ANALYSIS OF FACTORS INFLUENCING UTILIZATION OF AGRICULTURAL SERVICES AND TRAINING CENTRES (ASTC) BY SMALL-SCALE RICE FARMERS IN SELECTED LOCAL GOVERNMENT AREAS OF PLATEAU STATE, NIGERIA

BY

Sunday Adole AGADA

DEPARTMENT OF AGRICULTURAL EXTENSION AND RURAL DEVELOPMENT,
FACULTY OF AGRICULTURE
AHMADU BELLO UNIVERSITY
ZARIA,NIGERIA

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MSc. (Agricultural Extension and Rural Development)

BY

Sunday Adole AGADA
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A DISSERTATION SUBMITTED TO THE SCHOOL OF POST GRADUATE STUDIES, AHMADU BELLO UNIVERSITY, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF SCIENCE DEGREE IN AGRICULTURAL EXTENSION AND RURAL DEVELOPMENT

DEPARTMENT OF AGRICULTURAL EXTENSION AND RURAL, DEVELOPMENT,
FACULTY OF AGRICULTURE,
AHMADU BELLO UNIVERSITY,
ZARIA,NIGERIA

SEPTEMBER, 2021

DECLARATION

I hereby declared that this dissertation tittled **"Analysis of Factors Influencing Utilization of Agricultural Services and Training Centres (ASTC) by Small-Scale Rice Farmers in Selected Local Government Areas of Plateau State, Nigeria"** has been written by me and it is a record of my research work. All borrowed ideas and works of other scholars have been duly acknowledged and referenced.

_____ _____

Sunday Adole AGADA **Date**
Student

CERTIFICATION

This dissertaion tittled **"Analysis of Factors Influencing Utilization of Agricultural Services and Training Centres (ASTC) by Small-Scale Rice Farmers in Selected Local Government Areas of Plateau State, Nigeria"** by Sunday Adole AGADA meets the regulations governing the award of the degree of Masters of Science in Agricultural Extension and Rural Development of the Ahmadu Bello University, Zaria, and is approved for its contribution to scientific knowledge and literary presentation.

_____ _____

Prof. M. O. Akinola **Date**
Chairman, Supervisory Committee

_____ _____

Dr. E. Y. Dodo **Date**
Member, Supervisory Committee

_____ _____

Dr. F. Dutse
Head of Department **Date**

_____ _____

Prof. S. Abdullahi **Date**
Dean, School of postgraduate studies
Ahmadu Bello University, Zaria

DEDICATION

This dissertation is dedicated to the memory of my Late Mother Evangelist (Mrs) Agada Onyewu Paulina, who passed on to glory on 20th December, 2020. Mother your labour of love through prayers, counsel and financial support was not in vain. May your soul continue to rest in the Bosom of the Lord our God now and forever (Amen).

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ABSTRACT

This study examined the factors influencing utilization of Agricultural Services and Training Centres (ASTC) by small-scale rice farmers in selected Local Government Areas of Plateau State, Nigeria. A multi-stage sampling procedure was used for this study. First, a purposive sampling was used to select three Local Government Areas from two senatorial zones. Ten villages from each Local Government Area were randomly used to select 202 participants in ASTC programme in Plateau State. Structured questionnaire was used for data collection while data were analyzed with descriptive statistics and inferential statistics such as simple percentages, mean, tobit regression and linear regression statistical tools. Research questions were raised bothering on socio-economic/institutional characteristics of the respondents, level of ASTC services utilized by rice farmers, factors influencing the utilization of ASTC services, effects of ASTC services on income of rice farmers, and constraints faced in utilizing ASTC service were examined. Findings revealed that 86.6% of the respondents were male and 13.4%, females, 40.1% were between ages 41-50 years, overwhelming majority of them (90.1%) were married and majority (66.8%) identified the ex

tension agents as their sources of ASTC information. Findings further showed input supply services (M=4.21) was ranked highest followed by workshop/seminar (M=4.17), tractor hiring (M=3.65), planting (M=3.48), harvesting (M=3.36.), survey (M=3.21), Soil laboratory testing while marketing (M=1.76) was the least utilized. Also, age (=3.111), marital status (=4.669), education level (=4.607), financial status (=9.208), Household size (=1.955), extension visit (=3.176) and amount of credit accessed (=2.580) significantly influenced utilization of ASTC services which were statistically significant at 10%, 5% and 1% levels. The hypothesis test found a significant relationship between socio-economic/institutional characteristics with utilization of ASTC services which also had a significant effect on the

income level of the farmers at 5% level of probability. The study found that finance (M=4.81, SD=0.40), high cost of services (M=4.35, SD=0.69), late arrival of input (M=4.14, SD=0.90) were the major constraints rice farmers faced in utilizing services. Based on this finding, it was concluded that ASTC programme no doubt had positive effect on the income of rice farmers in the study area. However, the level of utilisation can still be encouraged through price reduction to increase participation in the project. The study thus recommended that the prices of inputs should be subsidised, so as not to discourage the participants. More so, ASTC should encourage optimal utilization by increasing the discount for rice farmers, awareness level should be raised to increase the number of participants and farmers cooperative should be strengthened to attract more soft loans to rice farmers at low interest rate in the State.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

The Agricultural sector is recognised globally as the vehicle credited with national development in terms of provision of raw materials, export commodities, provision of employment, poverty alleviation and food security. Agriculture is one of the world's most important sectors with an enormous capacity for economic development and poverty alleviation in many countries (Aref, 2011). According to Gilbert (2017), the agricultural sector has been responsible for economic growth through the centuries spanning from 18th century England, 19th century Japan, through to 20th century India, Brazil, China, South Korea, and Vietnam among others.

The experience of the Asian Tigers such as Japan, Taiwan and Korea over the years, is worthy of emulation in terms of agricultural transformation. In its annual report, Food and Fertilizer Technology Centre (F and FTC, 2005) revealed that agriculture in Japan, Taiwan and Korea witnessed immense transformation from labour intensive to technologically intensive approach hitting as high as 98%. Indonesia, Thailand, Malaysia, Vietnam and the Philippines have been receiving similar support from the government for its special projects and programme (F and FTC, 2005). Common among these countries is the prevalence of strong political support and farmers' cooperation, paving the way for advancements in agricultural technologies and systems.

Radcliffe (2017) argued that the ingenuity of the Japanese to take leading role in 1945 brought about agricultural transformation in the region which also had widespread impact

across other continents. The Asian Tigers had a lack of natural resources and a small amount of farmland. They were also overpopulated, poor, and could not feed their own populations. Not surprisingly, they had low capital resources for development, and thus they faced some of the same general problems as Japan. The standard Third World model for development is to increase agricultural production and to mine gold, silver, or other natural resources the country has for export.

In Africa, even though the potentials of small–scale farmers may not have been brought to the fore, they are still recognized as the major drivers of many economies, a strong option for spurring growth, overcoming poverty, and enhancing food security among rural people's livelihood (Asfaw and Shiferaw, 2010; Agriculture, Forestry and Fisheries, 2012). The small-scale farmers occupy a very central position in the enhancing the food security in the sub-Saharan African and the world in general. This is because about 80% of smallholders are responsible for managing the world's estimated 500 million small farms and food consumed in large part of the developing world (IFAD, 2013). Small-scale farming refers to the production of crops and livestock on a small piece of land without using advance and expensive technologies (Kutya, 2012). Green, (2011) further recognised the important role they play when it views the small scale farmers as the circulators of food and catalysts for productivity whom when given what large scale farmers take for granted such as bank loans, technical supports and land rights can boost the income of some of the poorest nations.

Global rice consumption remains enormous, propelled by both population and economic growth in Africa and other continents. Rice is one of the most valuable cereal crops cultivated and consumed all over the world (Ojo, Ogundeji, Babu and Alimi, 2020). The importance of rice production cannot be underestimated. Rice is a one of the leading food crops beside

maize and wheat that is consumed by virtually all families. Production of rice farming is vital for food security, especially in the quest to meet food demands from population growth and economic development (Dobermann, Nelson, Beever, Bergvinson, Crowley and Denning, 2013; Sasima and Suneeporn, 2017).

Nigeria has enormous potential for increase food production that is hinged on its human strength, abundant natural and material resources, good climate, vast arable and fertile land and rainfall which provide one of the best environments for people engaged in agriculture (Dauda, Musa and Ahmad, 2012; Nigeria Bureau of Statistics 2012; United Kingdom Department for International Development, UKAID, 2012). Any type of crops can be cultivated in Nigeria including rice. Nigeria is ranked as one of the leading consumers and a major importer of rice in Africa (United Nations Food and Agricultural Organisation, UNFAD, 2016). Rice is a crop that can be grown in all the States of the federation and Federal Capital Territory although productivity varies from State to State. The prevalent types of rice production systems in Nigeria include rain fed upland, rain fed, lowland, irrigated lowland, deep water floating and mangrove swamp (Federal Ministry of Agriculture and Rural Development, FMARD, 2011). Moreover, most rice farmers in Nigeria are small-scale farmers. It is believed that about 90% of domestic rice production comes from resource-poor and weakly organized smallholders (United State Agency for International Development 2009; Cadoni and Angelucci, 2013).

Reports have indicated that significant progress has been recorded in Nigeria's rice production in the past six years which has made Nigerian competitive among comity of world rice producers. For instance, data shows that between 2014 and 2019 Nigeria maintained top spot position among rice producers in Africa. Between 2014 and 2016 productions were 6.0,

6.2 and 7.5 million metric tonnes. In addition, in 2017 Nigeria Production figure fell to 6.6 MMT, but increased in 2018 to 6.81MMT. Again in 2019, it dropped to 5.1MMT and further to 5.04 in 2020 MMT. In all, record indicate an increased average rice production of about 7 metric tonnes for the past 6 years especially following government recent in order to encourage food self- sufficiency in rice production (FAO, 2020; United State Department of Agriculture, USDA, 2020). The over dependence on the importation of food products such as rice has the tendency of not only stimulating domestic inflation, but also hurt Nigerian farmers, displacing local production and fuelling rising unemployment (Federal Ministry of Agriculture and Rural Development, 2012). Thus any crisis that occurs in the international food market will be greatly felt in the country since it is neither in the pole position of food production nor exporting countries of the world (Olomola, 2015;UNFAO, 2017). In the wake of declining oil prices, the Federal Government through the Central Bank of Nigeria (CBN) in 2015 placed a ban on importation of 41 items including rice from accessing forex in the official foreign exchange market, a measure it argued was to help conserve the nation's foreign reserves and encourage local production, though cases of rice smuggling still exist to meet the deficit in consumption (Foyeku, 2018).

So many programmes were adopted in the past to encourage food production including rice in Nigeria and Plateau State is no exception. Among which are; United Nations Development Programme (UNDP), National Food Research Agency (NFRA), The Agricultural Development Projects (ADPs), International Fund for Agricultural Development (IFAD), National Special Programme for Food Security, (NSPFS), Multi-National New Rice for Africa (NERICA), Agricultural Transformation Agenda, Central Bank Anchor Borrower Schemes among others. However, Elemi, Angba, Ajah, Agube, and Idiku, (2015) observed that in as much as much of these programmes increased food production marginally, they

were truncated by succeeding administration who refused to continue where their predecessors stopped, forgetting that government is continuum.

One of the agricultural programmes that could have revolutionalised the agricultural sector was the Agricultural Transformation Agenda. According to Izuogu and Atasie (2015) the Agricultural Transformation is defined as a doubling of production, processing, and marketing of principal arable and tree crops, aquaculture, and livestock. The vision in the transformation strategy is to achieve a hunger-free Nigeria through an agricultural sector that drives income growth, accelerates achievement of food and nutritional security, generates employment and transforms Nigeria into a leading player in global food markets to grow wealth for millions of farmers. In order to achieve this vision, the usual approach to agricultural sector would change.

Agricultural transformation model in China, Vietnam, Brazil and Thailand has led to a dramatic growth in their agricultural sectors in the early 1940s with annual growth rates of 2.6, 2.0, 1.8 and 1.4 % respectively. In effect, a significant impact on poverty reduction was experienced. In Africa, Malawi made a positive stride toward self-sufficient in food production within one year through the replication of the agricultural transformation model (FGN, 2011). Comparatively, the Nigeria situation left much to be desired. ATA and other past agricultural programmes did not yield the much desired results. Even with so much rues on the establishment of these agricultural programmes, scholars (Onyeneke,2017; Adawo, 2011; Onyenekenwa, 2011) have noted with dismayed that none of the above mentioned programmes could be described as wholly successful and failed to live to their lofty expectations. Unfortunately, productivity still has not been able to meet the increasing

demand because a large proportion of the Nigerian population depends on rice for their food needs (Onyeneke, 2017).

A lot need to be done to improve the potential of the small- scale farmers in the face of poor access to modern inputs and credit, poor infrastructure, inadequate research and extension services (Akinola *et al.*, 2013). There is no gainsaying the fact that limited capacity of the Nigerian rice farmers to meet the domestic demand has been attributed to several factors; notable among them is the declining productivity due to low utilization of agricultural knowledge and information by the small scale farmers (Pham, 2016). This has no doubt made Nigeria as one of the leading consumers and a major importer of rice in Africa.

