unique way in which individuals acquire and maintain behavior, while also considering the social environment in which individuals perform the behavior. It takes into account a person's past experiences, which factor into whether behavioral action will occur. These past experiences influences reinforcements, expectations, and expectancies, all of which affect/ shape a person's decision to engage in a specific behavior and the reasons why the person engages in that behavior (Figure 2.2).

Generally the SCT explains how people regulate their behavior through control and reinforcement to achieve goal-directed behavior that can be maintained over time. Its

major constructs or elements that underlie the process of human learning and behavior change were summarized as follows (CommGAP, 2010, p2):

- Self-efficacy: a judgment of one's ability to perform the behavior.
- Outcome Expectations: a judgment of the likely consequences a behavior will produce. The importance of these expectations (i.e., expectancies) may also drive behavior.
- Self-Control: the ability of an individual to control their behaviors.
- Reinforcements: something that increases or decreases the likelihood a behavior will continue.
- Emotional Coping: the ability of an individual to cope with emotional stimuli.
- Observational Learning: the acquisition of behaviors by observing actions and outcomes of others' behavior.

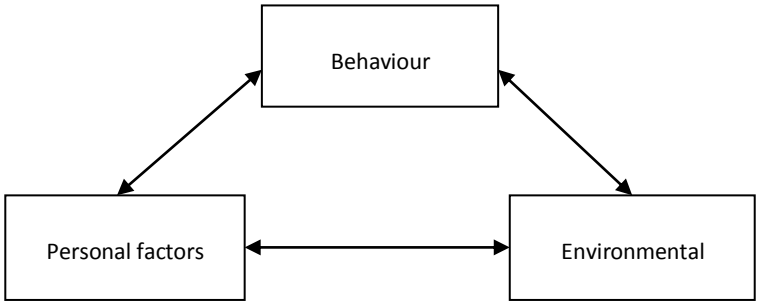


Figure 3.1: The Social Cognitive Theory Model
Adapted from: CommGAP (2010, p2)

Some critics of this theory argue that the 'influence of the environment' may not always be true with all persons due to individual human differences (BUSPH, 2013).

This theory is closely related to this study because of its multi-dimensional approach to analysis of behavioral change - taking into account the *individual*, the *environment* and

the characteristics of the recommended *behaviour* - in explaining behavioral change. The SCT guided this study in finding answers to questions such as: what proportions of the Project's participants adopted its innovations (the recommended behaviour)? Have the participants' socio-economic characteristics influenced their adoption of the recommended behaviour? Has adoption of the recommended behaviour led to the anticipated outcomes (impact) on livelihoods of the participants? The theory accommodates most of the key variables of the study, namely personal factors, institutional impact of the recommended behaviour. The theory is therefore very relevant and well fitted to this research study.

3.1.2 Diffusion of innovation theory (DOI)

E.M. Rogers's Diffusion of Innovation (DOI) Theory, developed in 1962, is one of the oldest social change theories. It originated in communication, and explains how, over time an idea or product gains momentum and diffuses (or spreads) through a specific population or social system. The end result of this diffusion is that people, as part of a social system, adopt a new idea, behavior, or product (Rogers, 1962). Adoption means that a person does something differently than before, acquire a new product or perform a new behaviour. The key to adoption is that the person must perceive the idea, behavior, or product as new or innovative. It is through this that diffusion is possible (Rogers, 1962). Adoption of a new innovation or product does not happen simultaneously in a social system; rather it is a process whereby some people are more apt to adopt the innovation than others. Researchers have found that people who adopt an innovation early have different characteristics than people who adopt an innovation later. When promoting an innovation to a target population, it is important to understand

the characteristics of the target population that will help or hinder adoption of the innovation.

There are five established adopter categories (Figure 3.2), and while the majority of the general population tends to fall in the middle categories. It is necessary to understand the characteristics of the target population when promoting an innovation. Different strategies can be used to appeal to the different adopter categories.

i. Innovators - These are people who want to be the first to try the innovation. They are venturesome and interested in new ideas. These people are very willing to take risks, and are often the first to develop new ideas. Very little, if anything, needs to be done to appeal to this population.

ii. Early Adopters - These are people who represent opinion leaders. They enjoy leadership roles, and embrace change opportunities. They are already aware of the need to change and so are very comfortable adopting new ideas. Strategies to appeal to this population include how-to manuals and information sheets on implementation. They do not need information to convince them to change.

iii. Early Majority - These people are rarely leaders, but they do adopt new ideas before the average person. That said, they typically need to see evidence that the innovation works before they are willing to adopt it. Strategies to appeal to this population include success stories and evidence of the innovation's effectiveness.

iv. Late Majority - These people are skeptical of change, and will only adopt an innovation after it has been tried by the majority. Strategies to appeal to this

population include information on how many other people have tried the innovation and have adopted it successfully.

v. Laggards - These people are bound by tradition and very conservative. They are very skeptical of change and are the hardest group to bring on board. Strategies to appeal to this population include statistics, fear appeals, and pressure from people in the other adopter groups.

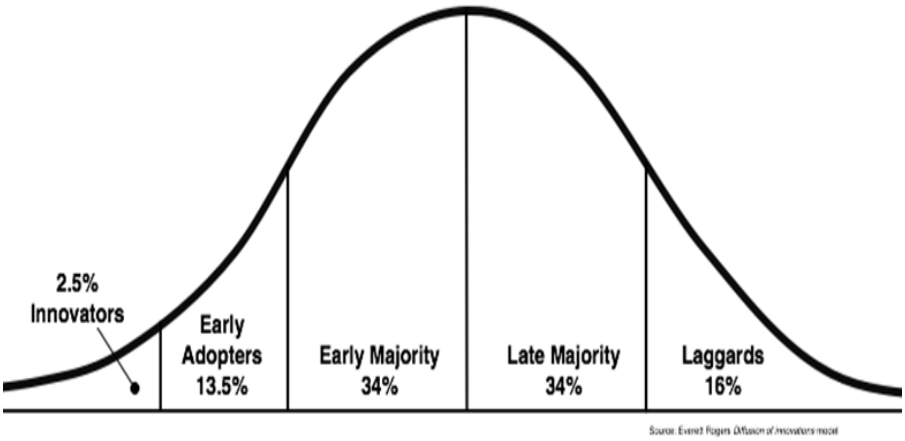


Figure 3.2: The Adoption Curve & Categories of Innovation Adopters
Adapted from: Rogers, E.M. (1962)

The stages by which a person adopts an innovation, and whereby diffusion is accomplished, include awareness of the need for an innovation, decision to adopt (or reject) the innovation, initial use of the innovation to test it, and continued use of the innovation. According to Rogers (1962) five main factors influence the adoption of an innovation**,** and each of these factors is at play to a different extent in the five adopter categories:

i. Relative advantage - The degree to which an innovation is seen as better than the idea, program, or product it replaces.

ii. Compatibility - How consistent the innovation is with the values, experiences, and needs of the potential adopters.

iii. Complexity - How difficult the innovation is to understand and/or use.

iv. Triability - The extent to which the innovation can be tested or experimented with before a commitment to adopt is made.

v. Observability - The extent to which the innovation provides tangible results.

vi. Cost of the innovation – although Rogers's analysis did not consider cost, research evidence has shown that cost is a major factor affecting adoption of agricultural innovations by small scale farmers (Tsado, 2008).

Everett Rogers, the father of innovation diffusion theory, periodically summarizes the literature (1962; 1971; 1983; 1995). In the 1983 edition, he acknowledges criticisms of the theory, noting that the absence of critical viewpoints in the early development of the theory may have been a weakness in the long run. Had adjustments been made earlier through critique and debate, perhaps some of the current problems with the theory would have been avoided. Criticisms compiled in the most recent edition (1995) include:

- *A Pro-Innovation Bias:* There is the implication that an innovation should be diffused and adopted by all farmers. The act of innovating is considered positive and the act of rejecting an innovation is considered negative. Remember the categories of adopters: Innovators versus Laggards.

- *Individual-Blame Bias:* The development agency is not blamed for its lack of response to the needs of farmers. Rather, the individuals who do not adopt the

innovation are blamed for their lack of response. Other research suggested that this process is not always one-way. In other words, conditions may change, and the farmer may decide to return to the old technology if the new is no longer profitable or efficient (Ganzel, 2007).

- *Issue of Equality:* The negative impacts of the theory are not considered. What are the consequences in terms of unemployment, migration of rural people, equitable distribution of incomes? Will the innovation widen or narrow socioeconomic gaps? For instance, in 1972, Jim Hightower (cited in Ganzel, 2007) reviewed the impact that two parallel innovations had, the mechanical tomato harvester and a hybrid tomato that would stand up to the jostling of the new harvester. The two innovations are credited with saving the tomato industry in California. But in the process, only the largest growers survived. Where there had been 4,000 farmers who worked their crops using migrant and hired farm laborers, only 600 large growers remained. Thousands of farm workers lost their jobs and, presumably, moved to the cities. And consumers began complaining that the tomatoes they bought in groceries were tougher and not as flavorful.

- *Bias in Favor of Larger and Wealthier Farmers:* **"**Development agencies tend to provide assistance especially to their innovative, wealthy, educated, and information-seeking clients. Following this progressive, or ('easy to convince') diffusion strategy leads to a lower degree of equality. For example, more progressive farmers are eager for new ideas, and have the economic means to adopt; they can also more easily obtain credit if they need it. Because they have larger farms, the direct effect of their adoption on total agricultural production is

also greater" (Rogers, 1995: 128-129). Consequently, the rich get richer and poor get poorer.

In spite the above criticisms; the theory has been used successfully in several fields including communication, agriculture, public health, criminal justice, social work, and marketing. The DOI theory was found relevant and offered invaluable theoretical guidance to the methodology of this study. Its stages of innovation adoption were adapted in defining the respondents' stages of adoption of the project's innovations. Thus we expect a participant of the extension program to pass through the stages of: *awareness*, *interest*, *trial* and *evaluation* or confirmation before *adopting* the project's innovation.

The theory's construct provided this study with the best frame for identifying adopters and non-adopters of the project's innovations, their characteristics, the reasons behind their decision to adopt the innovations and the factors generally influencing adoption among the project's participants. By guiding the definition, measurement and evaluation of these variables, the DOI theory enhanced the quality of this study. Therefore the DOI theory was a highly relevant tool that helped in achieving the purpose of the study.

3.1.3 The social impact theory (SIT)

Bibb Latané, who introduced the social impact theory (SIT), defined social impact as "any of the great variety of changes in physiological states and subjective feelings, motives and emotions, cognitions and beliefs, values and behavior, that occur in an individual, human or animal, as a result of the real, implied, or imagined presence or actions of other individuals" (Latané, 1981). The theory claimed that all forms of social

influence, whatever the specific social process, will be proportional to a multiplicative function of the *strength*, *immediacy*, and *number* of people who are the sources of influence (Latane and Drigotas, 1996). In other words the likelihood that a person will respond to social influence will increase with *strength:* how important the influencing groups of people are to the person; *immediacy:* how close the groups are to the person (in space and time) at the time of the influence attempt; and *number:* how many people there are in the group (ChangingMinds, 2015). The theory suggested that increasing the numbers has a decreasing incremental effect (going from 2 to 3 has more effect than going from 66 to 67). In fact beyond four or five, the effect tails off rapidly. This is the social influence model. The effect is powerful when everyone in the group (apart from the person being persuaded) clearly agrees (ChangingMinds, 2015). The theory's metaphor is similar to what Albert Bandura calls normative social influence (Bandura, 1986).

This theory guided the study in analyzing: farmer group dynamics, sources of influence in a farmer's behaviour change process, and the influence of minorities and majorities within farmer groups. It guided our analysis/ and explanation of the role of group influence in a respondent's decision to adopt the project's farm forestry innovations. It has a frame identifying/ analyzing sources of normative social influence, which is a key element, in behaviour change process. It helped our understanding of the relationships between social influence, social impact and diffusion of ideas within groups.

3.2 Conceptual Framework

The purpose of this section is to introduce and explain the major concepts that supported and informed this study. It described as well as illustrated the variables studied and the

presumed relationships among them. In the discussions below, the concepts of livelihood and farm forestry were highlighted; and a graphical model of impact of farm forestry on farmers' livelihoods is presented.

3.2.1 The concept of livelihood

The term livelihood refers is the various ways in which individuals or households make sure that there is enough food on the table, and provide the basic necessities for a good life, such as clothing, a house, blankets and so on. The concept of livelihoods has been in use in the development literature for a while. Earlier work defined a livelihood as that which comprises the capabilities, assets (including both material and social resources) and activities required for a means of living (Chambers and Conway, 1992).

Following from this definition, a livelihood is described as sustainable if it can cope with and recover from stress and shocks, maintain and enhance its capabilities and assets and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels and in the short and long term (Chambers and Conway, 1992). The sustainable livelihoods framework (Figure 3.3), has been adopted in many studies for livelihoods analysis and its contribution to the design and management of development interventions is well acknowledged (Ashley and Carney, 1999). The framework encompasses all the major factors that affect people's livelihoods, and the relationships which exist between them. It can be useful in the present study which is focused on assessing the contributions of farm forestry to existing livelihoods and the sustainability of livelihoods in the study area. In particular, the concept provides a checklist of important issues to examine and sketches out the way these issues link to each other. It draws attention to core influences

and processes; and emphasizes the multiple interactions between the various factors which affect livelihoods. The concept is people-centered. Therefore it does not work in a linear manner and does not try to present a model of reality. It will help the researcher with different perspectives to engage in structured and coherent analysis of the factors that affect livelihoods, their relative importance and the way in which they interact. This, in turn, should help in the identification of the intended and unintended impacts of the farm forestry extension intervention on the target population's livelihoods.

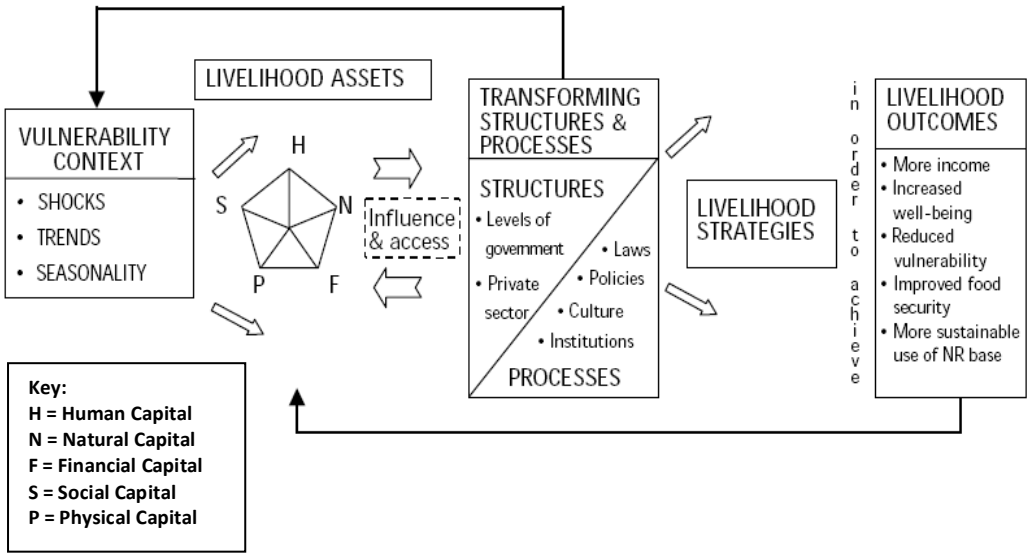


Figure 3.3: The Sustainable Livelihoods Framework
Source: DFID (1999).