The Small-scale farmers or peasant farmers have been hindered by shortage of manpower, facilities, inputs, access to land, credits among others in their effort to increase production (Mohammed and Onwurah, 2016). Other reasons that contributed to the failures of most agricultural programmes in the past as alluded to by scholars (Adawo, 2011; Onyenekenwa, 2011; and FGN, 2011) are top-down approach, failed development visions, abandoned development programmes and policy summersault, low productivity, low level of private sector investment, non-competitiveness, inadequate funding, shortage of skilled manpower, low investment in research and development, poor development of value chain and low value addition, poor regulatory environment, poor quality of goods and services and poor state of physical infrastructure, policy instability and discontinuity, low level of technology, paucity and poor flow of information and high cost of doing business are common problems militating against Nigeria's agriculture.

The need to give agriculture a boost necessitated the establishment of the Agricultural Services and Training Centres (ASTC) with the ultimate goal of transforming the agricultural sector in Plateau State from subsistence level to modernized and commercially oriented agriculture. The availability of sustainable agricultural technologies for Nigerian resource-poor rice farmers is important due to the country's effort at achieving food security (Adetimehin, Okunlola and Owolabi, 2018). This was done to create a self-sustained agricultural growth so as to provide food and raw materials for agro-based industries, strengthen the livelihood of small-scale farmers through increased production and value added by more effective marketing of their farm products and provide diverse technical training for staff and farmers by upgrading their knowledge so as to raise their agricultural productivity and improve quality/value for their produce (ASTC, 2012).

The ASTC was created to introduce principles of commercial agriculture in a rural subsistence agricultural setting through the provision of comprehensive, proven and state-of-the-art agricultural services to the farming community in Plateau State. Abdulsalam (2016) noted that as an attempt at addressing these problems and give agriculture a boost in Plateau state, made the then Governor, Jonah David Jang to enter into a public and private agreement between the Plateau State Government and SEC Equipment and Communications Nig. Ltd, signed on 29th May 2008. It was saddled with the task of raising agricultural production, boosting yield and improving crops quality of produce through mechanical agricultural services and training for the welfare of farmers and the entire population (ASTC Bulletin, 2012).

Plateau state has been encouraging farmers to go into rice production in addition to other cereal crops. Agricultural Services and Training Centres (ASTC) is one of the various

agencies with the ultimate goal of transforming the agricultural sector in Plateau State from subsistence level to modernized and commercially oriented agriculture. Agriculture Services and Training Centres (ASTC) is a unique concept developed by Green-2000 Limited for supporting small-scale farmers and improving their productivity (ASTC, 2012). Finintell (2013) observed that unlocking the growth potential of agriculture in Nigeria, lies in improving the lot of small-scale farmers. This can be done through empowering millions of small-scale farmers who can have the opportunity to millions of hectares will ensure they use appropriate inputs, necessary supports and sufficient financing to increase productivities through identifying and working on the problems that affects the utilization of agricultural inputs (Obidike, 2011).

The utilization of recommended agricultural services by the small-scale farmers is pertinent to addressing the ever growing population and its effects on food consumption. Improved production techniques and market-oriented strategies will no doubt assist farmers generate a sustainable source of income while supplying agricultural produce to satisfy the world's increasing demand for food (Njeru and Mwangi, 2015). Consequently, it was against this background that the research examined the factors influencing the utilisation of agricultural services and training centres by small scale rice farmers in Plateau state.

1.2 Statement of the Problem

Rice is one of the staple foods consumed by large proportion of both urban and rural Nigerian population. Significant proportions of the Nigerian population depends on rice for their food needs and energy (Onyeneke, 2017). Nigeria is reported to be the 14^{th} largest producer of rice (paddy) in the world and first in Africa with an annual output of 5,040,000 million metric tonnes for year 2020 which translate to an average production volume of 7 million metric tonnes for a period of 2014-2020 (Ayelegun, Ajewole and Adeyanju, 2018; USDA 2020).

China, India, Bangladesh, Indonesia, Vietnam and Thailand formed the first six highest producers in the world according to world rice Data Atlas of the United State Development Agency for 2020/2021.

Annual demand and supply of rice has been attributed to low productivity of about 3 tonnes per hectare compared to over 6 tonnes per hectare in other countries of the world such as China, India, Thailand, Indonesia and Vietnam (Adeyemi, *et al*., 2020; USDA, 2020). This has been attributed to inappropriate use of improved technologies, inappropriate crop and land management practices, farmers' socioeconomic factors, gender differentials in the accessibility to farm resources and in particular, the inefficient use of production resources (Nsoanya, 2011). Sultana *et al* (2015) analysed the drivers of increased rice production in five (5) Sub-Saharan African countries, including Nigeria, low rice production and attributed poor adoption of modern technology by farmers is a constraint. This was further reinforced by Pham (2016) which observed that only 7% in rice production is mechanised. The remaining activities are facilitated by draft animals and manual processes, accounting for 15% and 78% respectively.

However, studies (Saka and Lawal 2013; Awotide, Karimov and Diagne, 2016; Ojo *et al*., 2020, Adeyemi, Omotara, Adeyemo and Oludele, 2020) submitted that farmers had made appreciably progress in rice production using intervention programmes that promote the use of improved technology for enhanced productivity and poverty reduction in Nigeria. Rice farmers have also benefitted from the productive technologies in Plateau State. Agricultural services and training centres is a child of necessity established in 2008 to address the low farm production and to enhance the livelihood of farmers in Plateau state and environs (Wash, 2016).

The ASTC renders mechanized services including tillage, planting, spraying, cultivation and weeding, and harvesting for farmers in the area. Other services provided to its members include training, technical support and services which can lead to remarkable improvements in the agricultural profitability and development. The company's effort towards agricultural service provision was successful in Israel, India, USA, and some parts of Africa including Plateau State. Other ASTC sub-stations outside the Plateau can be found in Saminaka, Jere, Gurara, and Samaru Kaduna State.

The process of utilizing agricultural services has the tendency of leading to agricultural growth for farmers and is critical for Africa's productivity, profitability and increased livelihood for her people (Abdullahi, Atala, Akpoko and Sanni, 2015). These innovations are regarded as a new ideas, method, practice, or techniques which influence active achievement, sustained increased in farm productivity and income (Umeh and Onyeneke, 2017). This is even more important as population increases, along with rural to urban migration, ensuring food security based on employing all technology to outstrip the shortfall in local rice production in order to address inflation and food insecurity in Nigeria (Okechukwu, 2019; Oladimeji, 2017).

In Plateau State, it has been observed that accessibility and utilization of ASTC services and programmes by farmers has been limited to about 30% even as over 70% of her population are engaged in agriculture (Wash, 2016). Thus, little is known on factors influencing the utilization of ASTC programme by Small-scale rice farmers in Plateau State. Thus, the level of utilisation of ASTC by rice farmers is determined by various factors for which these technological inventions are utilised. This is because mere provision of agricultural technologies may not guarantee its effective adoption because a host of social, economic and

psychological factors influence the small-scale farmers (Akande in Uwandu,Thomas and Okoro, 2018).

Rice farming is an interesting area of focus for both federal and State government in curbing food insecurity. Hence, it is pertinent to further investigate the intensity or extent of use of improved agricultural technology in addressing technology gap by rice farmers given the numerous opportunities provided by ASTC for investment across the agricultural value chain. This became a necessary to beam searchlight on the factors influencing the utilization of ASTC programme by Small-scale rice farmers in Plateau State to ascertain if the objectives for which the programme were established have been achieved. Consequently, it was against this background that this research intended to answer the following questions:

i. What are the socio-economic/institutional characteristics of small-scale rice farmers in Plateau State?
ii. What is the level of utilization of ASTC services by participating small-scale rice farmers?
iii. What are the factors influencing small-scale rice farmers' utilization of ASTC services?
iv. What are the effects of the ASTC services on the income of small-scale rice farmers in the study area?
v. What are the constraints to the effective utilization of ASTC services by small-scale rice farmers' in the study area?

1.3 Objectives of the Study

The broad objective of this study was to examine the Factors influencing utilization of ASTC services by small –scale rice farmers in selected LGAs Plateau State. The specific objectives are to:

i. describe the Socio-economic/institutional characteristics of small-scale rice farmers' in the study area;
ii. assess the level of utilization of ASTC services by participating small-scale rice farmers;
iii. examine the factors influencing small-scale rice farmers' utilization of ASTC services;
iv. determine the effects of ASTC services on the income of small-scale rice farmers;
v. identify the constraints to effective utilization of ASTC services by small-scale rice farmers;

1.4 Justification of the Study

The study will be significant to small-scale farmers, Agricultural Services and Training Centres, Plateau state Government, Federal government, research institutes and other well meaning public and private individuals who want to invest in agriculture in the state.

The study will examine how effective has the Agricultural services provided by the ASTC especially to the small-scale farmers. Farmers are in the epicentre of all agricultural activities, equipping them with the necessary inputs will assist them to make effective use of improve technology at the right quality, quantity and price. The study is set to investigate their perception, factors influencing farmers' level of utilization and constraints in utilizing ASTC services.

Again, the study will served as the key to unlocking the growth potential of agriculture in the state and by extension, Nigeria. Since agriculture is the mainstay of over 80% of the rural population, there is the need to ensure that all forms of constraints militating against the effective utilization of necessary input be demystified for the small-scale farmers who are most times disadvantaged by finance and other socio-economic variables.

Also, the study unravelled some of the constraints militating against the effective utilization of ASTC services by small-scale farmers in the study area and proffer realistic measures to ameliorating the challenges facing the use of productive resources.

In unravelling some of the factors influencing utilization of ASTC services by farmers, the study served as model for stakeholders to identify new roles, clearly defined tasks and mandates, under the conditions to co-operate, share experience and exchange information on the prospects and problems emanating from the use of their services. It will provide useful framework for evaluating ASTC services in relation to whether the objectives for which it was set up is being achieved by the State.

The research work is driven by the desire to make contribution to growing knowledge and efforts at revamping and resuscitating agriculture. Prospecting researchers would find the study useful for further study and information.

The findings will also be valuable in ensuring proper linkages and adequate agricultural extension service delivery to propel small-scale farmers to see their farming activity in profit oriented and economic terms, and not just laborious activities that social, economic and environment condition has imposed on them. This will help them to be active participants and

make the best use of existing program that would uplift their productivity, income and level of living.

1.5 Hypotheses of the Study

$H0_1$. Socio-economic/institutional characteristics of small-scale farmers' have no significance influence on the level of utilization of ASTC Services.

$H0_2$. There is no significant effect of ASTC services on the income of small-scale rice farmers in the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

For a meaningful study, the importance of relevant literature on the subject matter cannot be overemphasized. Review of such works usually entails obtaining useful references or sources. Hence, the purpose of this review is to ascertain what is known as regards factors influencing utilization of Agricultural Services and Training Centre by Small Scale rice Farmers. This section reviewed some empirical works of scholars and writers relevant to the study as touching the utilization to farmers as well as interrogates farmers' experiences on factors influencing the utilization of agricultural services in Plateau, Nigeria Africa at large and other continents of the world.

2.2 An Overview of Agricultural Extension Services in Nigeria

Agriculture over the millennia has evolved through series of activities ranging from hunting and gathering, domestication of plants and animals, subsistence farming and now commercial agro-entrepreneurship (Gadzama, Saddiq, Dariya, Aliyu and Saleh, 2017). It is the watershed of most civilization in countries along the Indus Valley, Nile Valley, the Fertile Crescent and China upon which plants and animals were domesticated. Man in a quest for food security, knowledge, development, experimentation, survival and dominance of the environment.

The African agriculture is believed to have a great potential for the small scale farmers given its vast natural resource when they are properly harnessed. This can be achieved by providing access and use information, inputs, technologies and training in order to increase agricultural skills and practices, potentials, capacity to innovate, manipulate and address different rural development challenges through training programs, improved management and

organizational techniques (Birner, David, Pender, Nkonya, Ponniah, Ekboir, Mbabu, Spielman, Horna and Cohen 2009; Christoplos, 2010).

Efforts at solving these challenges by African leaders have been greatly hindered, despite commitment by African leaders to invest 10% their countries' annual budgets to agriculture in order to achieve an annual 6% agricultural productivity growth (African Food and Agricultural Policy Platform, AGRA, 2012; Adofu, Abula and Agama, 2012). Other reasons being adduced range from the continent's very diverse agro-ecologies; it's highly degraded soils; its reliance on rain-fed agriculture; the limited use of modern varieties and fertilizers; the largely undeveloped state of Africa's rural infrastructure; a lack of access to markets; and a history of poor macroeconomic policies and low public investment in agriculture (AGRA, 2012).

Some of the development programmes initiated included, Agricultural Development Projects (ADPs) in 1973, Operation Feed the Nation (OFN) in 1976, Green Revolution (GR) in 1980, Directorate for Food, Roads and Rural Infrastructure (DFRRI) in 1986, National Agricultural Land Development Authority (NALDA) in 1992, the National Fadama Development Project, NFDP, National Special Programme for Food Security, in 2003 and the Agricultural Transformation Agenda in 2011. Agricultural Transformation is defined as a doubling of production, processing, and marketing of principal agricultural products. The vision in the transformation strategy is to achieve a hunger-free Nigeria through an agricultural sector that drives income growth, accelerates achievement of food and nutritional security, generates employment and transforms Nigeria into a leading player in global food markets to grow wealth for millions of farmers. In order to achieve this vision, the usual approach to agricultural sector would change.