The concept's holistic frame is a comprehensive guidance for examining farmers livelihood strategies, assets (natural, physical, environmental, financial and social) and activities directed towards making a living out of farm forestry in the study area. Correctly defining these issues will enable systematic assessment of the impact (or expected outcomes) of involvement in farm forestry on the respondents livelihoods.

3.2.2 Concept of farm forestry

The term “farm forestry” or “agro-forestry” is not new. It is an umbrella term used to describe a collection of diverse activities, all of which relate to tree planting in the farm or around the farmstead. In Nigeria Farm forestry has been a component of forest extension services of the State Forestry Departments. More recently it has been prominently used in Government’s desertification control interventions. “Agroforestry” or “farm forestry” as it is often called these days, is defined as the integration of productive trees into the agricultural landscape (AFG, 2010). Farm forestry allows for a combination of tree growing and other agricultural activities to be conducted on the same land. The trees grown can be for commercial or used for grazing purposes. For example, strategically-placed timber plantations on farms, and strategically-placed shelterbelts on farms, are two different types of farm forestry practices or systems, managed to produce timber products while providing shelter for agricultural crops and animals. The main objective of farm forestry is to increase the total productivity of the land by producing tree products, while helping to control erosion, reduce salinity and provide shelter for livestock and windbreaks for crops. Selecting a farm forestry system that is profitable and appropriate based on farmer's needs, constraints and opportunities is a challenging question that has social, economic, technical and physical implications. There are several systems from which farmers can choose. Examples include community tree nurseries, communal woodlots, individual woodlots, on-farm border plantings, on-farm scattered plantings, on-farm orchards, on-farm windbreaks, roadside avenue plantings, compound planting, on-farm strip planting or alley farming and field shelterbelts. Jianchu Xu *et al.* (2013) provided a classification of farm forestry systems based on functionality (Figure 3.4). Farm forestry provides multiple benefits to farmers making it an attractive long term investment; for shade, shelter, wind-breaks, prevention

of soil erosion, lowering of the water table to remediate soil salinity, improvement of water quality and creation of habitats for native animals and plants (AFG, 2010). Trees on farms are also attractive and can improve the aesthetic appeal of a landscape. Farm forestry is suited for commercial as well as traditional family farmers, as a source of off-farm income/employment and a system which does not require the daily or even weekly input of many other forms of agriculture. It can restore the productivity of waste lands, thereby helping the environment as well as income generation. It is a sustainable land use system that protects soil and water quality, complements the rural character of a landscape, provides a pleasant living environment, improves agricultural productivity, improves farm viability by diversifying income, complements native vegetation, and provide wildlife habitat.

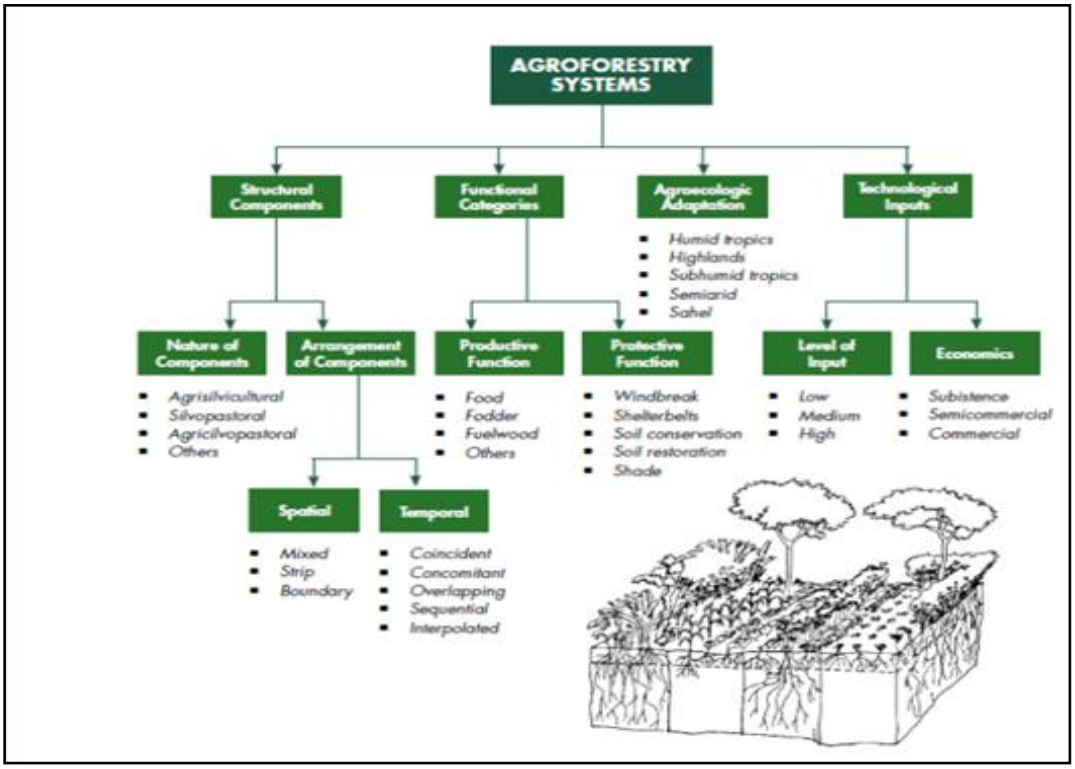


Figure 3.4: Classification Farm Forestry Systems
(Adapted from: Jianchu Xu *et al.*, 2013)

In Nigeria's drylands, the potentials of farm forestry practices can be harnessed and used in the on-going fight against desertification and environmental degradation. In the present study, this concept will give further guidance and help broaden the understanding of what is farm forestry, its models, products and range of socio-economic benefits.

3.2.3 Conceptual model of impact of the project on farmers livelihoods

Conceptual model of the factors which determine the impact of farm forestry on farmers' livelihoods is shown below (Figure 3.5). The model shows the key variables involved in the livelihood impact causal chain of farm forestry practices and the relationships existing between these variables. The column on the left shows the independent variables, the middle one shows the dependent variable and the column on the right indicates the livelihood outcomes (or impact) of the farmers involvement in farm forestry practices. An individual's stage of involvement in farm forestry depends on personal factors; like an individual's age, gender, educational status and attitude towards tree planting; factors related to recommended practice, and institutional factors such as membership of groups and extension visit. It is the combined effects of these variables that determine a household's stage of involvement in farm forestry. The ultimate stage of involvement in farm forestry is the adoption (continuous use) stage. Livelihood outcomes (impact) of farm forestry are the effects of adopting a farm forestry practice. As the column shows, impact manifests as change in various dimensions e,g, soil fertility, crop yield, farm income, wind erosion, spending on fertilizers, shade, fodder supply, fruits availability, knowledge, skills, social capital and other variables (Figure 3.5).

Figure 3.5: Conceptual Model of Impact of Forestry-II Project on Farmers Livelihoods

CHAPTER FOUR

METHODOLOGY

4.1 The Study Area

Kano State (Figures 4.1), is geographically located between Latitude 11° 30' 00" N and Longitude 8° 30' 00" E (Geographic, 2012). The population is approximately 9.4 million based on the 2006 census, and 2013 estimates at 12 million (MCICT, 2013). It has an agile work force, 50% of which is between 15- 64 years and 47% under 15 years. Population growth rate is approximately 3.5% per annum. Key sectors of the economy for growth are agriculture, commerce and manufacturing and the support services. The state has over 1,754,200 hectares of cultivable land, and approximately 1.6 million Micro, Small and Medium Enterprises, 30% of which is run by women. It hosts 400-500 manufacturing enterprises mainly in: leather tanning, seed processing, rice milling and animal feed production (MCICT, 2013).

Kano State (Figures 4.1), has about 20,760 square kilometers of land area, and lies in the tropical climatic zone. The state experiences variation in rainfall amount and duration (OnlineNigeria, 2003), being highest (about 1000mm) in the southern part, 800mm in the center and 600mm towards its northern fringe. Mean annual temperature ranges from 26°C - 33°C (Sani and Sulaiman, 2011). Agriculture is the key sector of the economy and directly or indirectly employs over 70% of the working population (Sani and Sulaiman, 2011). Major crops grown comprise of grains and vegetables like: groundnut, sorghum, millet, cowpea, maize, wheat, rice, pepper, tomato and onions; while the common livestock types include: cattle, sheep, goats, donkeys, camels and horses.

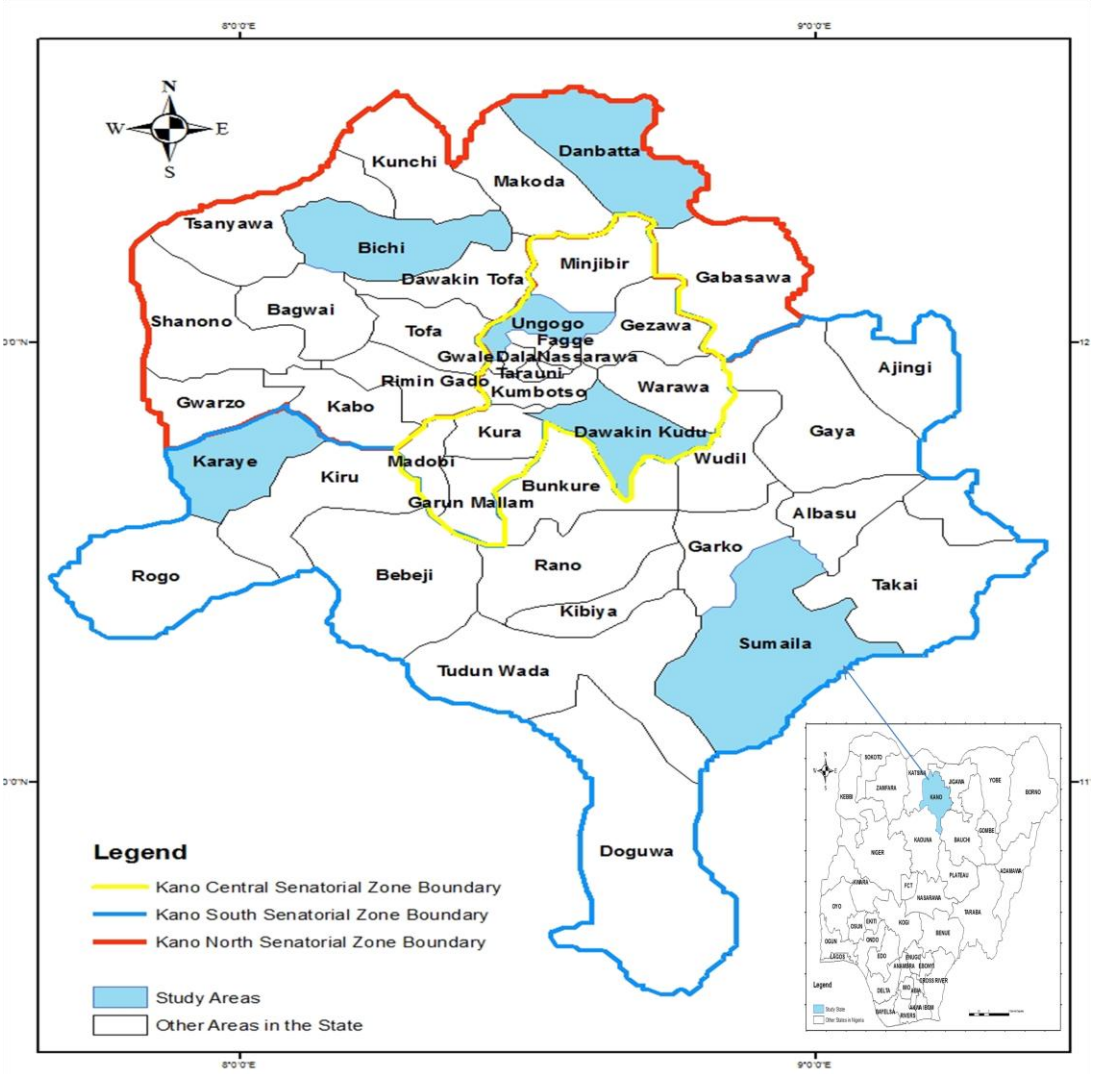


Figure 4.1: Map of Kano State Showing the LGAs Sampled

Agriculture thrives better in the southern part because it is wetter, the average annual rainfall is up to 1000mm and the climatic conditions more favourable compared to the northern part where the rainfall is erratic and temperatures are high (Sani and Sulaiman, 2011). About 90% of the land is arable, while the rest comprise of wasteland, rocky areas, forests and water bodies (Sani and Sulaiman, 2011).

Some analysts described Kano as a showcase state in agriculture, self reliance and admirable resource management. The state has several dams which supply water to their downstream communities all year round for irrigation and consumption. It is the most

irrigated state in the country, endowed with more than 3 million hectares of cultivable land (NgEX, 2006).

More than 80% of the State is underlain by quartzite, undifferentiated larger sediments and basement complex rocks. The major soil types were the ferruginous tropical soils to the south, southwest and south east; brown and reddish-brown soils and latosols found in the northern half; brown and reddish soils in the northeastern corner; and the juvenile and hydromorphic soils which occur along the alluvial channel complexes. In many areas, intensive use of the soils and addition of manure and chemical fertilizers have altered their profile, texture, structure and chemical characteristics. In many areas, irrigation and agriculture have accelerated the erosion of the top soil, resulting in loss of the fine particles and contributing to high sedimentation of the major rivers and reduction of the life span of reservoirs (OnlineNigeria, 2003). The natural vegetation consists of the Sudan and the Guinea Savannah both having been replaced by secondary vegetation. Four-fifth of the state is composed of farmed parkland, dotted with patches of shrub savannah. The savannah woodland, which is the second largest zone, accommodates the Falgore Game Reserve. The state had a few forest plantations of exotic trees (OnlineNigeria, 2003).