Agricultural transformation in China, Vietnam, Brazil and Thailand has led to a dramatic growth in their agricultural sectors over the last three decades with annual growth rates of 2.6, 2.0, 1.8 and 1.4 % respectively. In effect, a significant impact on poverty reduction was experienced. ATA was targeted at achieving self-sufficient in food production like Malawi within one year by focusing on an agricultural transformation (FGN, 2011).

Plateau state was not left out as it also established some interventions to cater for the need of the farmers at that time. Some of the supportive programmes include but not limited to the Panyam Fish Farm project, Kuru Livestock Complex, Bokkos Farm Project, Longkat Irrigation Scheme, Sabon Gida Gagnom Farm Project, Plateau Agricultural Development programme (PADP), Plateau Agricultural Mechanization Services Corporation (PAMSCO). All these programmes were aimed at contributing to agricultural sustainability, livelihood improvement and wellbeing of populations in rural areas (Global Forum for Rural Advisory Services, GFRAS 2010; Meizen-Dick, Quisumbing, Behrman, Biermatr-Jenzano,Wilde, Noordeloos, Ragasa, and Beintema, 2012).

However, with the huge capital injected to these various programmes, results have left much to be desired as there was and still no significant improvement noticed in the agricultural sector. Alluding to these glaring failures, Adawo (2011); Onyenekenwa (2011) and FGN (2011) emphasized that chief among these constraints include a top-down approach, failed development visions, abandoned development programmes and policy summersault, low productivity, low level of private sector investment, non-competitiveness, inadequate funding, shortage of skilled manpower, low investment in research and development, poor development of value chain and low value addition, poor regulatory environment, poor quality of goods and services and poor state of physical infrastructure, policy instability and

discontinuity, low level of technology, paucity and poor flow of information and high cost of doing business are common problems militating against Nigeria's agriculture.

2.3 Conceptualization of Small-Scale Farming in Nigeria

The small –scale farm farmers are often conceptualised as having small holdings, land scarcity, little use of input, low financial status, and subsistence form of production (whether business or own consumption) in most developing countries. The Small scale farmers have always played dominant role in agricultural productivity in Nigeria but their productivity and growth are hindered by limited use to services and training facilities (Odoemenem and Obinne, 2010). In other words, the concept of small-scale farmers arises as a classification based on the size of the landholding, the purpose of production which may be defined by home consumption or market and income levels of the farmer. Small-scale farmers are also determined according to their farm size (Deininger and Byerlee, in Benjamin, Timo, Stefan and Jukka, 2015).

There are about 500 million small-scale farms worldwide, providing livelihoods for more than 2 billion people according to Nwanze (2011). These small farms produce about 80% of the food consumed in Asia and sub-Saharan Africa, showing the importance of the small farm sector to agricultural and economic development in many developing countries.

Nevertheless, small-scale farmers operate in different conditions which vary across geographic regions; whether such farmers dwell in an urban or rural setting and or whether in a developed or a developing country. Obiechina, (2012) also revealed that one of the factors militating against the efficiency of smallholder farmers is lack of market which impoverishes and discourages them from vigorous production. In addition, the author stressed that the main

reason for poor performances of smallholder farmers is due to lack of commitment by all tiers of governments to implement the right policies.

The small-scale farming concept is often used synonymously with small holder. Mgbenka and Mbah (2016) posit that the smallholder farmers comprised of about 80% farmers who produce a substantial percentage of the food consumed by Nigerians. In the same vein, Agriculture, Forestry and Fisheries (AF and F, 2012) describes the small-scale farmers to mean 'smallholder', 'resource poor' and sometimes 'peasant farmer' owning small-based plots of land on which they grow subsistence crops and one or two cash crops relying almost exclusively on family labour. Also, according to Federal Office of Statistics in Mgbenka and Mbah (2016), smallholder farmers are farmers whose production capacity falls between 0.1 and 4.99 hectares holding. It therefore means that small-scale farmers comprise farmers who cultivate piece of land less than 5 hectares for production of crops and animals.

2.4 Agricultural Services and Training Centres (ASTCs) Project and Small-Scale Farming in Plateau State

The unique weather in plateau state has afforded farmers the opportunity to engage in the productions of wide range of products like tomatoes, peppers, egg plants, cucumber, melons, lettuce and cabbage. The Agricultural Services and Training Centres (ASTCs) was set up by the Plateau State Government on 29th May 2008 through a Public Private Partnership with an Israeli company to create self-sustaining agricultural growth, to provide food for the population and to give added value to produce. This vision was to make plateau state a self-sustaining agricultural state with increased farmers' productivity, income and to attain a self–sufficient food producing state via sophisticated agricultural practices. The mission was to apply modern and scientific method of management and production, training and marketing

as well as taking services nearer to the farmers at the grass root level (district and villages) (Bulletin, 2012).

ASTC is a well branded and well established organization, engaged in promoting agriculture not just in Plateau but in Nigeria at large. ASTC has focused on farmers with farmlands located within Plateau State, and has expanded its tractor hire services to neighbouring states. It has vast opportunities for clients with about 70% of plateau State's population (3.2 million are rural dwellers) engaged in agricultural related activities (Bulletin, 2016). ASTC was saddled with the responsibility of which accelerating agricultural productivity by providing diverse kind of services and training to staff members and farmers. ASTC established three farm comprehensive centres in the three senatorial districts of the State, which were Kassa and Vom in Northern zone; Mangu in central zone and Shendam in the Southern zone (Abdulsalam, 2016).

Goals

The specific goals of ASTC are the transformation of the agricultural sector in the state from subsistence level to modernized and commercially oriented agriculture, Creation of a self-sustained agricultural growth so as to provide food and raw materials for agro-based industries, strengthening the livelihood of small-scale farmers through increased production and value added by more effective marketing of their farm products and Providing a diverse technical training for staff and farmers by upgrading their knowledge so as to raise their agricultural productivity and improve quality/value for their produce.

ASTC Services

The scope of ASTC services as evaluated in articles (ASTC Bulletin, 2012; Wash, 2016) to include;

Soil laboratories analysis: ASTC provides comprehensive soil testing services for farmers this will helps to accurately assess and precisely manage soil fertility, reducing both the cost and negative environmental impact of fertilizers yet still improving your crop yields.

Tractor hiring services: Owing to farmers' limited financial resources, the division sets to provide a flexible arrangement for farmers in order to have access to tractors in order to actualize their dreams. Tractor section is designed where large, intermediate and small tractors can be rented or leased to farmers to assist in cultivating farmland. Tractor maintenance services are also embarked upon by the farmers where necessary.

Cultivation services: all cultivation activities within the scope of the project are carried out by ASTC to bring about increase productivity

Spraying: Technology for spaying of chemicals such as agrochemicals and fertilizers equipped with the necessary precautions to prevent environmental and health hazards.

Harvesting: Harvesters of varying specifications are available to ease the stress accompanying human energy. It makes harvesting over a vast area easier and saves time

Agric Input Supply (seeds, fertilizers, chemicals): Improved Seeds and seedlings of maize, agro-chemical, fertilizers, tomato, cabbage, and pepper that are tested are made available for farmers. These are very important at boosting the quality of produce that would be harvested by farmers in Plateau State. This improved seeds and seedlings are usually able to tackle the problem of substandard and disease prone seedlings. Seedlings of different varieties are supplied to farmers at affordable rate. Fertilizers of high quality based on the residual nutrients found after soil testing, the expected yield and the type of fertilizer materials

available. The farmer should strive to obtain fertilizer recommendations based on the analyses of soil samples

Surveys: survey of land by soil experts to ascertain the acidity, alkalinity, texture and structure of the land to be used for farming and also render advice on how best to put it into productive use.

Training and seminars: this is the crust of extension service component that involves the dissemination of vital information to farmers on new innovation in agriculture in order to boost agriculture. Calendars and schedules on training and seminars are conducted for farmers based on districts and villages level at a given period of time deem fit by the organization

Warehouse: farmers have had bumper harvest and don't have where to store their products can resort to ASTC for safe keeping until they are needed to avoid wastage.

Marketing: ASTC have over the years engage in linking farmers with markets or buyers who could not access the farmers on a particular crop. They served as intermediary or middlemen to farmers who were able to meet specification or standard required by the buyers through ASTC. This provides a highly structured marketing channel for farmers at any seasons of the year.

Empirical Studies on ASTC are limited to studies by Mommoh *et al*., (2018) on the Impact of Agricultural Services and Training Centres on livelihood of tomato farmers in Plateau State. Most of the services are still available but it has been constrained by neglect due to change in government regarding counterpart funding from the state.

2.5 Rice Production by Small Scale Farmers

The demand for rice has grown significantly over the last 40 years due to changing consumer dietary patterns and population growth. Rice is practiced over a wide range of agro-ecological

zones with very different climate conditions and growing environment. Rice is one of the most important food commodities in West Africa (Sahel, 2015). Rice is grown in all the States of the federation and Federal Capital Territory though production varies from State to State and the prevalent types of rice production systems in Nigeria include rainfed upland, rainfed lowland, irrigated lowland, deep water floating and mangrove swamp (FMARD, 2011).

The growth recorded in rice production has been facilitated by government policies towards achieving self-sufficiency in rice production. Empirical evidence suggests that mechanisation promotes rice production. According to a study conducted by Sultana *et al* (2015) which analysed the drivers of increased rice production in five (5) Sub-Saharan African countries, including Nigeria, farmers who ploughed with a tractor increased their production by 51% relative to those who utilised manual methods. According to Pham (2016), only 7% in rice production is mechanised. The remaining activities are facilitated by draft animals and manual processes, accounting for 15% and 78% respectively. This is even more important as population increases, along with rural to urban migration, ensuring food security in key staples becomes critical.

Rice farmers are bedeviled by inability to adopt production practices, lack adoption of innovative labour and cost saving technologies and are skewed towards subsistence level (Hodson and Emmanuel, 2018). Thus, investment by using optimal recommended inputs to maximize productivity is still believed to be low. Future global food security and the precarious livelihoods of the world's poor will no doubt depend on maintaining reliable growth in rice production and productivity (Ning, Mingsheng, Fusuo, Peter, Jianchang ,

Jianliang, Shiwei,Xiaojun, Qiyuan,Jianwei, Xuhua,Yixiang Shihua, Rongfeng and Achim, 2015).

2.6 Empirical Studies on the Utilization of Agricultural Extension Programmes by Farmers

The socio-demographic characteristics of farmers play a very important role in the adoption process and participation of farmers in any agricultural technology, in the sense that they influence their willingness to accept a particular change which could contribute significantly in raising farm productivity and eventually their standard of living. A number of empirical works abound within and outside the borders of Nigeria on factors influencing utilization of agricultural extension programmes by small-scale farmers. Few will be considered briefly along the line of socio-economic and institutional variables. Some of the most commonly assessed socio-economic variables include age, sex, marital status, level of education, farm size, and household size of the farmers.

Age is viewed as one of the socio-economic features important to describe a farmer's chronological years relevant to the sample and the population. For example, in a study by Ajah and Nmadu, (2012) on Maize Farmers in Abuja, it was found that the mean age of the farmers was thirty-nine (39) years which indicate that the farmers were still active and dynamic enough to undertake farming. As age increases, the willingness to pay for this agricultural information delivery technologies decreases. This means that older farmers were less willing to get information than younger ones. In alluding to this, Omotesho, Fakayode and Tariya (2012) observed that age of the farmers' varies among female vegetable Farmers who use Organic Manure in Cross River State, Nigeria. They held that young farmers are believed to be more flexible in their decision to adopt new practices that would improve their farm production and welfare.

Further study by Kolade and Harpham (2014) found that older farmers are, in general, less likely to adopt innovations than their younger counterparts in technological uptake in South West Nigeria. Similarly, Jiriko, Obianuko and Jiriko (2015) in the analysis use of Information Communication Technology (ICT) by Fish Farmers in Kaduna, asserts that young age group seems agile and responsive as they are ready to take risk in fish farming for their socio - economic development. In the same vein, Filli, Onu, Adebayo and Tizhe (2015) examined 'the Factors Influencing Credits Access among Small Scale Fish Farmers in Adamawa State, Nigeria and found that there was the probability for older fish farmers' accessing credit facilities than their younger counterparts. This was because as the farmers grew older, their family responsibilities increased than their younger counterparts.

On Educational qualification, there is no gainsaying the fact that education also serves as a determinant or factor that influence utilization of agricultural services. Education influences farmer's information utilization. Agbamu (2008) believed that educated people are expected to perform certain jobs and functions with higher efficiency and are also more likely to utilize information and new technologies in shorter period of time than uneducated people.

Gender and sex are considered another factor that limits access to and utilization of agricultural services. Adam (2018) posits that sex plays an important role in the agricultural sector where both men and women are involved in the agricultural activities, including agro-inputs supply business that complements each other. A study on the Influence of Sources of Agricultural Information by Maize Farmers in Southern Borno, Nigeria, Bawa, Ani and Bzugu (2014) reveals that majority (79%) of the respondents were males while 21% of them were females. However, a contrary finding by Ekenta, Akinola and Usman (2016) from a

study on the role of gender in farming in Kabba Bonu observed that more of the younger women from 20 – 39 years (71.66%) were more engaged in agricultural activities in the study area against the younger males (53.33%). Moreso, finding by Obidike (2011) shows that male respondents (69.8%) were more involved in farming activities than women (30.2%) in Nsukka because of the tedious and onerous effort that requires enormous strength and energy which some women cannot engaged. Women are less likely to participate because they have limited time to access or utilize available information due to pressure of household responsibilities. Women in particular are by-passed in the transfer of improved agricultural technologies assuming that they will get the information through their husbands.