4.2 Sampling Procedure and Sample Size

The study population comprised of the farmers reached (*participants*) and the farmers not reached (*non-participants*) by the Forestry-II Project's farm forestry extension activities. The project was said to have targeted about 250,000 farm families or about 10% of the farm families in the project area (World Bank, 1986), but was able to reach up to 330,000 farm families or about 132% of the initial target of contact farmers

(World Bank, 1997). In order to assess the impact of the project on the participant farmers' livelihoods, a sample of the *participants* was compared with a sample of the *non-participants.*

Table 4.1: Sampling Design

Zone	**LGAs**	**Participant Villages**				**Non-Participant Villages**			
		Villages	**Pop.**	**%**	**Sample***	**Villages**	**Pop.**	**%**	**Sample***
North	Danbatta	Shantake	42	8%	8	Walawai	25	5%	5
		Yanbawa	25	5%	5	Dangawa	24	5%	5
	Bichi	R/Rake	30	6%	6	Dansiri	27	5%	5
		Kyalli	40	8%	8	Madina	23	5%	5
Central	Karaye	Almajiri	35	7%	7	Amara	25	5%	5
		Yelwa	20	4%	4	U/Talle	21	4%	4
	Ungogo	Bauren Gurjiya	42	8%	8	Galadi Sule	35	7%	7
		Doka	15	3%	3	Kyankyaran	20	4%	4
South	D/Kudu	Daginawa	130	26%	26	D/Tsalle	89	18%	18
		Bafi Mariya	41	8%	8	Malale	70	14%	14
	Sumaila	H/Dutse	30	6%	6	Hulu village	65	13%	13
		Yan Audu	55	11%	11	Hula	71	14%	14
TOTALS			**505**	**101**	**101**		**495**	**100**	**100**

*20 percent of each population was sampled

A multi-stage sampling technique was adopted in selecting the area to be sampled for the study. In the first stage, all the three senatorial zones of the state (north, central and south) were selected. Choice of senatorial and over agro-climatic zones was primarily on discretion of the research rather than preference. Coincidentally, boundaries of the two zones were nearly the same in Kano State. From each zone, 2 Local Government Areas (LGAs) were randomly chosen, and from each LGA 2 participant villages and 2 non-participant villages were purposively selected for the study. A household census to determine the households' population of every selected village was conducted. Subsequently 20% of the population of every selected village was randomly selected; thus 101 participant households and 100 non-participant households were surveyed (Table 4.1).

4.3 Data Types, Sources and Methods of Collection

The study sourced data from primary as well as secondary sources. A reconnaissance study was conducted during which additional socio-economic information on the study area, especially the socio-economic characteristics of the project's target group, was collected through informal interviews with key informants and focus groups, to help in designing the survey instrument and planning the survey. During the survey face-to-face interviews were held with individual household heads, with help of semi-structured interview schedules. The interviews cut across the key issues such as the respondent's socio-economic background characteristics; awareness and level of involvement in farm forestry; factors affecting involvement, observed outcomes of involvement, the perceived constraints to involvement in the project and any possible recommendations towards the constraints. Secondary sources of information used were mainly official reports/records of the project and review of relevant research literature.

4.4 Analytical Techniques

The data generated by the study was analysed with help of the Statistical Package for the Social Sciences (SPSS), STATA v13 and the Microsoft Excel softwares. The tools of analysis used were: Descriptive statistics, Two-Sample Chi-Square test for independence, Two Sample t-Test for independence and the Ordinal Logit Regression Analysis.

4.4.1 Descriptive statistical techniques

Descriptive statistical techniques used included frequency counts, means, percentages, minimum, maximum, standard deviation, variance, the Likert scale, charts, tables and

cross-tabulations. Descriptive statistical tools were used in achieving objective 1 and 6, and parts of Objectives 2, 3, 4, and 5.

4.4.2 Two-sample chi-square (X2) test for independence

The Chi square test of independence is useful and widely used in statistics. It is used when comparing two categorical (nominal or ordinal) variables, each with two or more possible values. The data set is usually summarised by counting the number of observations in each category and presented in the form of a cross-tabulation, sometimes called "R×C table," where R is the number of rows and C is the number of columns. The X^2 test statistic is given as:

$$X^2 = \sum \frac{(O_i - E_i)^2}{E_i} \quad \text{..... (1)}$$

Where:

X^2 = computed chi square

O_i = observed frequencies of cases

E_i = expected frequencies of cases

$\sum$ = the sigma (or sum) notation

The only restrictions on its use are that the expected cases E_i should exceed 5 in most cells of the cross classification table. No expected case E_i should be less than 1 and No more than 20% of the cells should have less than 5 expected cases. The degrees of freedom (df) for the test is the number of row minus one times the number of columns minus 1: df = (r-1) x (c-1), where *r* is row and *c* is column. The level of significance for the test (or *p*-value) is selected. From the X^2 table, the critical value is obtained based on the level of significance and the degrees of freedom. The critical region is all values of

the X^2 statistic that exceed the critical value. The decision rule is: If the chi square statistic exceeds the critical chi square value, reject the null hypothesis and accept the alternative hypothesis that there is a relationship between the two variables. If the chi square statistic does not exceed the critical value, then do not reject the null hypothesis that there is no relationship between the two variables.

The Chi square test was used to achieve parts of objectives 2 and 3. It helped in determining relationships between a) participation in the project and the respondents' stage of adoption of farm forestry innovations, b) participation in the project and impact of farm forestry innovations on farmers' livelihoods, and c) participation in the project and the respondents years of adoption of farm forestry innovations. These were in line with objectives 2 and 3. Choice of the test is justified since the question we want to answer is whether there is some association between the project and specific outcomes, both of them categorical variables.

4.4.3 Two sample t-Test for independence

The *t*-Test for two independent samples is used for comparing two sets of data when the samples are collected independently. It is one of the commonly used techniques for testing a hypothesis on the basis of a difference between sample means, i.e. it determines the probability that two populations are the same with respect to the variable tested (Howell, 2007). The t-test statistic can be computed knowing just the means, standard deviation, and number of data points. The *t*-test for two independent samples is defined by the formula:

$$t = \frac{(\bar{x}_1 - \bar{x}_2)}{\sigma_{\bar{x}1-\bar{x}2}} \quad \text{……..……..(2)}$$

Where:

$\bar{x}_1$ = mean of the participants sample,

$\bar{x}_2$ = mean of the non-participants sample,

S_1 = standard deviation of participants sample

S_2= standard deviation of non-participants sample

$\sigma_{m_1-m_2}$ = standard error of the difference between the means.

Similarly:

$$\sigma_{m_1-m_2} = \frac{\bar{x}_1+\bar{x}_2-2}{\sqrt{(\bar{x}_1-1)S_1+(\bar{x}_2-1)S_2}} * \sqrt{\frac{1}{\bar{x}_1}+\frac{1}{\bar{x}_2}} \quad \text{…….(3)}$$

The Null (H_o) and Alternative (H_a) Hypotheses for the t-test are:

H_o: $\bar{x}_1 - \bar{x}_2 = 0$
H_a: $\bar{x}_1 - \bar{x}_2 \neq 0$

Where $\bar{x}_1$ stands for the mean for the Participants and $\bar{x}_2$ stands for the mean for the Non-Participants of the project. The two populations are assumed to be independent, and normally distributed. The test was used in achieving parts of objectives 2, 3 and 5. It is one of the commonly used methods for comparing two means. The choice of *t*-test test is justified since our aim is to compare the participants and the non-participants of the project on some variables like attitude score, average years of adoption of farm forestry innovations and impact of farm forestry among the two groups.

4.4.4 Ordinal logit regression model

The Ordinal Logit Regression model is used when a dependent variable has more than two categories and the values of each category have a meaningful sequential order where a value is higher than the previous one, then the model can be used (Torres-Reyna, 2009). The model fits most of the type of data collected during this study since most of the variables of interest were nominal/ordinal.

The test tried to see whether all the coefficients in the regression model are different than 0. Our p-value tested the alternative hypothesis that each coefficient is different from 0. To reject the hypothesis, the p-value has to be lower than 0.05, in which case we concluded by saying a variable had a significant influence on the respondents involvement in farm forestry (*Y*). The apriori assumption is that socio-economic characteristics of the respondents have a positive effect on their level of involvement in farm forestry practices.

The ordered logit regression model has the form:

$$\ln\left(\frac{\text{prob(event)}}{(1-\text{prob(event)})}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_k X_k \quad \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

The quantity to the left of the equal sign is called a Logit. Ti is the log of the odds that an event occurs. Usually the even of interest is observing a particulr score or less. The ordinal regression analysis was used in achieving Objective 4, by running a regression of socio-economic charcateristics of the respondents on their stage of adoption of the project's innovations.

Thus:

For stage of adoption, the odds for respondent no.1 will be β α θ as:

θ 1 = prob(score of 1) / prob(score greate than 1)

θ 2 = prob (score of 1 or 2) / prob)score greater than 2)

θ 3 = prob(score of 1, 2, or 3) / prob(score greater than 3)

The equation can be written as:

θ_j = prob(score <_*j)* / prob(score <_*j*) since the probability of a score greater than *j* is 1-probability of a score less than or equal to *j*. *Y* = will be scores of an individual's stage of involvement; 1 = awareness, 2 =interest, 3 = trial, and 4 = adoption.

While:

X_1 = Age

X_2 =Gender (yrs)

X_3 = Marital Status (male, female)

X_4 = Years of schooling (yrs)

X_5 = Primary livelihood activity (l-4)

X_6 = Source of cooking energy (1-6)

X_7 = Farming experience (yrs)

X_8 = Land tenure (1-4)

X_9 = Farm size (hectares)

X_{10} = Attitude (1-5)

X_{11} = Group Participation (1or 2)

X_{12} = Extension visit (number)

X_{13} = Livestock herd size (number)

X_{14} = Number of dependents (number)

4.5 Variables Definition and Measurement

A variable is a property or trait in individuals or groups which varies or takes on different values, while a measurement is the tool or means used to appraise it. The variables for this study are classified as independent, dependent and impact (or expected outcomes) variables; and were defined and measured as described below:

4.5.1 Independent variables

The operational definitions and measurements of the independent variables for this study were as follows:

4.5.1.1 Age

Age is the biological age of a respondent from birth to the date of the survey. It was an open-ended item measured in years, as specified by the respondent, similar to some earlier studies (Gidado, 2003; Agunga and Idogan, 2007). It is expected that the older a respondent is the more his farming knowledge and experience. Age is also expected to positively influence adoption, since older people are assumed to be more knowledgeable, such people may not need much persuasion in order to adopt new farming innovations.

4.5.1.2 Gender

Gender of a respondent was defined as the sex of a respondent. It was measured with a 2-point scale that segregated the respondents' gender into: 1=male and 2=female, as used in some earlier studies (Tafida, 2007). Based on the general culture of the people,

women are seldom heads of households in the study area. Such a role is usually for a man. It was therefore assumed that all the respondents will be of the male gender.

4.5.1.3 Marital status

This was defined a respondent's present status or position pertaining to marriage. It was measured with a 4-point categorical scale as: 1=single, 2=married, 3=divorced and 4=widowed. This variable is important in analyzing the socio-economic reasons behind a farmer's farming decision. According to cultural norms of the people in the study area, a married man is expected to provide the food and cooking fuel needs of his family. Therefore it is assumed that a farmer may consider adopting farm forestry as a means of meeting these socio-economic obligations.

4.5.1.4 Number of dependents

This was defined as number of individuals in a respondent's household that are directly maintained by him/her. It was open-ended and recorded as the number indicated by the respondents. This variable is expected to affect a farmer's farming decision. In the study area a man is expected to provide all the basic necessities of his family such as food and fuel. Farm forestry may therefore be attracted to a farmer for its multiple benefits as means of meeting many of his/her dependents basic necessities like fuelwood, cash, fruits and fodder for livestock.

4.5.1.5 Years of schooling

This is defined as the total number of years spent by the respondent in formal schooling; and was recorded in numbers. The assumption here is that a farmer's years of schooling will positively influence his or her level of involvement in the project's activities. Years

of schooling was also expected to favour level of adoption of farm forestry innovations, such that the more the farmer's years of schooling the higher his/her level of adoption of farm forestry practices.

4.5.1.6 Years of farming experience

This is defined as the total number of years spent in farming by the respondent. The assumption here is that the more years a farmer spent in farming, the more farming knowledge and skills he/she acquires. It was measured in years. Some earlier studies adopted a similar definition and method of measuring this variable (Yahaya and Olajide, 2005; Tafida, 2007). We expected farming experience to have a positive relationship with level of involvement in the project's activities; so that the more the farmer's farming experience the higher his/her level of involvement in the project's activities.

4.5.1.7 Primary source of livelihood

This is defined as a respondent's primary livelihood strategy or means of earning a living. It was measured using a 4-point categorical scale as follows: 1=farming, 2=trading, 3=petty trade, 4=others.

4.5.1.8 Farm size

This is defined as a respondent's total farm size in hectares. It was an open-ended item and was recorded in the figures. This variable is expected to influence a farmer's level of involvement in the project's activities, given that adoption of farm forestry practices takes up a certain amount of cropland. The expectation is that farmers with land constraints (or small holdings) will be less attracted to farm forestry. Thus the larger the

farmer's holding, the higher the likelihood of his/her involvement in farm forestry practices.

4.5.1.9 Land tenure

This is defined as the kind of land tenure arrangement which applies to the respondent's farm holding. It was assessed with help of a 4-point scale which categorized land tenure as: 1=inherited, 2=borrowed, 3=hired, 4=purchased and 4=others. Multiple responses were expected for this variable. The assumption here is land tenure affects many farming decisions of the farmer, e.g. type of crops to grow, amount of fertilizers to use, or extent of permanent improvements (trees, fencing, buildings, etc) to make on the land. The more flexible the tenure binding on the farmer the higher the likelihood of his/her involvement in farm forestry. Farmers on hired and borrowed land are expected to be less willing to implement farm forestry activities than farmers on purchased and inherited farmlands.

4.5.1.10 Primary source of farm labour

This was defined as a respondent's primary source of human labour for field farming operations. It was measured with a 3-point scale as: 1= family, 2=hired and 3=others. Since labour cost and availability are important considerations, the assumption is that, this variable will influence a farmer's decision on whether to be involved in farm forestry practices or not. The expectation is that the more available and affordable farm labour is to a farmer the higher is his/her level of involvement in the project's farm forestry activities.

4.5.1.11 Livestock herd size

This was measured as the total units of livestock (small ruminants) owned by a respondent; and recorded in numbers. Most farmers in the study area keep small ruminants. It was assumed that the need for fodder for livestock or the cash needed to buy it may influence a farmer's decision to participate in the project's farm forestry activities. Such that the larger the farmer's herd, the more his need for fodder and more will be his tendency to be involved in farm forestry practices for him to meet his fodder needs.

4.5.1.12 Participation in tree planting groups (TPGs)

This is defined as any form of affiliation to a Tree Planting Group or other types of farmer groups involved in tree planting/farm forestry activities during the project. The respondent's status of participation was measured with a simple 1=member, or 2=Non member. If member, he/she was requested to indicate role or position held in the group. An individual's role in a group was measured with a 5-point categorical scale as: 1=leader, 2=member, 3=patron, 4=local resource person and 5=others. This variable is expected to be a key factor affecting the respondents' level of involvement in the project's activities. As a precondition, the project staff worked with only the villages that showed interest by organizing a farmers tree planting group. The assumption is that the participant villages had the groups while the non-participant villages lacked the groups.

4.5.1.13 Main cooking energy

This was defined as a respondent's major cooking fuel. The major types of cooking fuel were simply categorized as: 1=cooking gas, 2=electricity, 3=kerosene, 4=firewood,

5=combination of 3 & 4 and 6=others. The assumption is that a respondent's involvement in the project's farm forestry activities will, among other reasons, be borne out of the desire to satisfy his fuelwood needs through farm forestry.

4.5.1.14 Extension Visit

This was defined as the number of times a respondent is visited by the project's extension agent in a growing season; and was recorded in figures. This variable is the criteria used in differentiating the project's participant villages from non-participant villages. It is expected that respondents visited by the project's extension agents had full access to its activities, benefits and incentives. Respondents not visited by the project may have gained some access through spill-over-effects and the mass media.

4.5.1.15 Relevance of message

This was defined as the respondent's perception of extent of relevance of the extension messages received from the extension agent; and was measured with a 5-point perception scale as: 5=highly relevant, 4=relevant, 3=neutral or uncertain, 2=irrelevant, 1=highly irrelevant.

4.5.1.16 Number of agric information sources used

This is defined as the number of agricultural information sources utilized by a respondent. The response recorded in figures as given the respondent.

4.5.1.17 Attitude towards farm forestry

Attitude towards farm forestry is defined is an individual's verbal response to attitude items. The items used consisted of positive and negative statements about farm forestry.

Attitude affects everything a person does. In this regard the attitude of a respondent towards farm forestry will have a bearing on his/her level of involvement in the Project's farm forestry activities. A positive attitude towards on-farm tree planting activities can serve as a source of motivation for farmers outside the project area to imitate the project's participants. Analyzing and measuring this important variable helped in explaining the amount of change attributable to the effects of the project, among the two groups. The responses to the items were measured with help of a 5-point Likert-type attitude measuring scale as: 5=strongly agree, 4=agree, 3=not sure, 2=disagree and 1=strongly disagree; and for the negative items the scores was reversed. The details of the Likert items can found in the *Appendix*: The Research Questionnaire (Parts 1 and 4), p138.

Likert scale, first introduced by Likert (1932) is a commonly used in combination with Likert items as a perception analysis tool in agricultural research. A Likert item is simply a statement about a specific aspect of the study, which the respondent will be asked to evaluate, according to a specific criteria, e.g. extent of his/her agreement or disagreement with the statement. The respondent's extent of agreement with the Likert-type items used was measured from highest to lowest strength level of agreement as: 5=strongly agree, 4=agree, 3=undecided, 2=disagree, and 1=strongly disagree. Each item response (n) was summed to yield an item total score ($\sum N$), from which item average score ($\bar{x}$) was determined. Thus:

Item Scores = n

Item Total Score = $\sum$ (n)

Item Average Score = $\frac{\sum (n)}{N}$ …… (5)

`

The scale was used to achieve part of Objectives 1 and 3. The Likert items used can found in the *Appendix*: The Research Questionnaire (Parts 1 and 4), p138.

4.5.2 The dependent variable

4.5.2.1 The respondents stage of adoption of the project's innovations

An individual's livelihood is his/her means of gaining a living. In this study, the dependent variable is a respondent's adoption and making a living out of the Forestry-II Project's farm forestry innovations. An adaptation of Rogers's (1962) stages of innovation adoption was used in defining the respondents' stages of adoption of the project's innovations. The stages were measured with a four-point categorical scale as: 1= *awareness* stage, 2=*interest* stage, 3=*trial* stage and 4=*adoption* stage. The *adoption stage* is the ultimate in involvement in the project and is what leads to diffusion of the introduced farm forestry innovations from one farmer to another. Since all of the respondents cannot adopt all of the innovations at the same time, different individuals were expected to be at different stages of adoption at any given time. While the innovators may have adopted several years ago, late majorities and laggards may have just started testing the innovations.

4.5.2.2 The innovations adopted/ years of adoption by the respondents

Respondents at the *adoption* stage were further asked to name the farm forestry innovation they adopted and the duration (in years) of adoption. To ease re-call, the respondents were assisted with a list of 11 farm forestry innovations extended to farmers by the project in the study area; these were: 1=village forest nursery, 2=personal forest nursery, 3=village woodlot/orchard, 4=personal woodlot/orchard, 5=farm boundary plantings, 6=farm scattered plantings, 6=farm road/avenue plantings, 7=farm windbreaks, 8=homestead plantings, 10=natural tree regeneration plot and 11=marginal

land reclamation. It was assumed that the respondents socio-economic background characteristics will influence their stage of adoption of the project's innovations. A key apriori assumption here was that the independent variables (socio-economic characteristics) are the **cause** or predictors, while the dependent variable (stage of adoption) of the project's innovations is the **effect**. Therefore farmers' level of involvement in farm forestry in the study area was expected to be dependent on their socio-economic characteristics such as age, farming experience, land tenure, extension contact, extension visit and participation in tree planting or similar grassroots groups.

4.5.2.3 The respondents reasons for adopting the project's innovations

Reasons behind adoption of the project's innovations by the respondents were defined as the factors behind the respondents' decision to adopt the project's innovations. This variable described the reasons which motivated the adoption of the project's farm forestry innovations as stated by the adopters among the respondents. An adaptation of Rogers's (1962) five factors that influence an individual's innovation adoption behaviour was used in measuring the variable, as a six-point categorical variable. The 6-points used were: 1=relative advantage of the innovation, 2=compatibility of the innovation, 3=complexity of the innovation, 4=triability of the innovation, 5=observability of the innovation and 6=other reasons such as cost, etc. Detailed explanation of each of these factors was given in page 66-67.

4.5.2.4 Factors influencing adoption of the innovations by the respondents

Factors influencing adoption of the project's innovations refer to the personal socio-economic/ institutional characteristics of the respondents (pp93-100), hitherto assumed

to be the predictors of adoption among the respondents (p83). The specific factors were determined through the ordinal logistic regression analysis (pp91-93).

4.5.3 Impact variables

4.5.3.1 Impact of the project's innovations on livelihoods of the respondents

The project's impact on livelihoods was defined as the outcomes of adoption of the project's innovations on the livelihoods of the respondents. Impact may be positive, negative, expected or unexpected. Adopters among the respondents were asked to indicate the degree of change that manifested on their livelihoods as a result of adoption of the project's innovations. The livelihood variables analysed were: 1=soil fertility, 2=soil erosion, 3=wind damage to crops, 4=spending on fertilizers, 5=crop yield, 6=farm income, 7=firewood & poles supply, 8=fodder for livestock, 9=shade for humans/livestock, 10=knowledge & skills, 11=availability of edible fruits & nuts, 12=household nutrition, 13=employment, 14=social capital, 15=ownership of assets and 16=sustainable use of natural resources. The degree of change was measured with a 5-point rating scale as: 5=increased significantly, 4=increased, 3=remained the same or not sure, 2=decreased and 1=decreased significantly. In addition to effects of the project's innovations, it was assumed that the socio-economic characteristics' of the respondents will positively influence the outcomes. Characteristics like extension agent visits, age and farming experience were expected to strongly influence the outcomes. The participants were expected to record more outcomes than the non-participants; because they participated in the project's activities.

4.5.4 The constraints' which affected the respondents' involvement in the project's activities

4.5.4.1 The respondents like and dislikes about the project

This section consisted of open-ended items namely: i. what the respondents liked the most about the forestry-2 project, and ii. What the respondents disliked the most about the project, Responses to the two questions were separately analysed, summarised, tabulated and reported in frequency counts and percentages.

4.5.4.2 Constraints which affected the respondents' involvement in the project and their suggestions towards them

The respondents' perception of constraints' that affected their involvement in the project's activities were sought. The respondents were then asked to suggest appropriate policy actions towards addressing the constraints. The open-ended responses to both items were recorded, analysed, summarised, tabulated and reported ad frequency counts and percentages.

CHAPTER FIVE

RESULTS AND DISCUSSION

5.1 The Respondents Socio-Economic Characteristics

This section presented and discussed the results on personal socio-economic characteristics of the respondents, who are the participants and non-participants of the Forestry-II project's farm forestry extension activities. The characteristics examined were age, gender, marital status, number of dependents in household, land tenure, farm size, farm labour type, farm power source, small ruminants herd size, primary cooking fuel, years of schooling, years of farming experience, primary agricultural information source, and the respondents' participation in local groups. Farmers' socio-economic characteristics have received immense attention of researchers because they help researchers to analyze and understand the situation of the farmer and the justification behind the farming decisions he/she makes.

5.1.1 The respondents' age, dependents and farming experiences

The results on age, number of dependents and farming experience of the respondents (Table 5.1), shows similarities as well as differences in the three characteristics between the two groups. The average age (45yrs), maximum number of dependents per household (35) and maximum farming experience (60yrs) of the two groups were the same. However, age variability was higher among the participants (*SD* = 6.576), compared to the non participants (*SD* = 2.387). On the other hand the maximum age (65yrs and 56yrs), minimum age (25yrs and 34yrs), average number of dependents per household (13 and 12) and average farming experience (26yrs and 23yrs) of the two groups differ respectively. These results were in contrast with the apriori assumption

that respondents were similar in all socio-economic characteristics except participation in the project.

Table 5.1: The Respondents Age, Dependents and Farming Experiences

Characteristics	**Participants** (n_1=101)	**Non-Participants** (n_2=100)
Age (yrs):		
Mean Age (*M*)	45	45
Maximum	65	56
Minimum	25	34
Standard deviation (*SD*)	6.576	2.387
Variance	43.246	5.697
Number of Dependents:		
Mean (*M*)	13	12
Maximum	35	35
Minimum	1	1
Standard deviation (*SD*)	6.890	7.195
Variance	47.478	51.763
Farming Experience (yrs):		
Mean (*M*)	26	23
Maximum	60	60
Minimum	5	3
Standard deviation (*SD*)	10.364	10.498
Variance	107.404	110.216

The respondents mean age, mean farming experience and average number of dependents all imply that they are generally active adults and experienced farmers. These characteristics suggest that the project enjoyed the patronage of the active segment of the farming population of the study area. The three characteristics need not hamper but rather promote adoption of the project's innovations among the respondents. Earlier research studies have established the association between adoption of agroforestry innovations and farmers level of farming experience and skills (Regmi, 2003; Ajayi *et al.*, 2007; Kwabe, Bigsby and Cullen, 2009). This meant the higher the farmer's level of farming knowledge and experience, the higher his/her likelihood of adopting a new farming innovation.

5.1.2 The Respondents gender, marital status, livelihoods and information sources characteristics

The results show that the two groups were predominantly males (99.0 % and 100.0%), married (99.0 % and 98.0 %) and primarily live on farming (86.0% and 92.0%), respectively (Table 5.2). Dominance of the male gender among the respondents is not coincidental but a cultural factor that is common throughout the study area. Similar social setting was found by researchers in many rural areas in Nigeria (Okwoche *et. al*., 2012, Tashikalma *et al*., 2010; cited in: Abdullahi, 2015). It is common knowledge men dominate farming in the study area, because the peoples norms field farm operations are the responsibilities of the male folk while harvesting and processing activities are tasks usually the roles of women. For these reasons, men are often the heads of households, have more say on matters relating to key farming decisions and are the breadwinners of the family.

The results further shows that respondents vary in terms of their information sources. While a large proportion of the project's participants (44%) had access to extension agents, only a small proportion of the non-participants (25%) had such access. Instead a large number of the non-participants (35%) depend on family members and friends for farming knowledge/innovations (Table 5.2). The results highlight the formal and non-formal information and communication channels used by the respondents, and imply the possibility that the project's innovations may diffuse from the target farmers to other farmers through non-formal pathways.

Furthermore the compatibility the respondents social norms and these characteristics (gender, marital status and primary livelihood) suggests they are likely to promote rather than hinder active participation in the Forestry-II project.

Table 5.2: The Respondents Gender, M-Status, Livelihoods and Info-Sources

Characteristics	**Participants** (n_1=101)		**Non Participants** (n_1=100)	
	Freq.	**Percentage**	**Freq.**	**Percentage**
Gender:				
Male	99	99.0	100	100.0
Female	2	1.0	0.0	0.0
Marital Status:				
Married	100	99.0	98	98.0
Single	1	1.0	2	2.0
Primary Livelihood Activity:				
Farming	87	86.1	92	92.0
Trading	9	8.9	2	2.0
Petty Trade	4	4.0	3	3.0
Others	1	1,0	3	3.0
Usual Info Sources (%):				
Extension Agent	43	43.6	25	25.0
Mass Media (Radio)	14	15.8	19	19.0
Family	14	14.9	35	35.0
Friends	16	16.8	16	16.0
Neighbors'	4	5.0	3	3.0
School	1	1.0	1	1.0

The results tallied with those of some earlier studies which established the influence of information sources on adoption of agroforestry technologies among farmers (Mustapha *et al.,* 2012). Non-farm sources of livelihoods can enable farmers to diversify their incomes and enhance their food security. It is therefore interesting to note that, in addition to farming, the respondents engage in off-farm livelihoods which include trading (8.9% and 2.0%) and petty trading (4.0% and 3.0%) respectively (Table 5.2). Therefore positive changes in these characteristics may increase the respondents' likelihood of participation in the project's activities. Earlier research has identified these variables among the factors influencing the adoption of farm forestry innovations by farmers (Regmi, 2003; Hillbur, 2014). There is evidence that low financial ability was a hindrance to farmers participation in farm forestry activities (Boateng, 2008).

5.1.3 The Respondents schooling, farm size and herd size characteristics

The results on these characteristics show that the respondents years of schooling, farm size and herd size vary (Table 5.3). The participants had more average years of schooling (*M* = 17yrs and *M* = 13yrs), and larger average farm size (*M* = 2.9Ha and *M* = 2.1Ha) respectively than the non-participants (Table 5.3).

Table 5.3: The Respondents Schooling, Farm Size and Herd Size

Characteristics	**Participants** (n_1=101)	**Non Participants** (n_2=100)
Years of Schooling:		
Mean (*M*)	17	13
Maximum	80	77
Minimum	4	3
Standard deviation (*SD*)	11.760	9.515
Variance	138.290	90.531
Farm Size (Ha):		
Mean (*M*)	2.9	2.1
Maximum	10.0	8.0
Minimum	0.4	0.2
Standard deviation (*SD*)	2.142	1.313
Variance	4.587	1.723
Herd Size (Small Ruminants):		
Mean (*M*)	11	12
Maximum	70	40
Standard deviation (*SD*)	10.033	8.804
Variance	100.652	77.517

Respondents with larger farms, more years of schooling and larger herds are expected to be more likely to adopt the project's innovations. Available research evidence supports this expectation and confirmed the association between farm size, level of education and adopt of farm forestry innovations by farmers (Regmi 2003, Essa *et al.*, 2011). The finding supports the assertion that the more years farmers spent in school the more proficient they become in ability to read recommended agricultural practices (Agbamu and Orhorhoro, 2007; cited in: Abdullah, 2015).