Kudi, Bolaji, Akinola and Nasa'i (2010) have observed in the Analysis of Adoption of improved Maize among Farmers in Kwara State Nigeria, a varying relationship among household size, level of education, farming experience, access to credit and yield of the improved maize varieties in the study area. The household size was significant at 5% level of probability with negative coefficient which indicates that there is a negative relationship between household size and adoption of improved maize technology. It was revealed that the larger the family size, the lower the level of adoption of improved maize varieties.

Marital status has implication for utilization of agricultural information and technologies (Idrisa, 2009). Igboji, Anozie and Chinaza (2015), found that married respondents have a responsibility of ensuring food security for their household members thus engage more in farming activities. This could be due to the fact that married men and women have greater household responsibilities and seek various opportunities to provide food such to ensure household food security for their families. Ofuoku, Emah and Itedjere (2008) found in a study

how the level of education of farmers has significant relationship with information utilization because educational level influences information utilization. Buttressing further, Chikezie, Omokore, Akpoko and Chikaire (2012) in another study on Factors Influencing Rural Youth Adoption of Cassava Recommended Production Practices in Onu-Imo Local Government Area of Imo State, Nigeria, revealed that education had positive implication as it hasten the adoption of farm technologies among farmers in the study area.

In a study however by Atedhor (2015) on Strategies for Agricultural Adaptation to Climate Change in Kogi State, Nigeria observed a fairly high proportion of respondents with no formal education that may serve as an indicator of agricultural vulnerability and a low capacity to adapt to climate change in the study area. In the same vein, Omonijo, Toluwase, Oludayo and Uche (2014) revealed from a study on Impacts of Agricultural Development Programme (ADP) on Rural Dwellers of Isan-Ekiti in Nigeria indicated the educational background of respondents, in which illiterates represent the majority. With regards to farming experiences, Oyeyinka, Bello and Ayinde (2014) found in a study on utilization of Farm –Radio programme in Oyo by farmer concluded that majority of the respondents (42.7%) had farming experience of 11-15years while a few (8.0%) had a farming experience of 1-5years.

In terms of farm size, Fawole and Tijani (2013) posited in a study in Ogun State where fairly large percentage (44.7%) cultivates 1-2 hectares, 28.0% cultivating 3-4 hectares while 5-6 hectares were cultivated by few (17.4%) respondents. To them the respondents can be regarded as small scale farmers since their farm size ranges between 1-6 hectares. Regarding financial status of the farmer, some scholars observed such as Ekweh in Ulumba and Rahji (2014) argued income of the farmer was at the base of adoption rate. On farm or off-farm

income accruing to the farmer is one of the important factors determining the adoption of agricultural programmes. The income obtained from off-farm activities helps farmers to purchase farm outputs. Some past empirical studies shows that the influence of off-farm income on adoption varies from one study to the other. Therefore, income can make positive contribution to households' adoption of improved agricultural technologies which could result in increase in yield as well as accruable income.

Institutional factors are variables that are external to the respondents and show various formal and organizations interacting together. The factors facilitating and enhancing the utilization of agricultural programme such as credit, farmers' co-operatives, extension visits, proximity, and market all tend to enhance farmers' adoption of extension programmes. Credit has strong and significant influence in determining use of combined packages depending on the production type. Credit according to Ekong in Elemi *et al*., (2015) is a very important factor that is needed to acquire or develop farm enterprise therefore its availability could determine the extent of production capacity. It helps in alleviating current financial constraints enhancing the use of technology packages correspondingly.

Fawole and Tijani (2013) observed that there was a probability of Institutional factors for older fish farmers' to have access to credit than the younger counterparts. This was because farmers that were older by age were more responsible and secured; having family with definite address than the younger counterparts. Similarly, Asogwa, Abu and Ocheche (2014) reveals that majority (69.23%) of the farmers had access to agricultural credit in Benue State. However, further study also shows that 82.22% of the farmers opined that their level of access to credit in terms of quality and quantum was low. This is evident as majority (42.22%) of the farmers accessed amount of credit ranging between 5,000 and less than

50,000 Naira, while 38.89% of the respondents accessed between 50,000 and less than 100,000 Naira of credit. This suggests that the credit facility available to rice farmers in the study area was small. A study by World Bank (2013) attributed sex and gender as determinant of access to credit. It found that women in developing countries receive less than 10% of available credit to expand trade, such as agro-inputs business. This is mainly due to cultural constraints and lack of collateral in rural areas.

It is a known fact in agriculture that belonging to farmers co-operative has been discovered as a bargaining tool to enhance farmers' productivity to acquisition of inputs and capital from agricultural programme. Asogwa, *et al*., (2014) observed that majority (50.77%) of the farmers were not members of cooperative society, while 49.23% were members of cooperative society. In another finding, Kolade and Harpham (2014) discovered that Cooperative membership has a high impact compared to other socioeconomic factors such as land access, gender, and educational status in the uptake of technologies in Southwest, Nigeria.

In a study by Bawa *et al.,* (2014), it was revealed that all the farmers were aware of improved varieties and important technologies made available to beneficiaries through agricultural extension workers who constitute the most important source of information, followed by friends and neighbours, contact farmers, radio, television, news papers and then posters/pamphlets and leaflets. Further results ranked Extension agents, contact farmers, and friends and neighbours were the most sources of information used by the respondents.

Further, Onyeneke (2017) observed that rice farmers in Imo State adopted improved rice technologies such as improved rice varieties, fertilizer application, agrochemicals and optimum seed rate in planting. The study used descriptive statistics such as simple

percentages and inferential statistics like chi-square and logistic regression. Data was collected using the questionnaire. It was recommended that programs should be designed to improve these socioeconomic characteristics of rice farmers in the area. This will go a long way as to increasing the adoption of improved technologies in the area. Farmers should receive more training and knowledge about improved rice technologies through steady flow of information by the extension agents. Rice processing industries should be established by private organizations to encourage commercial farming to support adoption of more improved rice technologies.

Also, another study by Gushit, Ekanem, Adamu, Abayeh and Malan (2013) in analyzing the Utilization pattern and risk assessment of herbicides usage by farmers, marketers and agricultural extension workers (AEWs) in Plateau pointed that the technology was gaining wide acceptance as it has helped in increasing food production within the study area. However, it was noted that low level of literacy and lack of technical know-how on the proper usage of the herbicides resulted in indiscriminate use of the herbicides. Data was collected through structured questionnaire and interview methods. Descriptive statistics mainly was used for analyses. It was recommended that public health institution should as much as possible intervene to address cases of indiscriminate application of herbicides so as to avoid any risk to farmers health and safety.

Similarly, Girei, Saingbe, Bitrus and Bassey (2017) on the impact of Fadama III Project on the Income Level of Beneficiary Farmers in Plateau revealed that the programme made appreciable impact on the average income of Fadama III user households based on their different enterprise activities. It has also been able to determine the proportion of the Fadama User households attaining the observed average income, the real income

of Fadama III beneficiaries increased by about 27.49% (from N61,020 to N84,160.00) as a result of participation in the project. Analytical tools such as simple percentages and double difference statistics were employed for the study. It was recommended that the project be allowed to outlive the government that established it, those in charge of disposing the inputs should make them available on time, awareness be created to encourage further participation and government should make available better service providers.

Again, Mommoh, Akpoko and Akinola (2018) found a positive significant impact on output, income and level of living among ASTCs tomato farmers in Plateau state Nigeria. Further, review shows that the output, income and level of living of the participating farmers increased significantly than the non-participating farmers reveals that significant relationship exists between ASTC project and the income of participating farmers at (Chow F calculated= 3.952 at 5% level of significance). Data were collected using structured questionnaire and Simple percentages, multiple regression, chow test and Z-test statistics were adopted to analysed the data. It was recommended that government should subsidised the inputs to make it affordable to farmers. The necessary inputs should also be made available on time when they are needed by the farmers and intensification of awareness campaign on recent happenings be encouraged to increase participation.

Further study by Dutse, Dodo, Saddiq, and Yakubu (2016) examining the effects of the adoption of Sampea-7 cowpea recommended production practices on income and level of living among farmers in Sabon Gari Local Government area of Kaduna State observed that awareness of the recommended production practices varies among the respondents. They further observed that the least adopted recommended production practice was spray insecticide once in 2 weeks before flowering and once a week within flowering and

pudding stages and those that have adopted the recommended practices did not adopt all the technologies.

In the finding of Rwibasira, (2016), on examining the relationship between fertilizer usage and Maize production reveals that maize prices at the end-markets influence fertilizer usage. An increase of 1% in maize prices at the end market increases maize production by 0.23. The research also showed that the use of improved seeds has statistical significance and positive impact (P=0.000) on the level of production about 95% (R-squared=0.9466) of the variation in the dependent variable, maize production is explained by the variation in the explanatory variables incorporated in the model.

A finding by Akinola, Odu, Ene and Baiyegunhi (2013) on adopted villages and farm beneficiaries in Kaduna revealed a significant effect of the project. They further showed that the average income of the beneficiaries of the project was N210, 214, while that of the non-beneficiaries was N95, 675.The minimum and maximum farm income project beneficiaries were N1, 680 and N2, 510,000 respectively, while those of non-beneficiaries were N240 and N1, 227,500 respectively .This indicates that the interventions have a significant effect on the income of the beneficiaries of the project.

Another study by Dutse *et al*., (2016) conducted in Kumbotso LGA of Kano State examined the effects of moringa leaf meal inclusion in dairy cattle meal among dairy farmers. The study concluded that inclusion of Moringa oleifera meal in the feeding system of white Fulani (*Bunaji*) breed increased the milk yields especially during the dry season and this had improved the income of the farmers from the sale of milk. Nwankwo, (2010), assessing the Impact of Agricultural Extension Services on Agricultural Development in Ibiaku

Community found that agricultural extension service has led to increase in food production as such has reduced the conservation attitude of the farmers. Also, educated farmers were more successful in boosting agricultural production than the illiterate's ones. Also, farmers who live near government established agricultural institutes perform better as regards the agricultural productivity.

Therefore, a lot needs to be done as smallholder farmers are still constrained by many problems including those of poor access to modern inputs and credit, poor infrastructure, inadequate access to markets, land and environmental degradation, and inadequate research and extension services (Akinola, *et al.*, 2013).

2.7 Theoretical Framework

A theory is a useful instrument for all empirical endeavour. According to Ekong (2003) theoretical framework is a broad system of explanation that is founded not so much on prior research findings but largely on interest and perhaps improvable assumptions. Abend (2008) defines a theory as "a general proposition, or logically-connected system of general propositions, which establishes a relationship between two or more variables. Similarly, Metitoba (2012) describes a theory as providing understanding and analysis for the explanation of complex social reality objectively.

Theories help contemporary academics to establish a tradition of viewing the external world within a theoretical premise (Elem and Nwabah, 2016). The target of theory structure is to provide a support to facilitate the accurate observation and reliable description of events, laws and theories by which social phenomena can be explained.

This study is guided by the social change theory and diffusion and adoption of innovation theories.

2.7.1 Social Change Theory

Social change is a phenomenon that is pervasive and an ever-present in virtually all societies of the world. Change is an event or incident that alters and disrupts the normal activities. It is the introduction of new ideas, events, or incident intended to improve a situation. Change always comes with certain consequences, some positive others negative. According to Ekong, (2003) social change theory encapsulates almost economic, technological, cultural and behavioural changes. It explains sources of societal changes, duration and the effect of such changes of the structure or the population under study. Change can be planned and unplanned intervention geared towards altering the state of a community or farmer's income, output and livelihood through the introduction of a service or project by an agency. The concept of development is mostly used to designate a holistic angle in social literatures (Idowu, 2012)

In general, social change theory encompasses virtually all areas of human endeavor and could manifest as economic, technological, cultural and behavioral changes (Ekong, 2003). Social change is concerned with the explanation of the sources of societal changes, the time span of change and the effect of change on the changing unit, that is, the target population. This exhibits as either planned or unplanned result. Planned change involves the direct human intervention in reforming and directing change towards some defined goals while unplanned change is that which occurs suddenly usually through the act of nature thereby affording man the no chance to plan before it happens.

Theory of change is still primarily looked at as a planning methodology. However, its real potential lies in supporting context based innovation by encouraging more robust hypotheses of change, on-going learning about what is effective through implementation in context, identifying and responding to opportunities, programmes are able to adapt and improve their

potential to achieve meaningful and lasting positive change to support people in developing countries (Vogel, 2012). The social change perspective is relevant as it will provide the basis for understanding and explaining transformation through the introduction of ASTC project in the study area (Plateau State) over the years on the beneficiaries. It will also help as guide in evaluating the way small-scale farmers utilize science-based programmes, method, technologies and interventions of ASTC to carry out their farming activities while improving income, output, yielding performance and raising the standard of living of the people.