The respondents average herd sizes are nearly the same, however, herd size appears to vary more among the participants (*Var* = 100.65), compared to the non-participants (*Var* = 77.52). Farmers with larger herds may experience higher demand for fodder. Consequently increase in demand for fodder may influence adoption of farm forestry innovations. Earlier research evidence supports this assumption. For example Neupanea *et al.* (2002) found that households with more livestock and male membership of local groups were more likely to adopt agroforestry innovations.

5.1.4 The respondents land tenure, labour source, cooking fuel and group participation characteristics

The results in Table 5.4 show that the two groups vary in terms of land tenure, farm labour, farm power, cooking energy and participation in local groups. The proportions of borrowed land (5.0% and 2.0%), purchased land (20.8% and 12.0%), hired labour (32.7% and 29.0%), animal power (19.8% and 14.0%), and members of local groups (37.0% and 26.7%) were higher among the participants than the non-participants respectively. On the other hand the non-participants had more hired land (5.0% and 7.0%), inherited land (69.3% and 79.0%) and use more family labour (66.0% and 71.0%) than the participants (Table 5.4). The finding implies that the participants' advantage in purchased land, may mean more freedom to investment on their land, such as tree planting, which may be less possible on either borrowed or hired land.

Both groups depend on human power as primary source of power for farm work, and use firewood and charcoal as the main fuels used for cooking in the household (table 5.4). However the non-participants had more inherited land (69.3% and 79.0%), dependence on family labour (66.3% and 71.0%) and membership/ in local groups (37% and 27%) respectively (Table 5.4).

Table 5.4: The Respondents Land Tenure, Farm Labour/Power, Cooking Fuels and Group Participation Characteristics

Characteristics	**Participants** (n_1=101)		**Non Participants** (n_2=100)	
	Freq.	**Percentage**	**Freq.**	**Percentage**
Land Tenure:				
Borrowed	5	5.0	2	2.0
Hired	5	5.0	7	7.0
Inherited	70	69.3	79	79.0
Purchased	21	20.8	12	12.0
Primary Farm Labour Type:				
Family	67	66.3	71	71.0
Hired	33	32.7	29	29.0
Others	1	1.0	0.0	0.0
Primary Farm Power Source:				
Human	81	80.2	81	81.0
Animal	20	19.8	14	14.0
Primary Cooking Fuel:				
Firewood	92	91.1	91	91.0
Kerosine	7	6.9	6	6.0
Charcoal	2	2.0	3	3.0
Participation in Groups:				
Member	37	37.0	27	26.7
Non Member	64	64.0	73	73.0

These characteristics may promote adoption of the project's innovations among the respondents. Researchers have established the influence of these variables on adoption of farm forestry innovations by farmers (Regmi, 2003; Kwabe, Bigsby and Cullen, 2009). Generally more purchased land may mean more freedom to invest on land. More farm power input may mean more labour available for farm operations. Some previous studies have identified labour availability among the factors affecting the adoption of farm forestry practices by farmers (Boateng, 2008). Similarly the need for fuelwood as the primary cooking energy in the study area, may influence adoption of the project's innovations. Subsequently all the variables are likely to encourage rather than hinder the respondents involvement in the project's farm forestry extension activities.

5.2 The Respondents Attitude towards Farm Forestry

The respondents' attitudes towards farm forestry were found to be similar (Table 5.5). The two groups responded in the same way to both positive and negatives attitude statement. A majority of the respondents, 67.0% and 76.0% of the participants and non-participants respectively, agreed with the positive statement 'I am fully aware of the beneficial effects of trees on farmland'. Also 93.1% and 96.0% of them respectively, agreed with the statement 'Trees help to conserve soil, soil moisture and reduce soil erosion' (Table 5.5).

Table 5.5: The Respondents Attitude towards Farm Forestry

Attitude Statements	**Participants (%)**			**Non Participants (%)**		
	Agree	Neutral	Disagree	Agree	Neutral	Disagree
I am fully aware of the beneficial effects of trees on farmland.	67	6	26	76	12	12
Trees help to conserve soil, soil moisture and reduce soil erosion.	93	4	1	96	4	0
Generally farmers do not like planting trees in their farms.	17	2	78	8	11	80
Generally planting trees in the farm is a tedious work.	22	2	74	28	9	60

On the other hand most of the respondents, 78.3% and 80.0% of the participants and non-participants respectively, disagreed with the negative statement 'generally farmers don't like planting trees in their farms'; and the statement 'tree planting is tedious' (74.3% and 60.0%) respectively (Table 5.5). The results imply that the respondents have a good understanding of the benefits of on-farm trees and positive inclination towards farm forestry practices. Subsequently we expect this positive attitude to influence the respondents' level of adoption of the project's innovations. In a similar study, Place *et al*. (2005) also found that attitude significantly influenced the adoption of farm forestry technologies by farmers.

The influence of attitude on adoption of farm forestry innovations by farmers is well documented by researchers. Oudul *et al*. (2006) suggested that since attitude is a key determinant of farmers' willingness to adopt agroforestry technologies, efforts to scale-up the adoption of agroforestry technologies should be preceded by a thorough understanding of farmers' perceptions and attitudes. However, research equally shows that farmers negative perceptions were among the causes of low up-take of agroforestry innovations in spite of several years of extension effort (Kwabe, Bigsby and Cullen, 2009). Sometimes farmers' negative attitude towards farm forestry results from low level of awareness and lack of technical advice (Kalaba *et al*., 2010; Ekesi *et al*., 2013). The finding implies that the state's agencies currently making effort towards scaling up the adoption of farm forestry innovations among farmers have a relatively knowledgeable and aware clientele as far as the purpose and multiple benefits of farm forestry is concerned.

5.3 The Respondents Stage of Adoption of the Project's Innovations

5.3.1 Stage of adoption

The results show that the respondents were at different stages of involvement in farm forestry (Table 5.6). About 49% of the non-participants compared to 20% of the participants were at the *awareness* level. Likewise 13% of the non-participants compared with only 7% of the participants were at the *interest* level. This meant most of the non-participants were at the preliminary levels of involvement in the project's farm forestry activities. About 27% of the participants compared to only 12% of the non-participants have reached the *trial* level; while 47% of the participants compared with only 26% of the non-participants have arrived at the adoption level of involvement in the project's farm forestry activities. This meant there are as many participants as twice

the number of the non-participants that have *tried* or *adopted* one of the farm forestry practices recommended by the project.

Table 5.6: The Respondents Stage of Adoption of the Project's Innovations

Stages of adoption	**Participants** (n_1=101)		**Non Participants** (n_2=100)		X^2
	Freq.	**Percentage**	**Freq.**	**Percentage**	
1. Awareness	20	20	49	49	
2. Interest	7	7	13	13	
3. Trial	27	27	12	12	25.356*
4. Adoption	47	47	26	26	

**Significant:* X^2 (2, N = 201) = 25.356, $p < .05$. Critical X^2 (2, N=201) = 5.991.

A Chi-squire test for independence was used to examine the relationship between participation in the project and level of involvement in farm forestry by the respondents. The relation between these variables was significant, X^2 (2, N = 201) = 25.356, $p < .05$ (Table 5.6). It is probable that level of adopters (26%) among the non-participants is as a result of temporal change, spill-over-effects, and the influence of the mass media. Given these three possibilities through the innovations introduced by the project could have diffused to the non-participants, the result is not surprising. The usual sources of information of the non-participants (75% of them rely on family and friends, see Table 5.3), supports this conclusion.

The size of the X^2 statistic implies a strong relationship exists between participation in the project the levels of involvement of the respondents in farm forestry activities. Apart from the project's influence, we may also attribute the results to the complementary influence of other socio-economic characteristics of the respondents', such as attitude towards farm forestry (see Table 5.5). The finding implies that only half

of project's target population has adopted the farm forestry practices it recommended. This being the case, coupled with the prevailing high demand for fuelwood and poles in the study area, there is a huge task ahead of the state – that of controlling deforestation by persuading farmers to adopt farm forestry practices, in order to stop desertification and restore ecological stability in the state.

5.3.2 The project's innovations adopted by the respondents

The result shows that the respondents have adopted 5 of the 11 farm forestry practices introduced by the project (Figure 5.1). This meant they preferred these to the rest. About 29% of participants adopted *boundary plantings* compared to 20% of the non-participants. Also 6% of the participants adopted *woodlots* compared to 3% of the non-participants. Very few (1%) of the participants adopted *scattered* farm plantings compared to none among the non-participants. Generally, higher proportions of the participants adopted the farm forestry practices, compared to the non-participants (Figure 5.1). The result is a clear reflection of the relationship between participation in the project and level of adoption of farm forestry practices by the respondents.

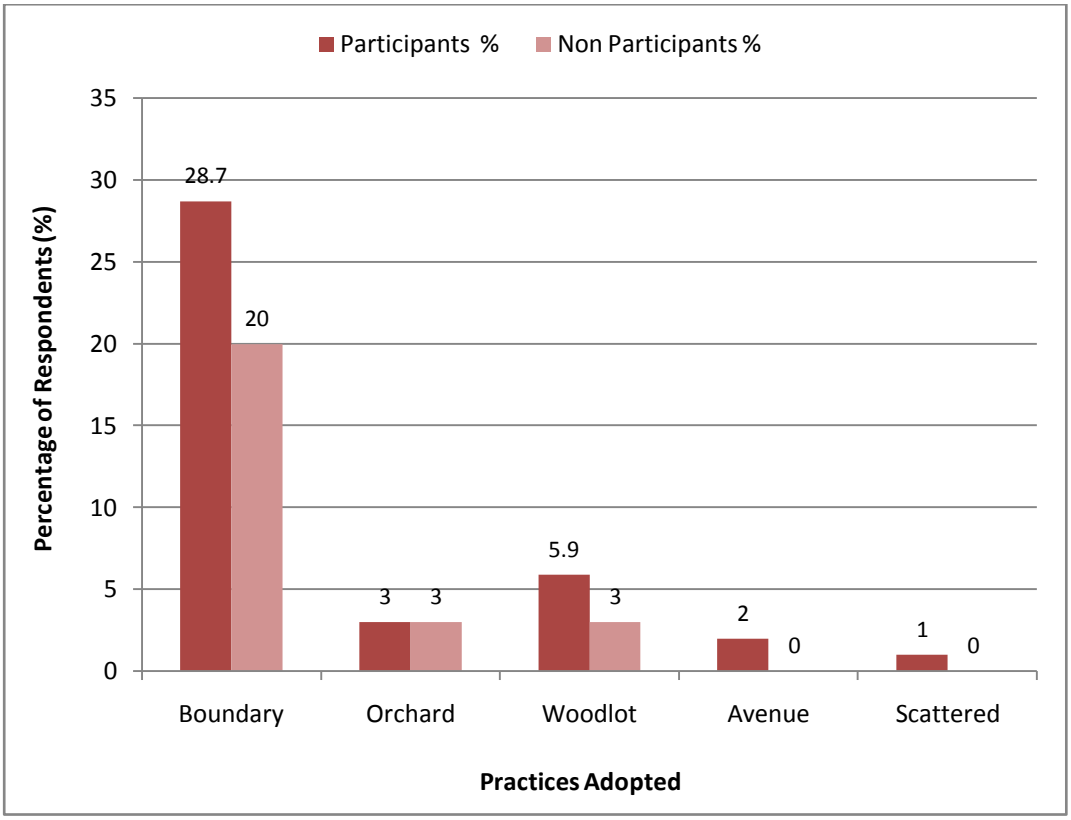


Figure 5.1: The Project's Innovations Adopted by the Respondents

The observed outcome tallies with our expectation given the influence of the participants' background socio-economic characteristics and access to the project (see Table 5.1, 5.3 and 5.5), all of which can influence the observed outcome. Therefore the project has helped its beneficiaries to adopt farm forestry practices. The result agreed with that of some earlier research findings which reported the influence of extension interventions and farmers socio-economic characteristics on farmers' adoption of farm forestry practices (Kalaba *et al*., 2010; Ekesi *et al*., 2013).

The result also implies that *boundary* plantings are preferred the most by the respondents, and agree with the observation that in the study area, *boundary* plantings are commonly seen in protected farmlands, graveyards, wells, schools, mosques and livestock watering points (MAHF, 1989). Generally less than 50% of either group

adopted farm forestry practices. The adoption levels for both groups are low and unexpected, given that 28 years have lapsed since the inception of the project, and 19 years since its termination, a period long enough for most tree technologies to diffuse within the rural populations of the study area. The situation implies that the task ahead of Kano State Afforestation Programme (KNAP) and the State's Agricultural and Rural Development Authority (KNARDA), among others, is to persuade farmers to plant more trees on their farmlands. This must happen if the state is to win the fight against desertification, for the restoration of ecological stability and agricultural sustainability in the state.

5.3.3 The respondents' years of adoption

The respondents differ in terms of their mean years of adoption of farm forestry practices (Table 5.7). On the average, the participants had significantly higher (M = 7.3 yrs) mean years of adoption compared to the non-participants (M = 5.1yrs, t (71) = 2.725, p = .05. The participants result further reflects the strong relation between participation in the project and the respondents' average years of adoption of farm forestry practices. Therefore the observed difference is attributable to the project's influence. The project has empowered its beneficiaries to acquire several years of experience in using farm forestry technologies in the study area.

Table 5.7: The Respondents Years of Adoption of the Projects' Innovations

Years of Adoption	**Participants** (n_1=47)	**Non Participants** (n_2=26)	**t cal statistic**
Mean	7.30	5.12	3.021*
Maximum	25	20	
Minimum	3	3	

**Significant t(2, N=73) = 3.021) >Critical t(1.972), α= 0.05, df=199.*

The project has made a difference in the lives of its beneficiaries in terms of facilitating their acquisition of farm forestry knowledge and experience. Apart from the project's influence, the respondents socio-economic characteristics such as farming experience and contact with extension agents could have strongly contributed to the finding. The observed outcomes could be a source of inspiration for greater participation in future similar projects for the respondents. An earlier study reported how participation in farm forestry activities enhanced some Malawian farmers' confidence and inspire the feeling among some of them that "farm forestry adopters were seen as superior to other farmers" (Oudul *et al.*, 2006). The range (22 years) of the years of adoption among the respondents gives a hint of the long gestation of tree technologies and why small scale farmers in the study area need to be supported through incentives to encourage them to adopt on-farm tree planting activities.

5.4 Factors Influencing Adoption of the Project's Innovations among the Respondents

5.4.1 The reasons behind adoption

The results in Figure 5.2 shows the distribution of the respondents according to the five major reasons behind their adoption of the project's farm forestry innovations. The major reasons were - relative advantage of an innovation over the one it replaced (40% and 56%), compatibility of the innovation with values and needs of the respondents (22% and 6%), easiness to be understood and used (14% and 3%), triability of the innovation prior to its adoption (7% and 11%), observability of the results of the innovation tangibly (12%and 2%) and other factors – like cost (6% and 2%); according to the two groups respectively (Figure 5.2). It can be seen that relative advantage was the major reason motivating the respondents to adopt the project's farm forestry innovations.