2.7.2 Diffusion and adoption of Innovation Theory

The second theory upon which this study would be anchored is Roger's Diffusion of Innovation theory. For Rogers in Nwandu,Thomas and Okoro, (2018) adoption is a decision of "full usage of an innovation as the best way of action available" and rejection is considered as a decision "not to adopt an innovation". Rogers describes diffusion as "the process by which an innovation is communicated thorough certain channels over time among the members of a social system". Meanwhile, Adoption is the receipt of continued usage of an innovation after individuals or groups had gone through certain mental processes (Agbamu, in Nwandu, *et al*., 2018). The models of explaining the adoption process is the following sequence from Awareness > Interest > Evaluation > Trial > Adoption.

Awareness stage is the first stage of the process. This occurs when an individual (or other decision-making unit) is exposed to the innovation's existence and gains some understanding of how it functions. Awareness-knowledge represents the knowledge of the innovation's existence. Farmers' knowledge of a new innovation and how it works in terms of potential or capacity is reinforced by interest. They therefore become curious about the innovation. This phase deals with how the farmers' interest is developed in more factual or real idea or

technology according to Agbamu, (2008) innovation spurs curiosity in the mind of the farmers due to the interest towards the idea, method or technology. At another level, the interest of the farmer is followed by genuine or marked desire for the application of the knowledge to manipulate his environment. He/she is involved in thorough mental activities as he or she evaluates the applicability of the idea or practice in the light of the solution to his own situation. Farmers at this level assess how the practiced idea can affects their social, economic and cultural world. A positive outcome will no doubt motivate adoption, whereas, negative outcome will discontinue the adoption.

Thus, in the trial stage, farmers need consider strength and weaknesses that can accompany such an adopted practice. Farmers at this stage should consider the benefits and the risks involved and if the practiced can be shared into small unit or parts to allow for trial under a controlled condition and capacity. This can be carried out on a pilot field or plots to test its success. Where the test is proven to be successful, it is retained and where otherwise, it is rejected. If the trial provides poor result, he may reject the innovation. After this, comes the adoption stage. The Adoption phase is the stage in which the farmers after successful trial accepts the innovation and decide to continue its usage.

Adoption involves acceptance and repeated use of a practice capable of boosting productivity of the farm by helping to overcome tedious farm task or operation will help to ease a difficult farm (Agbamu, 2008). Technology is the application of knowledge for practical purpose which is generally used to improve the condition of human and natural environment as well as carry out some other socio-economic activities (Rogers, in Nwandu *et al*., 2018). Rogers highlighted two conditions explains farmers adoption rates. These are perceived relative advantages that would accrue from adopting the technology in comparative terms with other

practices preceding it and its perceived compatibility with existing values, needs and experiences of the community or social system.

A farmer presumably compares all potential profits from alternative practices and then makes a decision about adoption, (Tingting, Rendall, and Mattew, 2018). This theory is functional here in that it advances the understanding of the socio-economic factors influencing adoption of ASTC services among the farmers in the study areas. It will also help to explain how the ASTCs technologies had spread among the respondents under study.

2.8 Conceptual Framework

2.8.1 Concept of utilization

Scholars such as Nwaobiala and Eze (2012) found that simple mechanized farm implements used in crop production in Abia state were of varying degree. They noted that farmers use of knapsack sprayer were encouraged by the perception that the implement was labour saving and improves the quality of harvested products. Also, farmers' use of watering Can was encouraged by the perception that the implement was time saving and improvement of product quality, while farmers used sickle because of simplicity and accessibility of the implements. The study used simple percentages and probit regression model as methodology. It was recommended that Input agencies should make this technology readily available and affordable to farmers. Also, there was the need for proper training of the farmers on the application and use of these implements in crop production. Fabricators should produce implements that have the attributes of time and labour saving advantages.

In another study, Uwandu, Thomas and Okoro (2018) found the use and adoption of Crop and animal farmers in Imo State shows that higher proportion (33.6%) of the respondents

involved in crop farming adopted crop technologies like recommended crop spacing, pesticides application, pest and disease control; whereas, 8.3% adopted thresher and sickle respectively. However, there was variation in the adoption status of animal technologies by the respondents involved in animal husbandry. Primary data was collected with the aid of a structured questionnaire. Results show that 29.9% of the respondents adopted animal technologies like improved breeds of livestock, vaccination date, and de-worming. The least adopted animal technologies were dwarf wall/wire screening and east west orientation, where 2.1% and 4.1% of the respondents adopted dwarf wall/wire screening and east west orientation respectively. It was recommended that government and private individuals should make improve investment in the agricultural sector so that farmers can utilize innovations in crops and animals and information dissemination among farmers be encouraged since farmers rely on extension agents as source of information.

2.9 Conceptual Model of the Study

It is important to emphasize that a model is a human construct or description to help better understand real world systems. It is an abstract way of presenting the relations between social phenomena. In this light, Ahmad's (2011) description of a model includes an object used as an example to follow or imitate or a simplified description, especially a mathematical one, of a system or process, to assist calculation and prediction.

Figure 1 depicts influence of independent variables (sex, age, marital status, house-hold size, farming experience) and institutional factors (access to credit, extension contact, belonging to membership of a co-operatives) can influence farmers utiisation of ASTC services. These services (survey, Tractor hiring, spraying, laboratory, planter, workshop/training, agro-

chemicals, harvesting, warehousing, marketing) if properly discharged no doubt have the tendency to positively affect the income of beneficiaries who adopt these services.

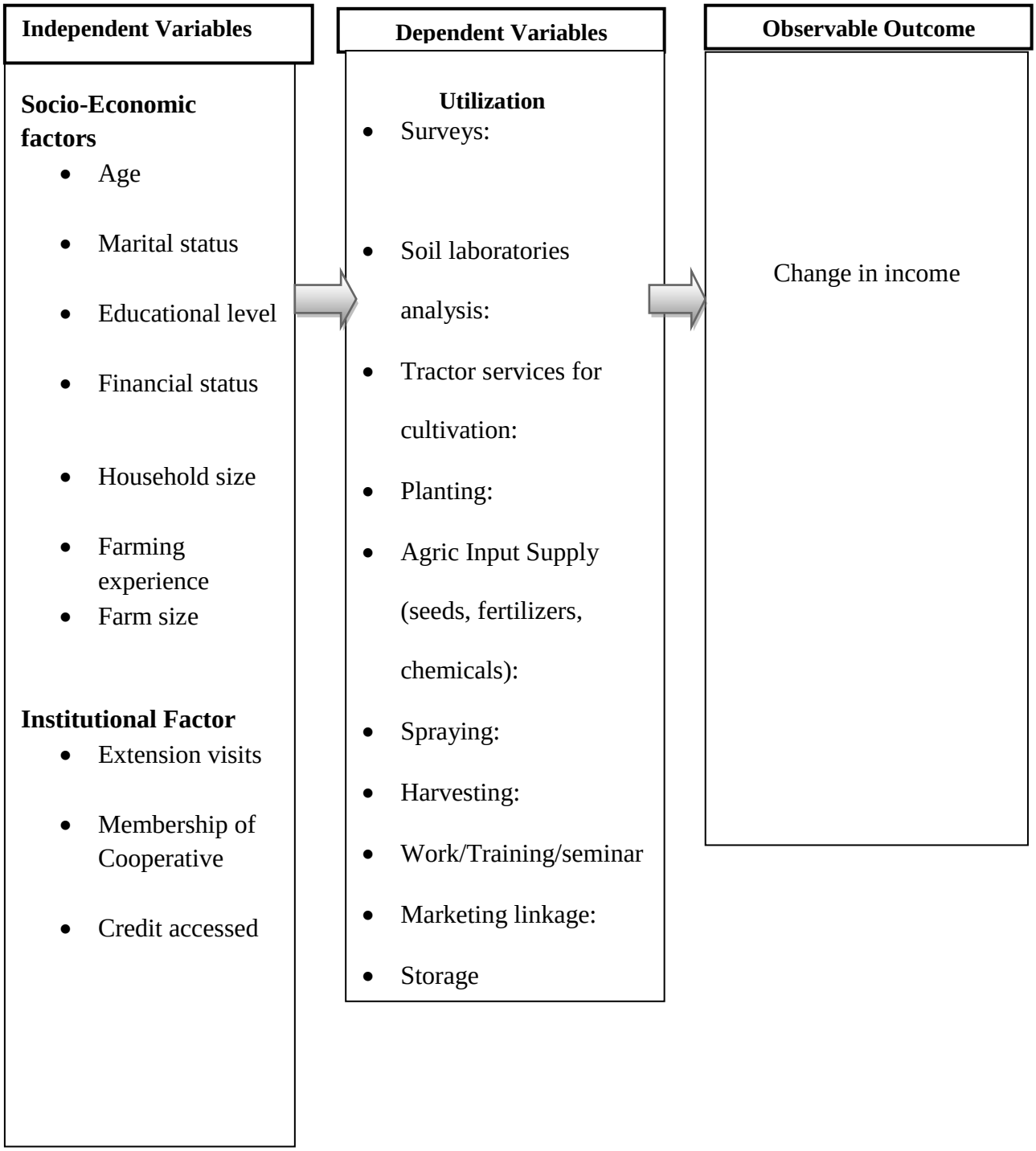


Figure 1: Conceptual Model of the study

CHAPTER THREE

METHODOLOGY

3.1 Description of the Study Area

The study was conducted in Plateau State. Plateau State is located in the central part of Nigeria, which lies within the middle belt region of the country. It is located between latitude $80^{o}28'$N and longitude $80^{o}32'$ and $100^{o}38'$E. The State has a land area of 30,913km^2 with a population of 3,553,440 (NPC, 2006). The projected population for 2021 is estimated at 5,372,801 on an annual growth rate of 3.2 percent. The climate of the state is near temperate with an average temperature between 18 and 22°C., no doubt is good for agriculture (Jacobs *et al*., 2017; Girei *et al*., 2017).

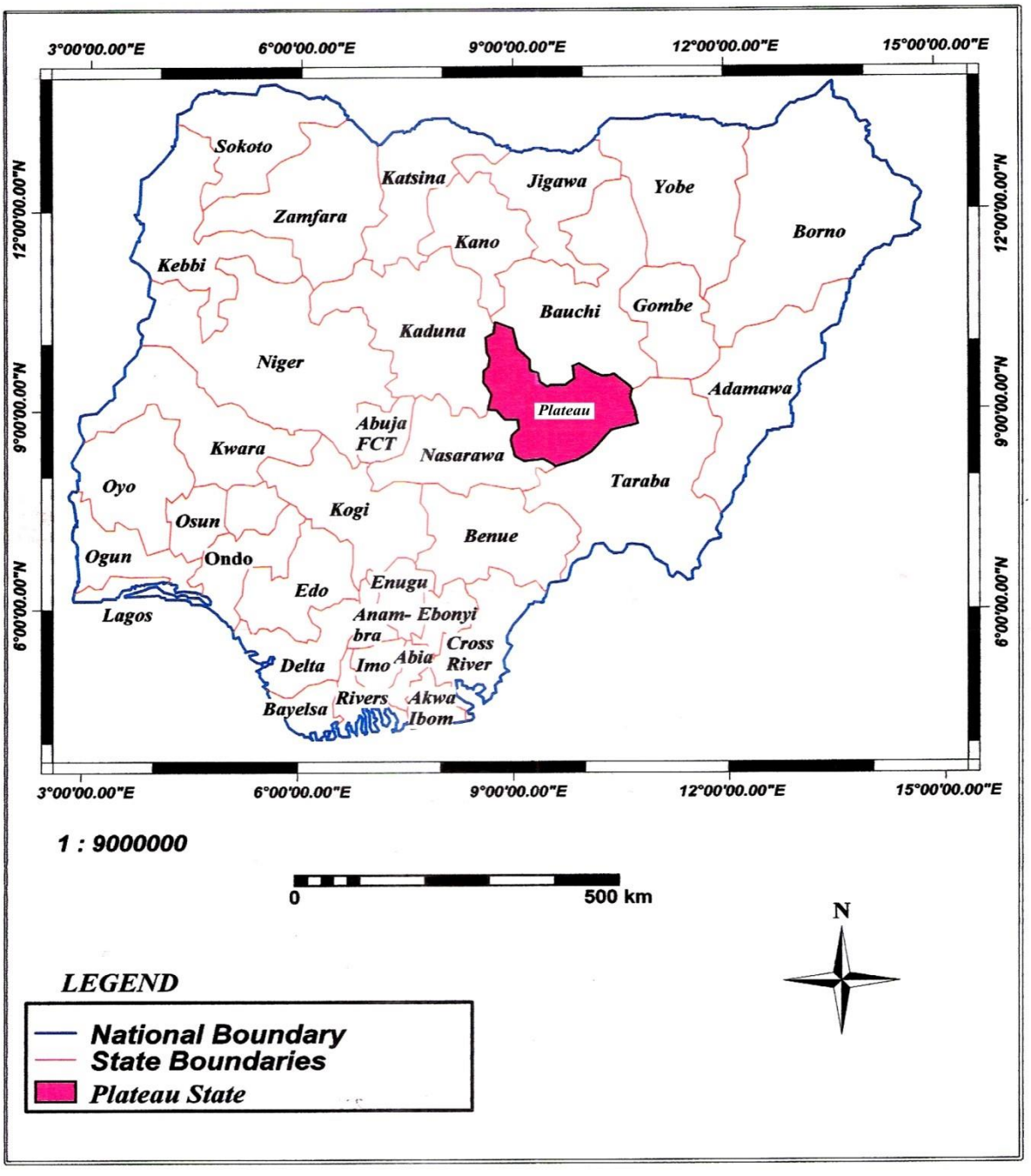
Plateau State is bordered to the North West by Kaduna State and Bauchi State to the North East. Interestingly, it is flanked in the south east by Taraba State and to the south west by Nasarawa State. Plateau State is known for both agricultural and manufacturing activities. Agricultural products produced include potatoes, groundnut, vegetables of varied sorts, fruits, yams and many other items. The Plateau State agricultural system is dominated by rain-fed farming. However, vegetables are grown on the damp soils exposed in the dry season in the volcanic crater lakes of the Plateau.