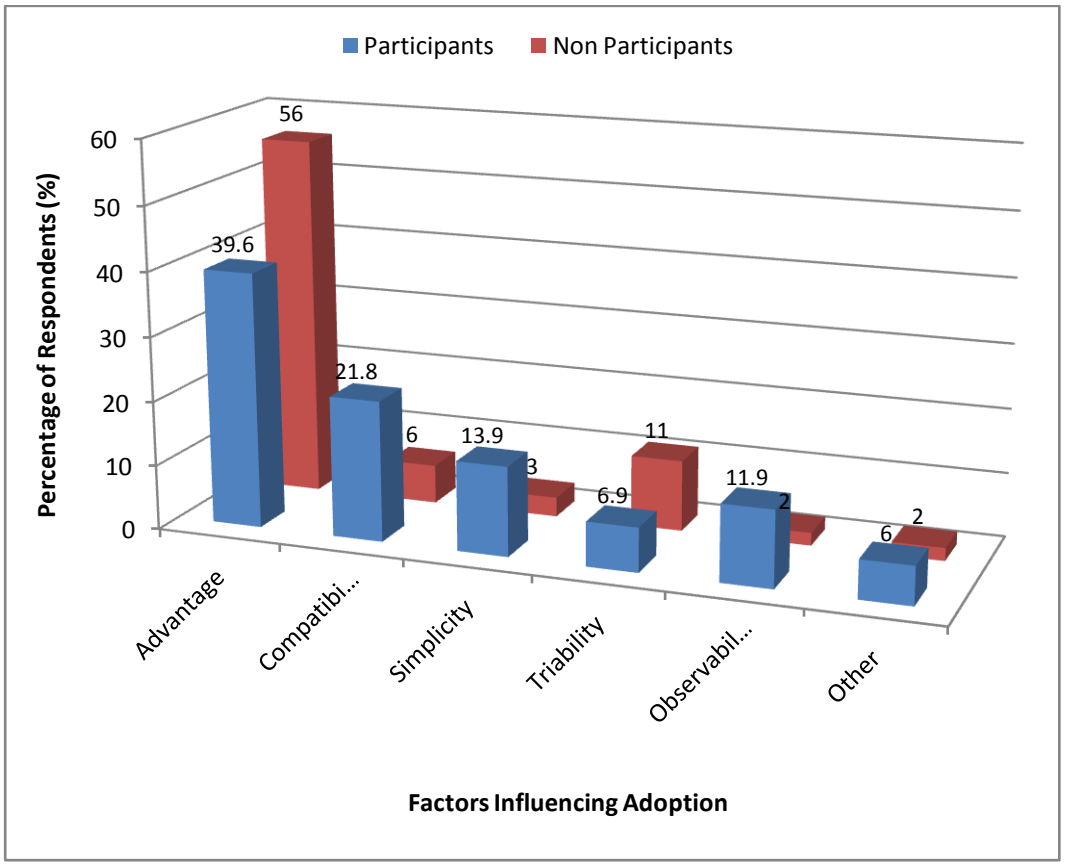


Figure 5.2: Reasons behind the Respondents Adoption Decisions

The other reasons behind the respondents' decision to adopt the project's innovations were compatibility, simplicity, triability, observability and other reasons such as cost (Figure 5.2). Higher proportions of the participants reported each of the reasons. Thus the observed trend may have relationship with participation in the project. The results are in agreement with several earlier studies which equally identified tangible benefits (Essa *et al.*, 2011; Mustapha *et al.*, 2012), technical knowhow (Ajayi *et al.*, 2007) and compatibility (Kalaba *et al.*, 2010; Hussain *et al.*, 2012; Jamala *et al.*, 2013) among the factors influencing farmers adoption of farm forestry technologies. There are various reasons motivating farmers' adoption of farm forestry technologies. However, resource-poor farmers most of whom lack adequate financial resources and technical knowledge may find it more difficult to adopt farm forestry innovations. Therefore to increase these

farmers' resilience and ability to cope with the environmental stresses and shocks facing them, they will need to be supported with technical and material incentives, so they can actively participate in farm forestry.

5.4.2 The factors influencing adoption

The results of a regression analysis of the factors influencing stage of adoption among the respondents (Table 5.8), shows that the positive determinants of stage of adoption among them were: cooking fuel (P>z=0.006), years of schooling (P>z=0.010), and age (P>z=0.002), all significant at α=.05 level (Table 5.8).

Table 5.8: OLR of the Factors Influencing the Respondents Stage of Adoption of the Project's Innovations

Stage of Adoption	Coef.	Std. Err.	Z	P>z	[95% Conf.	Interval]
Age	0.19529	0.0627127	3.11	0.002*	0.072375	0.318205
Dependents	0.009704	0.0256342	0.38	0.705^{NS}	-0.04054	0.059946
Primary livelihood	-0.96382	0.3900048	-2.47	0.0102*	-2.12021	0.19257
Land tenure	-0.06109	0.01755873	-3.48	0.000*	-0.40523	0.283059
Farm size	-0.01862	0.00893752	-2.08	0.0435*	-0.19379	0.156551
Farm labour	-0.52313	0.3965458	-1.32	0.187^{NS}	-1.30035	0.254084
Farm power	-0.38597	0.3314341	-1.16	0.244^{NS}	-1.03557	0.263628
Herd size	-0.13981	0.0490229	-2.85	0.004*	-0.23589	-0.04372
Cooking fuel	0.139118	0.05325484	2.61	0.006*	-0.90466	1.182894
Yrs of schooling	0.170292	0.0662742	2.57	0.01*	0.040397	0.300187
Farming exp	-0.01074	0.0181786	-0.59	0.555^{NS}	-0.04637	0.024893
Ext contact	0.08337	0.5154742	0.16	0.872^{NS}	-0.92694	1.093681
Attitude	0.02476	0.0178567	1.39	0.166^{NS}	-0.01024	0.059758
Grp. Participation	0.279834	0.14584626	1.92	0.05142^{NS}	-0.61874	1.178404

Logistic Regression

Log likelihood= -185.488 Prob > chi2=0.000
Number of observations=201 Pseudo R2=0.589
LR chi2(15)=129.59 NS = Not Significant at α= .05
*Significant at α= .05

Cooking fuel had the weakest, while age had the strongest association with stage of adoption. Earlier research evidence has revealed the positive influence of extension contact, membership of groups, level of education, herd size and attitude on adoption of

agroforestry innovations among farmers (Neupanea *et al.*, 2002; Hillbur, 2014). On the other hand the significantly negative determinants of stage of adoption, at α=.05 level, were: farm size (P>z=0.044), land tenure (P>z=0.000), herd size (P>z=0.004) and primary livelihood source (P>z=0.010), of the respondents (Table 5.8). Farm size had the weakest, while primary livelihood source had the strongest negative influence on stage of adoption. In other words increases in these negative factors decreases stage of adoption by the magnitude of their respective coefficients. Number of dependents (P>z=0.705), farm labour (P>z=0.187), farm power (P>z=0.224), farming experience (P>z=0.555) and group membership (P>z=0.051) had no significant influence, at α=.05 level, on stage of adoption of the respondents (Table 5.8).

Generally there is a strong association (R^2 = 0.589) between the respondents stage of adoption and their socio-economic characteristics. This implies that the respondents' involvement in the Forestry-II project was profoundly influenced by their personal characteristics. The finding implies that the positive determinants are likely to influence rather than hinder adoption of the project's innovations by the respondents. The result shows that the respondents' number of dependents, farm labour source, farm power source, farming experience and extension contact had no relationship with stage of adoption (Table 5.8). In contrast earlier research evidence shows that number of dependents, group membership, education and age had negative effects on adoption of agroforestry innovations by farmers (Neupanea *et al.*, 2002). On the whole, the findings disagree with the apriori assumption that all of the respondents' socio-economic characteristics had positive effects on adoption of the project's innovations.

Test of Hypothesis I:

It was hypothesized that there is no relationship between the respondents' socio-economic/institutional characteristics and their stage of adoption of the Forestry-II Project's innovations. To test this hypothesis the ordered logit regression analysis was applied. The p-values (P>z) test the hypothesis that each coefficient is different from 0. To reject this, the p-value has to be lower than our chosen alpha level, which is 0.05. If lower, the decision rule is to reject our null hypothesis and say that the independent variable has a significant influence on stage of adoption (the dependent variable). Results of ordered logit regression of socio-economic/institutional factors influencing the respondents stage of adoption among the respondents, shows three groups of factors namely - positive, negative and non-significant factors (Table 5.8). The positive factors significantly influencing the respondents stage of adoption, at α=.05 level, were the cooking fuel (P>z=0.006), years of schooling (P>z=0.010), and age (P>z=0.002), of the respondents respectively (Table 5.8). The negative factors influencing stage of adoption were farm size (P>z=0.044), land tenure (P>z=0.000), herd size (P>z=0.004) and primary livelihood (P>z=0.010) respectively; while the non-significant factors were number of dependents (P>z=0.705), farm labour (P>z=0.187), farm power (P>z=0.224), farming experience (P>z=0.555) and group membership (P>z=0.051), respectively (Table 5.8). The null hypothesis is rejected. It is concluded that there are several socio-economic/institutional factors significantly influencing the respondents' stage of adoption of the Project's innovations. Some of the factors had positive influence; some had negative influence on adoption stage of the respondents.

5.5 Impact of the Project's Innovations on the Respondents Livelihoods

The result in Table 5.9 shows that the two groups differ in terms their livelihood outcomes of adopting the project's farm forestry innovations. Higher proportions of the participants reported decreases in water erosion (17% and 3%) and wind erosion (28% and 26%) respectively than the non participants. Similarly more of the participants reported increases in soil moisture (48% and 2%), firewood supply (55% and 39%), poles supply (55% and 29%) fodder supply (49% and 30%) and knowledge & skill (58% and 38%) respectively than the non-participants (Table 5.9).

Table 5.9: Impact of the Project's Innovations on the Respondents' Livelihoods

Livelihood Outcomes	**Participants (%), n=47**			**Non-Participants (%), n=26**		
	Decrease	No Change	Increase	Decrease	No Change	Increase
Soil erosion by water	17	5	28	3	9	16
Soil erosion by wind	29	6	27	26	3	12
Soil moisture	1	1	49	1	25	2
Cost of Fertilization	37	3	22	27	2	12
Crop output	5	5	52	0	5	34
Farm income	2	2	57	0	4	36
Firewood supply	4	3	55	0	1	39
Poles supply	2	5	55	1	11	29
Fruits availability	5	9	47	1	7	33
Fodder supply	3	9	49	0	10	30
Shade availability	4	3	54	1	3	37
Knowledge & skills	2	1	58	0	3	38
Employment	1	2	58	0	7	34
Social capital	1	1	58	0	3	38
Durable assets owned	2	0	57	0	0	41
Sustainable use of NR	2	0	58	0	1	39

It can be seen that the proportions of all the outcomes were higher for the participants, a fact that is primarily attributed to the influence of the project. The result clearly reflects the relation between participation in the project and the outcomes of adoption of farm forestry innovations on livelihoods. In conclusion, the trend provides the evidence to

assume that adopters of the project's innovations may have achieved more soil stability, increased fertility and increased supply of fuelwood and poles for their households, as envisaged by the project. Other positive livelihood outcomes accrued to the respondents were increases in crop output (52% and 34%), fruits availability (47% and 33%), shade for humans and livestock (54% and 37%), employment (58% and 34%), social capital (58% and 38%), ownership of durable assets (57% and 41%) and more sustainable use of natural resources (58% and 39%) among the participants and the non participants respectively.

These findings agree with earlier research evidence on the livelihood impact of farm forestry innovations in terms of generating increases in farm income, fuelwood supply, control of pollution and provision of shade (Hussain *et al.*, 2012). It became evident that the project made a difference in the life of the respondents. The findings inspire hope about the future of agriculture in the study area. Nevertheless one of the tasks ahead is up-scaling the adoption of farm forestry innovations among farmers in the study area.

A two sample independent t-test was applied to see if the participants' livelihoods outcomes differ significantly from those of the non-participants. The increases in livelihoods of the respondents averaged, 49.000 and 29.375 for the participants and non-participants respectively. The average increase achieved by the project's participants was significantly ($t=4.596$, $t_{cv}=2.042$, $df=30$, $\alpha=.05$) higher than that of the non-participants. There were no significant differences in the 'decrease' and the 'non-change' in livelihoods observed by a minority among the two groups (Table 5.10).

Table 5.10: Differences in Livelihood Outcomes between the Two Groups

Participation Status	Livelihood Outcomes	Decreased	No Change	Increased
1	Soil erosion by water	17	5	28
1	Soil erosion by wind	29	6	27
1	Soil moisture	1	1	49
1	Cost of Fertilization	37	3	22
1	Crop output	5	5	52
1	Farm income	2	2	57
1	Firewood supply	4	3	55
1	Poles supply	2	5	55
1	Fruits availability	5	9	47
1	Fodder supply	3	9	49
1	Shade availability	4	3	54
1	Knowledge & skills	2	1	58
1	Employment	1	2	58
1	Social capital	1	1	58
1	Durable assets owned	2	0	57
1	Sustainable use of NR	2	0	58
2	Soil erosion by water	3	9	16
2	Soil erosion by wind	26	3	12
2	Soil moisture	1	25	2
2	Cost of Fertilization	27	2	12
2	Crop output	0	5	34
2	Farm income	0	4	36
2	Firewood supply	0	1	39
2	Poles supply	1	11	29
2	Fruits availability	1	7	33
2	Fodder supply	0	10	30
2	Shade availability	1	3	37
2	Knowledge & skills	0	3	38
2	Employment	0	7	34
2	Social capital	0	3	38
2	Durable assets owned	0	0	41
2	Sustainable use of NR	0	1	39
1=Participants 2=Non-Participants		M1 =7.313 M2 = 3.750 df= 29 t = 1.016 t_{cv} = 2.045 Aplha = .05	M1=3.438, M2=5.875, df=21, t=-1.451 t_{cv}=2.079 Alpha=.05	M1=49 M2=29.375 df=30 t=4.596 t_{cv}=2.042 Alpha=.05

Test of Hypothesis II:

It was hypothesized that there is no difference in livelihood impact of farm forestry innovations between the Project's participants and non-participants. The two-sample t-

test was used to test this hypothesis. The test compared the mean livelihood outcomes of the two sample groups. The goal was to infer whether the populations from which the samples were drawn are significantly different. For us to reject the null hypothesis, our computed t must be larger than a critical t value at .05 alpha level. The results of the test shows that the average increase in livelihoods achieved by the project's participants (49.00) was significantly ($t=4.596$, $t_{cv}=2.042$, $df=30$, $\alpha=.05$) higher than that of the non-participants (29.60). The null hypothesis was rejected, and it was concluded that the Forestry-II Project has significantly increased the livelihoods of its target farmers.