Plateau State has 17 Local Government Areas which is further divided into three senatorial zones to ensure effective coverage of the state. The zones are: Northern Zone (Bassa, Jos East, Jos South, Jos North, Riyom and Barkin Ladi); Central Zone (Bokkos, Mangu, Pankshin, Kanke and Kanam); Southern Zone (Langtang North, Langtang South, Mikang, Shendam Quanpan and Wase) (Goshit *et al*., 2013) The state is home that

accommodate people from different ethnic groups including Berom, Ngas, Afizere, Taroh, Anaguta, Buji, Mushere, Pyem, Ateng, Kuleri, Irigwe, Boghor, Rukuba, Jukun and Fulani.

Plateau State has attracted people of all walks of life owing to its strategic and cosmopolitan nature. Rural areas are mostly inhabited by farmers of the original Plateau tribes with a significant minority of settled Fulani herders. The varieties of crops cultivated include vegetables, cereals, tubers and roots for subsistence and commercial purposes in which they have some comparative advantage.

The major religion practices in plateau state are Christianity, Islam and traditional worship. Religious belief is based on individual conviction and no group is expected to coerce or influence any group or persons to accept another faith under duress. It must be by consent. Religious beliefs and practices is free in as much as it does not trample on the inalienable rights of others and constitute a threat to peace and harmony of the state.



SOURCE: National Centre For Remote Sensing Jos, Nigeria.

Figure 3.1. Map of Nigeria with Plateau State shaded

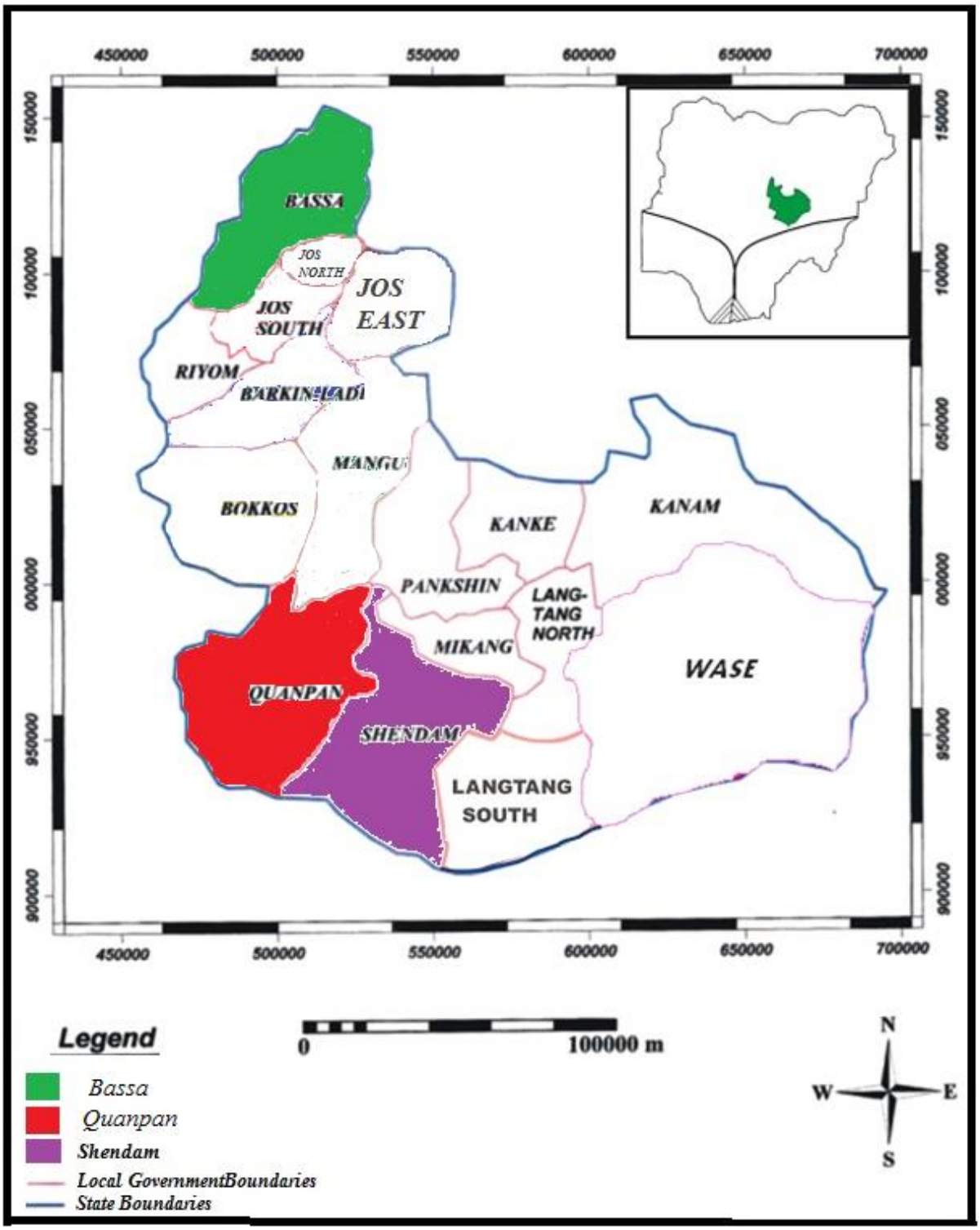


Figure 3. Map of Plateau state showing the three selected LGAs

3.2 Sampling Procedure and Sample Size

The purposive and random sampling techniques were used in selecting the respondents for the study using multi-stage process. Multistage sampling procedure was used in this study in order to effectively cover the study area. In the first stage, three Local Government Areas out of the seventeen local government area of Plateau State were purposively selected. The selected LGA are Bassa, (Northern zone), Quanpan and Shendam (Southern zone) LGAs as they are predominantly known for rice production over the rest LGAs and had presence of ASTC centres..

In the second stage, out of the three local governments selected, ten (10) villages were randomly selected from each local government area. The villages covered by ASTC field officers for the three local governments are fifty five (Bassa 29, Shendam 32 and Quanpan 26). The name of each of the villages were written on a piece of paper and put in a container where the ten villages were drawn from each local government until the required number of 30 villages were selected. This was done to give every village the opportunity or chance of being selected without bias. Areas that had no participants were not included in the sampling technique in order to have a wider coverage of the real respondents and which gave a total of thirty (30) villages.

In the third stage, 49% was introduced into the sample frame (farmers register) from where the sample size for the individual farmers (respondents) was randomly drawn based on a percentage derived from Taro Yamane formula. Taro Yamane formula is ideally for selecting sample size randomly (Adamu and Garba, 2019).The Taro Yamane sample determination formula was adopted to ascertain the sample size and it was based on 5% expected margin of error 95%

confidence interval. The rate of 49% was introduced and used to select the sample size from the sample frame to get the respondents from the study area.

Sample size formula: $n = \frac{N}{1 + N(e^2)}$ ... ... (1)

Where: n = Sample size, e = 0.05, N = Total number of observation

Hence:

$$n = \frac{N}{1 + N(e^2)}$$

$$n = \frac{409}{1 + 409(0.05)^2}$$

$$n = \frac{409}{1 + 409(0.0025)}$$

$$n = \frac{409}{1 + 1.022}$$

$$n = \frac{409}{2.02}$$

$$n = 202$$

Therefore: $\frac{202}{409} \times 100 = 49\%$

Table 1: Population and sample size

Selected LGA (Purposive)	Selected Villages (Random)	Participants' (sample frame)	Participants (49%) (sample size)
Bassa	Fuskan-Mata	28	14
	Jengre	22	11
	Kadamo	25	12
	Pandauda	20	10
	Kamare	24	12
	Tsika	15	7
	Udazu	18	9
	Kazizi	10	5
	Fadaman Shanu	14	7
	Zallaki	6	3
Quanpan	Kopmoejak	12	6
	Kwalla	9	4
	Ba'al	5	2
	Roek	8	4
	Pangnaan	4	2
	Njak	10	5
	Goepal	6	3
	Debil	8	4
	Dogon Maje	6	3
	Pian	8	4
Shendam	Longvel	15	7
	Kalong	22	11
	Lawan	6	3
	Ajikamai	24	12
	Yelwa	18	9
	Kwansa	10	5
	Naburuk	16	8
	Shimakar	20	10
	Ntuer	12	6
	Lakushi	8	4
Total	**30**	**409**	**202**

A total of 202 respondents were sampled from mainly ASTC participating small-scale farmers and questionnaire were administered in order to get an in-depth response.

3.3 Method of Data Collection

Data for this study were collected from primary source. The primary data were collected with the aid of a structured questionnaire administered to the respondents by the researcher. The questionnaire was prepared in five sections to cover the five objectives of the study. Part one contained questions on socio-economic/institutional characteristics, two contained questions on the level of ASTC services utilised, third contained questions on the factors influencing utilization of ASTC services, fourth include questions on the effects of ASTC services on the income of rice farmers and the fifth deals with questions on the constraints to utilistion of ASTC services.

3.4 Method of Data Analysis

The analytical tools used for this research were:

3.4.1 Descriptive statistics

Descriptive statistics (such as frequency counts, percentages, mean and standard deviation) to analyze objective (i), (ii), and (v).

3.4.2 Inferential Statistics

Inferential statistics such as Tobit regression to analyze objective (iii) whereas, linear regression was used to analyze objective (iv). Gross Margin analysis was also used to analysed part of objective iv to determine the return on investment on the rice farmers.

Tobit regression model

In this model the dependent variable (Y) is dichotomous, representing the probability of choosing a set of ASTC services in the study area. It specifies the relationship between the probability of choosing an option and the set of explanatory variables (Greene, in Awotide, Karimo and Diagne, 2016):

The empirical Tobit model is expressed as:

Y = Xβ + μi if Xβ > μi,0 if Xβ = μi …….(2)

Y =Y*, if Y* > 0 Y =0 if Y* ≤ 0

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + ei \ldots\ldots\ldots (3)$$

Where:

Y = Utilisation index of ASTC service,

β_0 = the constant term

β_1-β_{10} = regression coefficients

e_i = error term

X_1= Age (years)

X_2=Marital status (Number)

X_3 =Education (years spend in formal education)

X_4= Financial status (₦)

X_5 =Household Size (number)

X_6 = Farming experience (years)

X_7=Farm size (hectares)

X_8 = no of extension visit (no of times)

X_9= years spent as members of co-operatives (Years)

X_{10} = Credit accessed (₦)

X = vector of the explanatory variable, β = vector of the Tobit maximum likelihood estimates, μ = random error term.

Linear Regression Model

The Linear Regression model was used to determine the significant effects of ASTC services on the income of the participating small-scale farmers in the study area to achieve objective (iv). However, return on investment will be determined using farmers Budget.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X + \beta_8 X_8 + \beta_9 X_{9+\beta_{10} X_{10+}} e_{i\ldots} (4)$$

Where:

Y= Gross margin of the farmers (₦)

X_1= cost Survey (₦)

X_2 = Soil testing Laboratory (₦)

X_3= cost of Tractor Hiring (₦)

X_4 = cost of Planting (₦)

X_5 = Input supply (₦)

X_6 = Spraying (₦)

X_7= Harvesting (₦)

$X_{8=}$ Workshop/Training (₦)

X_9 = Marketing Linkage (₦)

$X_{10=}$ Storage (₦)

e_i = Error term

β_0 = constant term

$\beta_1 - \beta_{10}$ regression coefficients (explanatory variables-services)

This analytical tool was used to determine the income of ASTC rice farmers in the study area to achieve objective (iv).

Hypotheses Testing

The Tobit regression analysis was used to test hypothesis i. and linear regression analysis was used to test hypothesis ii.

3.5 Definitions and Operational Measurements of Variables

3.5.1 Dependent variable (Y)

Utilization of ASTC services: utilization referred to the process of making practical and effective use of available agriculture services to expected results. This was measured individual farmers index derived from utilization the various services they could afford using a scale of 5 likert (Always, Sometimes, Undecided, Rarely and Never).

Tractor hire services: this referred to the extent to which rice farmers utilise tractor services from ASTC it is measured in amount paid.

Planting services: Means activities that involve the planting of rice seedling by drip or broadcasting method by the farmer using the ASTC. They are measured in Naira

Survey services: Referred to the rate at which rice farmers utilise survey services. It is measured in Naira

Agro-Chemical services: The level at which rice farmers utilise spraying equipment provided by the ASTC. They are measured in naira.

Training, Workshop and Seminar: The cost for which the rice farmers incurred in the acquisition of knowledge on improved technology. This could be workshop attended and seminars organised by ASTC. They are measured in naira.

Soil Laboratory Services: The level at which rice farmers used the soil testing or laboratory service provided by ASTC. They are measured in naira paid

Storage services: The level at which farmers utilised storage facilities in ASTC. They are measured in naira.