5.6 Constraints to the Implementation and Success of the Project's Activities

Like every other project, the Forestry-II Project faced constraints which affected its operations and success. To examine the beneficiary perceptions of such constraints, the respondents were asked to mention a) their *likes* about the project, b) *dislikes* about the project, c) constraints that affected their involvement in the project, and d) possible recommendations for addressing the constraints for this and future similar projects.

5.6.1 The respondents' likes-about-the project

The result shows that the respondents liked orchards (42.6% and 37.0%), income (21.8% and 7.0%), woodlots (9.9% and 4.0%), tree planting campaigns (6% and 1%), boundary plantings (4% and 1%), road avenue plantings (3% and 1%), support/incentives to participants (2% and 2%), shelterbelts (2% and 1%), scattered farm plantings (1% and 0%), and nursery practices (0% and 1%) the-most-about the project, according to the participants and non-participants respectively (Figure 5.3).

Higher proportions of the participants responded to this evaluative question than the non-participants. Probably the trend has a relationship with participation in the project. Overall, the respondents liked Orchards the-most, and 'scattered plantings' and 'nursery practices' the-least. Some researchers reported a similar trend on farmers' opinions about agroforestry technologies (Ekesi *et al.*, 2013). However, divergence is normal since every farmer will usually need a specific tree species for a specific purpose.

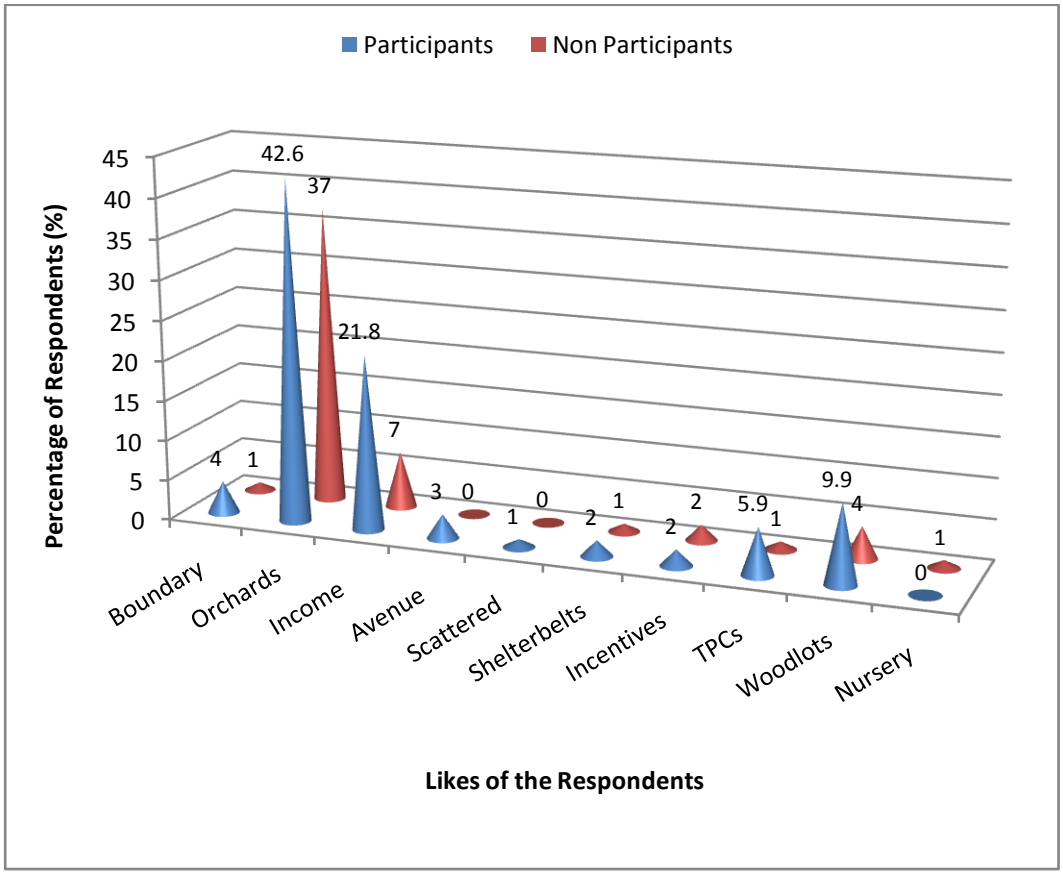


Figure 5.3: The Respondents likes-about-the Project

The farmers' preference implies that they are more likely to accept and implement agroforestry models based on integration of orchard trees and agricultural crops. This preference should be borne in mind in planning extension activities aimed at scaling up the adoption of farm forestry innovations in the study area.

5.6.2 The respondents' dislikes-about-the project

The results shows that the respondents disliked long gestation of trees (18% and 34%), negative effects of trees on soil properties (33% and 5%), ineffectiveness of the project to counter the rate of deforestation (20% and 4%), low incentives given to the project's participants (9% and 1%), waste of land (8% and 1%) poor management of the project's activities (5% and 6%), and low participation of farmers and relevant stakeholders (4% and 4%), according to the participants and non-participants respectively (Figure 5.4).

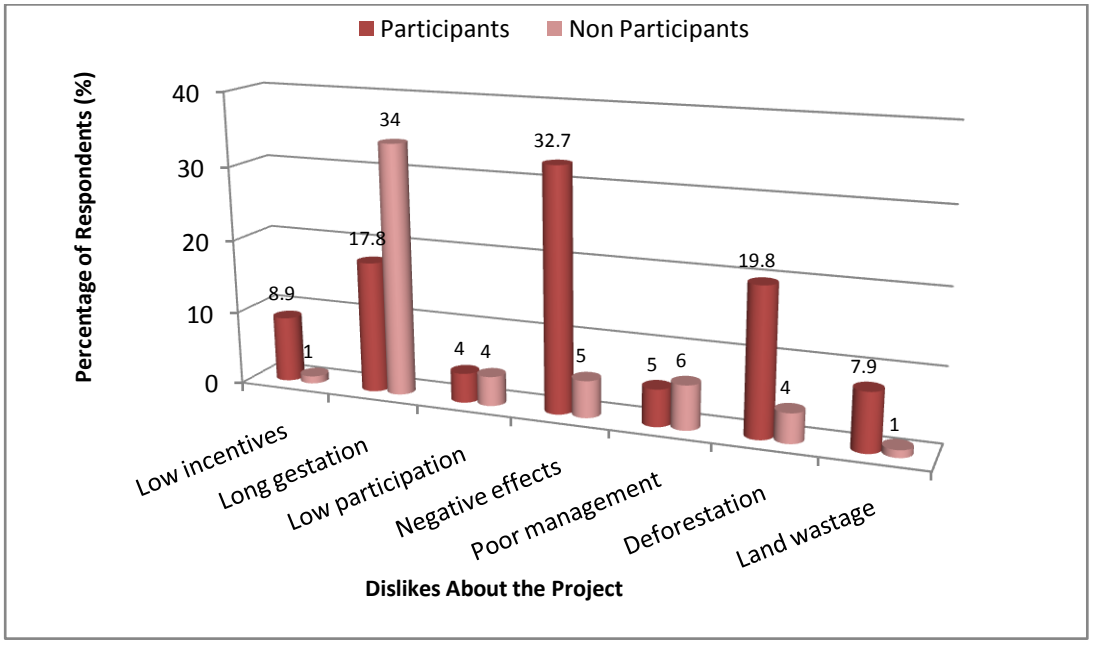


Figure 5.4: The Respondents Dislikes about the Project

Higher proportions of the participants responded on all the issues. Probably the response rates have a relation with participation in the project. The respondents' views tally with the general findings in earlier studies (Boateng, 2008), it shows farmers readiness to give their opinions about interventions which affect their lives. The respondents opinions should be accorded attention by governmental and non-governmental organizations' wishing to successfully promote and scale up the adoption of farm forestry innovations among farmers in the study area.

5.6.3 Constraints that affected the respondents' involvement in the project

The result in Table 5.10 shows the various constraints which affected the respondents' involvement in the project's activities (Table 5.10). The foremost constraint is "inadequate support and incentives to farmers" according to the participants (24.8%), and "poor management of the project's activities" according to the non-participants (27.0%).

Table 5.11: Constraints that affected the Respondents Involvement in the Project

Variables	**Participants** (n_1=101)		**Non Participants** (n_2=100)	
	Freq.	**Percentage**	**Freq.**	**Percentage**
Deforestation remain uncontrolled	8	7.9	4	4.0
Natural factors e.g. pests and diseases	3	3.0	2	2.0
Negative effect of some of the new trees	3	3.0	2	2.0
Low participation of farmers	11	10.9	2	2.0
In effective project implementation	19	18.8	3	3.0
Inadequate support and incentives	25	24.8	9	9.0
Poor maintenance of plantations	3	3.0	26	26.0
Poor project management	21	20.8	27	27.0
No response	8	7.9	25	25.0

The constraints were stated as: the project's inability to decrease deforestation (8% and 4%), pests and diseases (3% and 2%), negative effects of trees on soil (3% and 2%), low participation of farmers (11% and 2%), ineffective implementation (19% and 3%), inadequate incentives (25% and 9%), poor maintenance of plantations (3% and 26%), and poor project management (21% and 27%), by the participants and the non-participants respectively (Table 5.10). The response rates of the participants' were higher than those of the non-participants, and probably this has a relationship with participation in the project (Table 5.10). A major implication of this finding for policy is the need for the Kano State government to consider the views of the respondents in the

planning of future similar projects, and in guiding the activities of the on-going KNAP program.

5.6.4 Recommendations of the respondents' towards the constraints

The respondents recommended various measures needed in order to address the indentified constraints for future similar projects as: more tree planting campaigns should be incorporated into future projects (2.0% and 1.0), more coverage and participation of farmers in future projects (4% and 4%), more competent extension agents to serve the clients in future projects (4% and 1%), more steady funding of future projects (5% and 1%), more grassroots mobilization and involvement of local stakeholders in future projects (6% and 2%) and more effective project implementation in future projects (20% and 3%), according to the participants and non-participants respectively (Table 5.12).

Table 5.12: Recommendations by the Respondents towards the Constraints

Recommendations	**Participants** (n_1=101)		**Non Participants** (n_2=100)	
	Freq	**Percentage**	**Freq.**	**Percentage**
More tree planting campaigns	2	2.0	1	1.0
More trained FEAs to serve farmers	4	4.0	1	1.0
More coverage and participation	4	4.0	4	4.0
More steady funding of future projects	5	5.0	1	1.0
More grassroots mobilization	6	6.0	2	2.0
More effective implementation	20	20.0	3	3.0

Higher proportions of the participants gave the recommendations, than the non-participants. Probably the result has a relationship with participation in the project.

However the trend is not unexpected given the participants' first-hand knowledge and experience of the project's activities. Generally the issues identified by the respondents were similar to those which affected farmers active participation in some earlier projects (Ajayi *et al.*, 2007).

The finding implies that although smallholder farmers are usually not well organised and therefore lacked the ability to influence policies, they do understand the strength and weakness of interventions connected with their livelihoods. It is time for the Kano State Afforestation Programme to take the farmers views more seriously. The farmers opinions and concerns can be useful in guiding the planning of future similar interventions, as well as in State's on-going effort to scale-up the adoption of farm forestry innovations by farmers throughout the State. The results can also serve as a useful tool in guiding policy formulation by the LGAs in the state and the Federal Ministry of Environment.

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 Summary

The major objective of this study was to assess the impact of the Nigeria Forestry-II Project on farmers' livelihoods in Kano State. The specific objectives of the study were to describe the socio-economic characteristics of the project's target farmers, assess the farmers attitude towards farm forestry, assess the farmers stage of adoption of the project's farm forestry innovations, evaluate the factors influencing the farmers adoption of the farm forestry innovations, assess the impact of the farm forestry innovations on the farmers livelihoods, and determine the constraints that affected the farmers involvement in the project's farm forestry activities in the study area. A with-and-without approach to impact assessment was adopted, whereby villages reached by the project (participants) were compared with the nearby villages not reached by the project (non participants). Multistage sampling was used to select a sample of 201 respondents, comprising participants and non-participants from 24 villages across the state, from whom data about the project were collected through a survey and the results analyzed with help of descriptive statistical techniques, two-sample chi-square, two-sample t-test, and the ordinal logit regression analysis.

On background socio-economic characteristics, it was found that the respondents differ in age, number of dependents, land tenure, farm labour, farm power, cooking energy, group participation and farming experience. However, the two groups had similarities in average age (45yrs), maximum number of dependents (35) and maximum farming experience (60yrs). Most of the respondents were males (99.0 % and 100.0%), married

(99.0 % and 98.0 %) and primarily live on farming (86.0% and 92.0%) respectively. However, the participants had higher average years of schooling (17yrs and 13yrs), access to extension agent (43.0% and 25.0%), and average farm size (2.9Ha and 2.1Ha) than the non-participants respectively. Also the participants also had more borrowed land (5.0% and 2.0%), purchased land (20.8% and 12.0%), hired labour (32.7% and 29.0%), uses more animal power (19.8% and 14.0%), and had more membership of groups (37.0% and 26.7%) than the non-participants. The two groups use mainly: human power in the farm, firewood for cooking and had a favourable attitude towards farm forestry. Characteristics of the respondents like farming experience, level of education and access to extension agent may have a positive influence on adoption of the project's farm forestry innovations.

The respondents' stages of adoption of the project's innovations vary. The distribution of the two groups stages of adoption were: *awareness* stage (20% and 49%), *interest* stage (7% and 13%), *trial* stage (27% and 12%) and *adoption* stage (47% and 26%), of the participants and non-participants respectively. Majority (47%) of the participants have reached the *adoption* stage, while a majority (62%) of the non-participants was lagging at the *awareness* and *interest* stages. There is significant, X^2 (3, N=201) = 25.356, $p<0.05$, relationship between participation in the project and the respondents stages of adoption of farm forestry innovations. A significantly larger proportion of the participants' has adopted farm forestry innovations compared to the non-participants.

The respondents adopted 5 of the 11 innovations promoted by the project, namely: boundary plantings, private/communal woodlots, and scattered farm plantings respectively. The participants had significantly higher average years of adoption (*M* =

7.3 yrs) compared to the non-participants (M = 5.1yrs, t (71) = 2.725, p = .05). Therefore the project has induced more years of adoption of farm forestry innovations among its target farmers in the study area.

While the major reason behind decision to adopt is 'relative advantage of a farm forestry innovation'; the socio-economic/institutional factors which influence adoption among the respondents were: cooking fuel, years of schooling and age. The factors which had negative effects on adoption were: farm size, land tenure, herd size and primary livelihood source; while those which had no effect on adoption were number of dependents, farm labour, and farm power, farming experience and group membership among the respondents. The null hypothesis that socio-economic/institutional characteristics have no influence on adoption among the respondents was rejected. Several socio-economic/institutional factors significantly influence the respondents' stage of adoption of the Project's innovations.

The project's participants achieved more livelihood outcomes of farm forestry than the non-participants. Higher proportions of the participants achieved decrease in: water erosion, wind erosion; and increases in: soil moisture, firewood supply, poles supply, fodder supply, and knowledge & skill, crop output, fruits availability, shade for humans and livestock, employment, social capital, durable assets and more sustainable use of natural resources compared to the non-participants. The hypothesis that there is no difference in livelihood outcomes of farm forestry innovations between the Project's participants and non-participants was rejected. The average increase in livelihoods achieved by the project's participants (49.00) was significantly (t=4.596, t_{cv}=2.042, df=30, α=.05) higher than that of the non-participants (29.60). Therefore the Forestry-II

Project has significantly increased the livelihoods of its target farmers. It is highly likely that the project has also achieved its objective increasing soil stability and the supply of fuelwood and poles in the study area.

The respondents likes/dislikes-about, and the constraints which affected their effective involvement in the Forestry-II Project were evaluated. Their likes-about-the project were: orchards, addition to income, woodlots, tree planting campaigns, boundary plantings, road avenue plantings, shelterbelts, scattered plantings and nursery practices. Their dislikes were: long gestation, trees negative effects on crop and soil, ineffectiveness of the project on deforestation, low incentives to farmers, waste of land, poor management, and low participation of farmers and other local stakeholders. Orchards were liked-the-most, while scattered plantings and nursery practices were liked the least, respectively by the respondents. Generally all the response rates were higher for the participants compared to the no-participants. The finding shows the preferences of the respondents. The findings imply that if future similar interventions are to succeed in the study area, they must take account farmers socio-economic priorities in relation to tree planting activities in the farm. Doing so will help such projects to select/introduce appropriate farm forestry technologies that are responsive to the needs of the farmers and stand a high chance of being adopted.

The respondents cited the constraints which affected their involvement in the project as: inability of the project to reduce the rate of deforestation, pests and diseases, negative effects of trees on soil, low participation of farmers in the project, ineffective implementation, inadequate incentives for participants, poor maintenance of plantations and poor project management respectively. The response rates of the participants were

higher than those of the non-participants. The difference is probably associated with participation, given the former's better first-hand knowledge of the project. The non-participants may have acquired some knowledge of the project through spill-over-effects and the mass media.

The respondents recommendations towards addressing the constraints included: the need for increasing the number tree planting campaigns in future similar projects, increasing the coverage and participation of farmers in future projects, recruitment of adequate number and training of competent extension agents to serve target farmers in future similar projects, more steady and adequate funding of future similar projects, increase in grassroots mobilization and involvement of local stakeholders such as LGAs, private agencies, NGOs and local traditional institutions; and more effective implementation by stakeholders in future projects. The response rates of the participants were higher and this is likely related to their participation in the project. The recommendations are worthy of consideration in designing future similar interventions in the study area, and by among others, the Kano State Afforestation Program (KNAP) and the Kano State Agricultural and Rural development Authority (KNARDA), in their on-going effort towards scaling-up the adoption of agroforestry technologies in Kano State.

6.2 Conclusion

The conclusions drawn from the findings of this study which assessed the impact of the Nigeria Forestry-II Project on farmers' livelihoods in Kano State, Nigeria were as follows. The sample groups share similarities as well as differences in socio-economic characteristics. Generally the respondents were predominantly male, married, farmers

and had a favourable attitude towards on-farm tree planting activities. Characteristics of the respondents like farming experience, level of education and access to extension agents may have a positive influence on adoption of the project's innovations. The positive attitude of the respondents meant that the project as well the State's other agencies making effort towards scaling-up the up-take of farm forestry innovations among farmers in the study area enjoyed the patronage of a relatively knowledgeable and well aware clientele as far as the purpose and multiple benefits of farm forestry is concerned.

Differences found in stages of adoption of the two sample groups, revealed a significant, X^2 (3, N=201) =25.356, $p<0.05$, relationship between participation in the project and stage of adoption. Therefore a significantly larger proportion of the participants' has adopted farm forestry innovations compared to the non-participants. The study found that the respondents have adopted up to 45% of the innovations recommended by the project. However the project's participants had a significantly higher average years of adoption compared to the non-participants. Therefore the project has induced longer years of adoption of farm forestry innovations among its target farmers. Socio-economic/institutional factors significantly influencing adoption of the project's innovations among the respondents include cooking fuel, years of schooling and age, farm size, land tenure, herd size and primary livelihood source. The study found that the project has impacted upon the livelihoods of the respondents. The average increase in livelihood of the participants was significantly higher than that of the non-participants. Therefore the project has significantly increased the livelihoods of its target farmers. It is also highly likely that the project has achieved its objective increasing soil stability and the supply of fuelwood and poles in the study area.

The respondents likes/dislikes-about, and the constraints which affected their effective involvement in the Forestry-II Project were evaluated. The finding revealed the farm forestry priorities of the farmers. The farmers priorities must be taken into consideration in designing future similar projects in the study area. Doing so will make such projects more responsive to the needs of the farmers and will increase the projects chances of success. The constraints cited by the farmers and their recommendations towards addressing them are worthy of consideration in designing future similar interventions in the study area, and by among others, the Kano State Afforestation Program (KNAP) and the Kano State Agricultural and Rural development Authority (KNARDA), in their on-going effort towards scaling-up the adoption of farm forestry technologies in Kano State. This study has contributed fresh knowledge on the research problem. It has re-examined the socio-economic and institutional characteristics of the target farmers of the forestry-II project in the study area. The study has also re-examined the farmers attitude towards farm forestry, their stage of adoption of the Forestry-II project's innovations and the factors influencing their adoption of such innovations. A key contribution is evaluating the outcomes of farm forestry on the livelihoods of farmers in the study area, a question that was hitherto left unaddressed by researchers reporting on the achievements of the project. Therefore this study has narrowed the existing knowledge gap on these research questions.

6.3 Recommendations

In the light of this study, the following recommendations are given:

i. The respondents' preference, concerns and recommendations about the Forestry-II Project should be given attention by the Kano State Government in particular and policy makers in general. The farmers views are worthy of consideration in

designing future similar interventions, and possibly in the managing the on-going government sponsored programmes aiming to scale up the adoption of farm forestry innovations among farmers in the state. Some past projects failed because their planners' neglected stakeholders' opinions and wishes.

ii. Non-governmental Organizations and Donor Agencies wishing to embark on a similar interventions should consider salient issues, relating to farmers participation in farm forestry, such as provision of incentives to encourage smallholder farmers to adopt tree technologies. Many poor farmers want to plant trees in their fields, but are hindered by constraints such as poverty, lack of labour, and the long gestation of tree crops. Incentives in the form of close supervision, planting materials, links to markets and access to credit will encourage greater participation of small scale farmers in farm forestry.

iii. The Kano State Afforestation Program and similar organizations implementing Farm Forestry Extension interventions should consider the need to assist small scale farmers to diversify their livelihood activities so as to lessen the short term effects of trees occupation of cropland. Alternative livelihood activities for participants of farm forestry may include agro-eco-tourism, bee keeping and markets for non-wood products. In addition extension agents should help the farmers to get organised and so to empower them to have a stronger voice and more access to resources and services.

iv. The Kano State Government and Donors wishing to implement similar projects in future should plan and conduct effective good grassroots sensitization and

mobilization so as to secure effective participation of key stakeholders; which include farmers, Non-Governmental Organizations, Local Government Authorities, and local opinion/traditional leaders. Doing so will increase farmers participation, increase legitimacy of the project and ensure broader impact of the project.

v. The Kano State Government should provide adequate funds to the State's Afforestation Program (KNAP) so as to enable it to perform its functions and fulfil its mandate effectively. The national Action Program (NAP) published by the Federal Ministry of Environment observed that the magnitude of desertification problem in Nigeria requires funds that are far in excess of what is currently allocated by government. This meant that the finances allocated so far have not been able to have any significant impact in combating desertification (FME, n.d.). Although a good number (47%) of the farmers in Kano State have adopted farm forestry practices, the problems of deforestation and desertification persist unabated as observed by the respondents of this study. It is evident that existing plantations/shelterbelts are being encroached due to the prevailing pressure on fuelwood in the study area. Therefore the task ahead of KNAP and similar organizations aiming to combat desertification in the state is enormous; that of persuading farmers to plant and maintain trees on their farmlands. Achieving such task will require funds in addition to physical effort.

6.4 Suggestions for Further Research

From the findings of the study the following recommendations' for further research are hereby suggested:

i. There is need for a deeper evaluation of the impact of the Project's farm forestry activities on the target farmers' livelihoods, particularly in terms of impact on food security and poverty reduction among farmers in the study area.

ii. There is need for a study of the impact of the project on women's and youth's socio-economic empowerment in the study area.

iii. There is need to for an ex-post environmental impact assessment of the project on soil stability, soil conservation, fuelwood supply, agricultural productivity and other environmental parameters of the study area.

iv. There need for a study on farmers attitude towards on-farm tree planting activities in the study area.

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APPENDIX

RESEARCH QUESTIONNAIRE

IMPACT OF FARM FORESTRY ON FARMERS LIVELIHOODS IN KANO STATE: A CASE STUDY OF NIGERIA FORESTRY-II PROJECT

Part I - Respondents Socio-Economic Characteristics

1. Name of Village: .....
2. Village type: 1. Participant 2. Non-Participant
3. Local Government Area: ……..
4. Respondent's Name: …….
5. Age: ……..
6. Gender: 1. Male 2. Female
7. Marital Status: 1. Married 2. Single 3. Divorced 4. Widowed
8. How many dependents have you in your household? ……
9. What are your approximate years of schooling? ……
10. What are your approximate years of farming experience? …….
11. What is your primary source of livelihood? 1. Farming, 2. Trading 3. Petty trade 4. Others (Specify) ……
12. What is the Total Size of your Farm holding (hectares)?……..
13. Land tenure: 1. Inherited 2. Borrowed 3. Hired 4. Purchased 5. Others
14. Primary source of Farm Labour: 1. Family 2. Hired 3. Others……..
15. Primary type of Farm Power: 1. Human, 2. Animal, 3.Tractor, 4.Others……
16. How many small ruminants do you own? ……
17. Main cooking fuel: 1.Gas 2. Electricity 3.Kerosene 4.Firewood 5.Others

18. Have you had contact with a Forestry Extension Agent? 1. Yes 2. No

19. How often are you visited by a Forestry Extension Agent in a season?

20. Has the Agent given you information regarding on-farm Tree Planting, Care and Maintenance? 1. Yes 2. No

21. If yes, how relevant to your need was the information given by the Extension Agent? 1. Highly irrelevant, 2.Irrelevant, 3. Neutral or Not sure, 4. Relevant 5. Highly relevant

22. What is your usual source of information on farming & agro-forestry?……

23. From how many sources do you normally seek information on farming & agro-forestry? .....

24. Please indicate your extent of agreement about these statements. *(Circle the appropriate answer) (5=Strongly agree, 4=Agree, 3=Not sure, 2=Disagree and 1=Strongly disagree).*

a). Trees help to conserve soil moisture and reduce soil erosion by wind or water	1	2	3	4	5
b). I am fully aware of other benefits of on-farm tree planting	1	2	3	4	5
c). Generally farmers do not like on-farm tree planting	1	2	3	4	5
d). Generally on-farm tree planting and care is a tedious work	1	2	3	4	5

25. Do you participate in a Tree Planting Group, a Farmers Group, or a Farmers' Cooperative Society? 1. Yes 2. No

26. If yes, what is your position such a group? 1. Leader 2. Member 3. Patron 4. Local Resource Person 5. Others …….

27. Has your group contributed towards promoting on-farm tree planting in this community? 1. Yes 2. No

28. If yes, what is your group's major contribution? …….

Part II - Respondent's Stage of Involvement in Farm Forestry

29. What is your present stage of involvement in farm forestry? *(Please tick the appropriate answer)*

1. **Awareness** stage
2. **Interest** stage
3. **Trial** stage
4. **Adoption** stage

30. Give the reason for your answer in Q29 above: ……

31. If you are at the **adoption stage**, name the farm forestry innovation you have adopted: ……..

32. For how many years have you practiced the innovation? …….

Part III - Factors influencing the Respondents Involvement in Farm Forestry

33. What is the reason behind your decision to adopt a farm forestry innovation? *(please tick the appropriate answer):*

1. **Relative advantage** i.e. the extent to which it was seen as better than the old practice.
2. **Compatibility** i.e. how consistent it was with local values experiences and needs.
3. **Complexity** i.e. how difficult it is to understand and use.
4. **Triability** i.e. the extent to which it can be tested before decision to adopt it.
5. **Observability** i.e. the extent to which the new innovation gives tangible results.
6. **Other reasons** (specify) …….

Part IV- Impact of Farm Forestry on the Respondents Livelihoods

34. To what extent has your adoption of a farm forestry practice resulted in the following livelihood outcomes for you? *(Circle the appropriate answer) (1=decreased significantly, **2**=decreased, **3**=neutral or not sure, **4**=increased and **5**=increased significantly).*

a) Soil fertility 1 2 3 4 5

b)	Soil erosion	1	2	3	4	5
c)	Soil moisture	1	2	3	4	5
d)	Wind damage to crops	1	2	3	4	5
e)	Spending on fertilizers	1	2	3	4	5
f)	Crop yield	1	2	3	4	5
g)	Farm income	1	2	3	4	5
h)	Firewood supply	1	2	3	4	5
i)	Poles supply	1	2	3	4	5
j)	Fruits supply	1	2	3	4	5
k)	Fodder for livestock supply	1	2	3	4	5
l)	Shade for humans/livestock	1	2	3	4	5
m)	Knowledge & skills	1	2	3	4	5
n)	Availability of edible fruits & nuts	1	2	3	4	5
o)	Household nutrition	1	2	3	4	5
p)	Employment	1	2	3	4	5
q)	Social capital	1	2	3	4	5
r)	Ownership of assets	1	2	3	4	5
s)	Sustainable use of natural resources	1	2	3	4	5

Part V - Constraints to effective Implementation and Success of the Farm Forestry Project

35. What do you like best about the farm forestry project? ……

36. What do you dislike most about the farm forestry project? ……..

37. In your opinion what is the major constraint that affected the implementation and success of the farm forestry project? …….

38. What recommendation can you offer to the project or to future similar projects?

……

39. Respondent's Phone No. ……

40. Enumerator's Name and Phone No: ……

Part VI – Respondents Agricultural Productivity and Income in Last One Year

41. Major food crop grown last year? ……

42. Output of the major food crop? (Bags): ……

43. Area of the major food crop? (Ha): ……..

44. Major cash crop grown last year?: ……

45. Output of the major cash crop? (Bags): ……

46. Area of the major cash crop? (Ha): ……

47. Income from the major cash crop? (N): …….

48. Off-farm income of last year? (N): ……