Harvesting services: The level at which rice farmers used harvesting services for their mature products with the help of ASTC services. It s measured in naira

Marketing: The rate at which rice farmers were linked to buyers of their product by ASTC in order to get access to the large share of the market. It is measured in naira.

3.5.2 Independent variables

***Age*:** This refers to as the number of years an individual has spent on earth. It was measured in no of years. It was expected that aged could either positively or negatively influence utilization of ASTC services.

Educational level: This refers to the duration spent acquiring a certificate of learning in formal institution by the respondents. It was measured by the number of years spent in formal education. It is expected that respondents' education would have either positive or negative influence of utilization of ASTC.

Household size: This is the number of person either related by blood or by adoption who live under the same roof or eating from the same pot. It was measured in numbers. It is expected that respondents household size would have either positive or negative influence of utilization of ASTC.

Farm size: This refers to the total land areas under cultivation by the farmers or respondents. This will be measured in hectares. It is expected that respondents farm size will have either positive or negative influence of utilization of ASTC.

Farming Experience: experience represent the technical know-how or skills accumulated and practiced overtime in the course of farming activities. It is measured in years. It is expected that

respondents farming experience will have either positive or negative influence of utilization of ASTC.

Agro-chemical usage: t his is the number of litres of agro chemical used by the farmer and it is measured in litres. It is expected that respondents agro-chemical use will have either positive or negative influence of utilization of ASTC.

Amount of credit/ loan accessed: this is the amount of money obtained or borrowed from lending institution with the intention of a repayment at a given period of time with or without interest in order to enhance the productivity and profitability of the farm. It was measured in naira.

Membership of cooperative: This refers an association that a farmer belongs to which enhances his/her bargaining power to access and use improve technology. It motivates farmers to effective participation where the interest of members are safeguarded

Extension contact: This is the number of times an extension agent visits the farmer. It was measured using a scale of 1– 5, farmers with weekly contact was scored 1, those who meet fortnightly was scored 2, those with monthly contacts was scored 3, those with quarterly contacts was scored 4 and those with yearly contacts was scored 5.

3.5.3 Expected Outcome

Farmers' income: This is the gross margin or net income that accrued to the farmer from the sale of his/her products or output after each farming season using the farmers budget of revenue and expenses. It was measured in naira. It is expected that respondents income would either positive or negative affected by the utilization of ASTC services available.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Socio-Economic and Institutional Characteristics of the Rice Farmers

4.1.1 Age distribution of rice farmers

Findings from Table 2 show the distribution of rice farmers by their age. It revealed that the highest proportion of rice farmers (40.1%) were between ages 41-50 years. Furthermore, a little over a quarter of the rice farmers (27.2%) were between ages 31-40 years. Other farmers between ages 51-60 years and 20-30 years were only 21.8% and 10.9% of the entire rice farmers respectively. Result also indicates the mean age of rice farmers as 46 years. This result may imply that majority of rice farmers who engaged in rice farming in the study area were in their active or energetic age brackets. This is a common trend in a country like Nigeria, where farming activities such as rice farming are predominantly undertaken by farmers in their active age brackets. Studies like that of Obayelu, Lawal-Adebowale and Agbonlahor (2012) reported similar results of respondents in Ekiti and Ogun states who were rice farmers.

Table 2. Distribution of rice farmers according to age

Age	**Frequency**	**Percentage (%)**
20 years-30 years	22	10.9
31 years-40 years	55	27.2
41 years-50 years	81	40.1
51 years-60 years	44	21.8
Total	**202**	**100.0**
M=45.8 **SD**=12.9		

Field Survey (2019)

4.1.2 Sex distribution of rice farmers

Result in Table 3 shows that majority (86.6%) of the rice farmers were males, while the remaining 13.4% were females. This may indicate that rice farming like other agricultural activities is tedious and onerous predominantly dominated by their male counterpart. This result also may reflect the reality of the unbalanced gender difference in rice farming and production in Nigeria. For instance, Anyawale and Amusan, (2014) found that there were more men than women in farming production among farmers in Osun state. This is also an indication that men had more physical capacity to engage in rice production. The result also suggests that gender may be a factor in accessing ASTC services among small scale rice farmers in the study area.

Table 3. Distribution of rice farmers according to sex

Sex	**Frequency**	**Percentage (%)**
Male	175	86.6
Female	27	13.4
Total	**202**	**100.0**

Field Survey (2019)

4.1.3 Marital status of rice farmers

Result in Table 4 above shows that an overwhelming majority of the rice farmers (90.1%) were married. A few rice farmers (7.9%) were single and another 1% and 1% were divorced and separated respectively. The result therefore suggests that married people are more involved in rice farming and production among the sample studied. This could be because married men and women have greater household responsibilities and seek various opportunities to provide a staple food such rice and ensure household food security for their families. Such assertion was also put forward in the study of Igboji, Anozie and Chinaza (2015), who found out that married rice farmers have a responsibility of ensuring food security for their household members and thus engage more in farming activities.

Table 4. Distribution of rice farmers according to marital status

Marital Status	**Frequency**	**Percentage (%)**
Married	182	90.1
Single	16	7.9
Divorced	2	1.0
Separated	2	1.0
Total	**202**	**100.0**

Field Survey (2019)

4.1.4 Education status of rice farmers

According to the information contained in Table 5, years spent in formal education were distributed across most categories. For example, 31.2%, 35.1% and 22.8% of rice farmers admitted to have spent between 1-6 years, 7-12 years and 13-18 years in formal education respectively. While some 7.4% of the rice farmers had not been through any formal education, 3.5% stated that they had spent few months in school before they dropped out of school. The distribution of rice farmers in this regard is also an indication that many of the rice farmers spent a considerable amount of time in school. The implication of this is that education provides the capacity for patronage and adoption of modern innovations, easy communication and access to information.

The distribution of rice farmers in this regard is also an indication that many of the rice farmers spent a considerable amount of time in school. This finding is consistent with the results of Osanyinlusi and Adenege (2016) who found that 43.1 percent, 34.4 percent, 8.8 percent and 5.0 percent of the rice farmers had primary (6 years), senior secondary (12 years), junior secondary (9 yrs) and tertiary level of education (16yrs or above) respectively. The findings suggest that many rice farmers were literate. Such level of literacy or exposure could therefore have

significant implication on the ways rice farmers perform certain rice farming activities such as enhancing their level of understanding and desirability of adopting new farm technologies or interacting well with extension agents. On the other hand, this present result does not align with the outcome from the study of Mustapha *et al*., (2011) who revealed that about 39% of the rice farmers had only adult education with very low formal education in Pategi, Kwara State. Education has been identified as a catalyst in the patronage of modern agricultural and other productive activities.

Table 5. Distribution of rice farmers by years spent in formal education

No of Years spent in Education	**Frequency**	**Percentage (%)**
None	15	7.4
1-6 years	63	31.2
7-12 years	71	35.1
13-18 years	46	22.8
Others	7	3.5
Total	**202**	**100.0**

Field Survey (2019)

4.1.5 Distribution of rice farmers on financial status

Result on Table 6 shows results of financial status of the rice farmers. The income from rice activities were categorized and responses revealed that majority (45%) have between ₦151,000 - ₦ 200,000. The finance status of the farmer can help them in the adoption of relevant technology in order to improve their income. This implies that income encourages the adoption of improved technologies. On the other hand, increase in adoption of improved technologies could result in increase in yield as well as accruable income. This aligned with the study by Ekweh in Olumba and Rahji (2014) where the income of the farmer was at the base of adoption rate.

Table 6 Distribution of rice farmers based on the financial status from rice farming

Financial Status	Frequency	Percentage (%)
None	-	-
10,000-50,000	6	3
51,000-100,000	18	8.9
101,000-150,000	56	27.7
151,000-200,000	91	45
201,000-Above	31	15.3
Total	**202**	**100.0**

Field Survey (2019)

4.1.6 Distribution of rice farmers by occupation

Result in Table 7 shows that more than half of the rice farmers (56.9%) admitted being full time farmers. Some 19.8%, 16.8% and 0.5% said that they were civil servants, business men/women and artisans respectively. Only 5.9% of the rice farmers mentioned other types of occupation that were not presented in the table. Overall, the finding suggests that a majority were full time farmers, implying that most of the respondents are engaged in agricultural activities, particularly rice production. Farming was also identified as the sole occupation of majority of the rice farmers in the study. This result corroborates the findings of other studies (Osanyinlusi and Adenege, 2016; Samarpitha, Vasudev and Suhasini, 2016) which revealed that majority of those who practice rice farming in both Nigeria and India were predominantly farmers and did not have any side job they used in complementing this source of livelihood. A probable explanation for this phenomenon as it is found among these diverse population may be that farming activities which involves rice production are time consuming (since such activities are not particularly mechanized), which may have deprived them of engaging in other jobs.

Table 7. Distribution of rice farmers by their occupation

Occupation	Frequency	Percentage (%)
Full time farmer	115	56.9
Civil servant	40	19.8
Business	34	16.8
Artisan	1	0.5
Others	12	5.9
Total	**202**	**100.0**

Field Survey (2019)

4.1.7 Distribution of rice farmers by household size

Findings in Table 8 present the distribution of rice farmers according to the number of persons in their households. As shown in the table, the highest proportion of the rice farmers (40.1%) had 7 or more persons in their households. Others (5.0%, 8.9%, 12.4%, 21.8% and 11.9%) reported having 2,3,4,5 and 6 persons in their households respectively. The average score of number of persons per household is 4.5. The mean score is a reflection of the average household size in Nigeria. Overall, the results are indicative of the fact that having more than 7 or more persons living in a household is a common phenomenon. According to the Nigeria Demographic and Health Survey (2018), the average household number is 5. Such outcome could have implications for rice farming activities in the area by supplying family labour required for rice production, such that the more the number of household, the more involved they become in rice farming activities.

Table 8. Distribution of rice farmers by number of persons per household

Household Size	**Frequency**	**Percentage (%)**
2	10	5.0
3	18	8.9
4	25	12.4
5	44	21.8
6	24	11.9
7 and above	81	40.1
Total	**202**	**100.0**

M=4.49**, SD**=1.59

Field Survey (2019)

4.1.8 Rice farmers years of farming experience

Findings in Table 9 presents information on the number of years rice farmers have spent in rice farming. The highest proportion of rice farmers (41.6%) admitted spending between 6-10 years. Furthermore, 30.7%, 17.3%, and 9.4% of the remaining rice farmers said that they had spent 1-5 years, 11-15 years and 16-20 years respectively in rice farming. Meanwhile only 2 rice farmers admitted to have spent more than twenty years in rice farming. In general, the findings suggested that the rice farmers had relatively adequate years of experience in rice farming, implying that the rice farmers would have better understanding on the need to patronize ASTC services that may improve their level of farm productivity. This is in consonance with the findings of Makama, Abba, Isha and Kagara,(2017) who suggested that 60% of the rice farmers had 5-24 years' experience in rice production.

Table 9. Distribution of rice farmers by number of years spent in rice farming

Years in Rice Farming	**Frequency**	**Percentage (%)**
1-5 years	62	30.7
6-10 years	84	41.6
11-15 years	35	17.3
16-20 years	19	9.4
Other	2	1.0
Total	**202**	**100.0**

Field Survey (2019)

4.1.9 Rice farmers number of years with ASTC

Results from Table 10 shows that most (55.9%) of the rice farmers had patronized ASTC services for a period of 6 years. Furthermore, 21.8% of the rice farmers had patronized ASTC services for a period of 9 years. Other respondents (12.4% and 9.9%) admitted to have patronized ASTC services for a period of 2 years and 12 years respectively. The implication is that most of the rice farmers had adequate years of patronage of ASTC services that enhanced their level of farm productivity, thereby suggesting an improved ability to further patronize other ASTC services that may improve their productivity, and this therefore validates the usefulness of ASTC services among the rice farmers.

Years spent as members of ASTC indicates to a reasonable extent the Farming experience normally deals with the number of years farmers have been participating in certain farming activities. In this regard, the study found to be consistent with studies of authors like Usman (2011) who reported 62% of his respondents had less than 10 years' experience. However, such level of experience among the sample under study contradicts what was found in a study carried out by Girei and Onuk (2016). These findings go further to show that rice farmers may at the moment be somewhat experienced (going by the number of years they have spent) in rice farming.

Table 10. Distribution of rice farmers by when respondents started using ASTC services

Years with ASTC	**Frequency**	**Percentage (%)**
12	20	9.9
9	44	21.8
6	113	55.9
2	25	12.4
Total	**202**	**100.0**

Field Survey (2019)

4.1.10 Distribution of rice farmers by size of land

Findings in Table 11 shows the distribution of rice farmers by the size of the land they cultivated. According to the information in the table, more than a quarter (28.7%) and close to a quarter (24.8%) of the rice farmers admitted that they cultivated 1.50-2.0 hectares and 0.60-1.0 hectares respectively. Whereas land size between 0-50 hectares, 2.50-3.0 hectares and 3.50-4.0 hectares were cultivated by 10.4%, 15.8% and 13.4% of rice farmers respectively. In addition, some 6.9% of the rice farmers reported cultivating over four hectares of land for rice farming. This corroborates with the research work carried out by Nte *et al.,* (2017) who also reported that majority of farmers operated an average farm size of 1.97 hectares. This may be due to the land tenure systems common in the area of study which often results in land fragmentation among farmers leading to small land holdings. The outcomes of these studies indicate that farmers are still constrained by their lack of access to very large farmlands which could have enormous impact on productivity.

Table 11. Distribution of rice farmers by the size of the land they cultivated

Farm Size	**Frequency**	**Percentage (%)**
0-50 hectares	21	10.4
0.60-1.0 hectares	50	24.8
1.50-2.0 hectares	58	28.7
2.50-3.0 hectares	32	15.8
3.50-4.0 hectares	27	13.4
Others	14	6.9
Total	**202**	**100.0**

Field Survey (2019)

4.1.11 Method of land acquisition by rice farmers

The result in Table 12 shows the distribution of rice farmers based on their methods of land acquisition. Most (45.0%) of the rice farmers indicated that they inherited their land. Others (30.7%, 16.3% and 3.0%) equally mentioned acquiring their land through rent, purchase and gift respectively. The remaining 5% of the rice farmers indicated that they got their land via farm land lease from the federal government of Nigeria. While the means through which rice farmers acquired their land vary, the implication of land tenure system is that this may affect the size of farmland available to the respondents which invariably may affect the level of output. Ownership of land therefore is a major determinant of rice production. This outcome is consistent with the findings of Ben-Chendo and Joseph (2014) who found that inheritance was one of the major methods of land acquisition for rice farmers in Ihitte/Uboma Local Government Area of Imo State. This result also confirms the reality of the Nigerian society where it is generally believed that lands could be transferred to others (especially their offspring) under specified and accepted native system by individual owners.

Table 12. Distribution of rice farmers by how they acquire their land

Method of land Ownership	**Frequency**	**Percentage (%)**
Inheritance	91	45.0
Rent	62	30.7
Purchase	33	16.3
Gift	6	3.0
Others	10	5.0
Total	**202**	**100.0**

Field Survey (2019).

4.1.12 Number of years spent as co-operative members

Finding from Table 13 shows that more than a quarter (28.2%) of the rice farmers admitted being members of the organisation for the past 1-5 years. Some 16.3%, 9.4%, 5.4% and 40.6% of the

remaining rice farmers reported that spending between 6-10 years, 11-15 years, 16-20 years and more than 20 years respectively in their organisations. The results suggest that the highest proportion of rice farmers admitted to have spent more than 20 year years in their organisations. Being a member of the organisation have a way of putting such farmers in a good stead as they are in better position of utilizing the services given the fact that they can be perceived as credit trust worthy and facilities at subsidized or cheaper rate as members in respective of the organisation. This is in line with study conducted by Kolade and Harpham (2014).

Table 13. Distribution of rice farmers by the number of years spent as members in the organizations

Years with Cooperative	**Frequency**	**Percentage (%)**
1-5 yrs	57	28.2
6-10 yrs	33	16.3
11-15 yrs	19	9.4
16-20 yrs	11	5.4
Others	82	40.6
Total	**202**	**100.0**

Field Survey (2019)

4.1.13 Membership of co-operative/association rice farmers belong

Findings from Table 14 below shows that rice farmers belong to co-operative and others (20.3% and 20.3%) were equally mentioned as the type of association rice farmers belong to. Other association/cooperative mentioned by 8.4%, 2.0% and 2.5% of the rice farmers were community development, thrift and credit society and workers' union/welfare respectively. Majority of 46.5% of attested that they belonged to farmers association. The result implies that the highest proportion of the rice farmers belong to farmers association. This study is similar to study by Abdullahi *et al*., (2015).

Table 14. Distribution of rice farmers based on membership to association

Membership of Association	**Frequency**	**Percentage (%)**
Co-operative society	41	20.3
Farmer association	94	46.5
Community development	17	8.4
Thrift and credit society	4	2.0
Workers' union/welfare	5	2.5
Others	41	20.3
Total	**202**	**100.0**

Field Survey (2019)

4.1.14 Distribution of rice farmers on loan

Further findings from table 15 on sources of credit indicates that majority of the farmers (75.2%) had access to credit through Workers union/welfare. On the other hand, 2.5%, 14.4%, 3.0% and 5.0% had access to credit through bank, friends/family, farmer association and community development respectively. This implies that Workers union/welfare had a good loan scheme that encourage its members to access their loan. A similar study carried out on rural farmer sources and use of credit in Nsukka LGA of Enugu state identified that cooperative societies or what is known 'Esusu' was one of the commonest sources of credit for rural farmers (Akinnagbe and Adonu, 2014). It implies that farmers association in this context appears to be a port of call where individual members of the farmers contribute in order to become eligible to access loans or credit for their rice farming activities.

In addition, findings on the amount of loan farmers accessed shows that great majority of the respondents (78.2%) said that they have accessed between 10,000-50,000, while some 4.0% did not accessed any loan, 5.0%, 4.5%, 5.0% and 3.5% admitted to have accessed credit loan between 51,000-100,000, 101,000-150,000, 151,000-200,000 and 201,000-250,000 respectively. The loan accessed perhaps could be due to institutional factors such as collateral and high

interest rate associated with financial policies, hence the low loan acquisition. This outcome therefore resonates one of the key challenges, which also affects rice productivity in Nigeria. Also, the very fact that rice farming is an expensive business: machinery, seeds, fertilizers and other agro-chemicals cost a great deal of money (Sanusi, 2019). This study is also in tandem with similar work carried out by Asogwa *et al.,* (2014) where they observed that farmers in Benue state were able to access between ₦5,000-₦50,000 loan to be able to carry out their farming activities.

Table 15. Distribution of rice farmers on loan accessed

Loan	**Frequency**	**Percentage (%)**
Farmers' sources of credit loan		
Bank	5	2.5
Friends/family	29	14.4
Farmers association	6	3.0
Community development	10	5.0
Workers union/welfare	152	75.2
Total	**202**	**100.0**
The amount of credit loan farmers accessed		
None	158	78.2
10,000-50,000	8	4.0
51,000-100,000	10	5.0
101,000-150,000	9	4.5
151,000-200,000	10	5.0
201,000-250,000	7	3.5
Total	**202**	**100.0**

Field Survey (2019)

4.1.15 Frequency of extension visits by ASTC extension agents

Table 16 shows results on how often rice farmers get visited by extension agents from the ASTC in a year. Rice farmers maintained being visited by the organization at different times of the year. For instance, over a quarter of the rice farmers (26.2%) reported being visited by the ASTC quarterly. Others (20.3%, 19.3%, 15.8%, 9.9%, 5.0% and 3.5%) agreed that they were visited by

ASTC annually, bimonthly, monthly, any other times (others), fortnightly and weekly respectively. This finding is consistent with the study of Akinagbe, Ezeuzo and Onwubuya (2017) who reported that farmers were visited by extension workers at different time of the years. While the findings of the present study showed that rice farmers were visited ASTC at different times of the year, the frequency of the visit did not align with the recommendation of Food and Agricultural Organization (FAO). The organization recommended that farmers are expected to be visited at least once in every two weeks (forth nightly), which translates to a minimum of 15 extension contacts in a farming season (Idrisa, Ogunbameru, Ibrahim, and Bawa, 2012). This implies that farmers can put to used or practice information disseminated to them by extension agents as this could serve as springboard for increase food production even where they could not afford other services in the country and rice farmers are not exempted. This concurs with the study by Muhammed , Akpoko, Musa, Ajayi and Muhammed (2019) where extension services were the highly sort after by farmers.

Table 16. Distribution of rice farmers based on the frequency of extension visit by ASTC

Extension Visits	**Frequency**	**Percentage (%)**
Weekly	7	3.5
Fortnightly	10	5.0
Monthly	32	15.8
Bimonthly	39	19.3
Quarterly	53	26.2
Annually	41	20.3
Others please specify	20	9.9
Total	**202**	**100.0**

Field Survey (2019)

4.1.16 Sources of information on ASTC services by rice farmers

As shown in the Table 17, a majority of the rice farmers (66.8%) identified the extension agents as their sources of ASTC information. Furthermore, the radio and workshop/seminar were

respectively mentioned by 10.9% and 9.9% of the rice farmers as their sources of information on ASTC services. This result therefore suggests that extension agents still play vital role in disseminating ASTC information in the area. Sources of information contributed uniquely to the utilization of any services including ASTC. This is in consonance with study by Muhammed *et al.*, (2019) which alluded to the influential role the extension agents still play in the dissemination of improve technology even if they are not adequate.

Table 17. Distribution of rice farmers based on their sources of information on ASTC services

Sources of Information	**Frequency**	**Percentage (%)**
Extension agents	135	66.8
Radio	22	10.9
TV	3	1.5
Bulletins	2	1.0
Workshop/seminar	20	9.9
Text messages	5	2.5
Others please specify	15	7.4
Total	**202**	**100.0**

Field Survey (2019)

4.2 Level of Utilization of ASTC Services by Rice Farmers

Results on table 18a revealed the mean score of the services showing that input supply services (M=4.21) was ranked highest ASTC service patronized. Overall, result suggests that input supply services were the most utilised ASTC service by the respondents. Followed by workshop/seminar (M=4.17), tractor hiring (M=3.65), planting (M=3.48), harvesting (M=3.36.), survey (M=3.21), Soil laboratory testing (M=3.0), spraying (M=2.43), warehousing (M=2.05) and marketing (M=1.76). Further finding on table 18b on the Level of utilization of ASTC services by the rice farmers were categorized into low, moderate and high using the adoption index. The index gained by individual farmer was categorized as low (0.1-0.39), moderate (0.4-0.69) and high (0.7-above) taken for each farmers on number of services utilized. Result indicated that out of the 202

respondents, it was discovered that 8 respondents (3.96%) had low utilization of the services, while 165 respondents (81.68%) had moderate utilization and 29 rice farmers (14.36%) had high utilization of the services. This indicates that majority of the rice farmers have moderate utilization level of ASTC services. It could be deduced that though, other services were utilized but not at effective as one would expect. This study contradicts study by Olumba and Rahji (2014) which discovered that majority of plantation farmers had low adoption level due to their potential in Anambra State, Nigeria.

Table 18A Distribution of rice farmers by the level of services utilized from ASTC

S/N	ASTC Services	Always N	%	Sometimes N	%	Rarely N	%	Never N	%	Undecided N	%	M(SD)	Rank
1	Survey	7	(3.5)	117	(57.9)	13	(6.4)	42	(20.8)	23	(11.4)	3.21(1.57)	6th
2	Laboratory/ soil testing	2	(1.0)	88	(43.6)	12	(5.9)	100	(49.5)	0	(0.0)	3.0 (0.98)	7th
3	Tractor hiring	12	(5.9)	153	(75.7)	0	(0.0)	29	(14.4)	8	(4.0)	3.65 (0.94)	3rd
4	Planting	11	(5.4)	126	(62.4)	14	(6.9)	51	(25.2)	0	(0.0)	3.48 (0.93)	4th
5	Spraying	0	(0.0)	21	(10.4)	77	(38.1)	71	(35.1)	33	(16.3)	2.43 (0.88)	8th
6	Workshop/ seminar	75	(37.1)	105	(52.0)	7	(3.5)	11	(5.4)	4	(2.0)	4.17 (0.88)	2nd
7	Input supply	84	(41.6)	95	(47.0)	9	(4.5)	9	(4.5)	5	(2.5)	4.21(0.91)	1st
8	Harvesting	10	(5.0)	119	(58.9)	11	(5.4)	57	(28.2)	5	(2.5)	3.36 (1.02)	5th
9	Warehousing	0	(0.0)	0	(0.0)	52	(25.7)	109	(54.0)	41	(20.3)	2.05 (0.68)	9th
10	Marketing	0	(0.0)	0	(0.0)	15	(7.4)	124	(61.4)	63	(31.2)	1.76 (0.58)	10th

Field Survey (2019)

Table 18B. Adoption index

Level	Index	Frequency	Percentage
Low	0.1-0.39	8	3.96
Moderate	0.4-0.69	165	81.68
High	0.7-Above	29	14.36
		202	**100**

4.3 Factors Influencing the Utilization of ASTC Services and Hypothesis 1

As shown in the Table 19, the result of Tobit regression model indicates that the model correctly predicted 52% of the respondents' scores on their utilization of ASTC services. Meaning that 52% of the variation in the utilization of ASTC services by rice farmers was accounted for by the variables specified in the model. Out of the ten variables included in the model; age (=3.111), marital status (=4.669), education level (=4.607), financial status (=9.208), Household size (=1.955), extension visit (=3.176) and amount of credit accessed (=2.580) were positively significant and statistically related to the dependent variable; all these variables significantly influences farmers utilization of ASTC Services.

With respect to age, as farmers get older they acquire more experience which will in turn increase their understanding. Similar study by Obayelu, Lawal-Adebowale and Agbonlahor (2012) alluded to the fact that age was significant to rice farmers in Ekiti and Ogun States. This attribute can be tapped to improve the respondents farming prowess thereby increasing their level of adoption of the technologies. Marital status influence adoption as they help in farm management and planning. Igboji *et al.,* (2015) who found that married respondents have a responsibility of ensuring food security for their household members and thus engage more in farming activities. Osanyinlusi and Adenege (2016) observed that majority of farmers had a considerable level of education (16yrs or above) respectively. The number of years spent in formal education was positively significant because education is the basic for the acquisition of applied theoretical knowledge when it put into use improvement in the productivity manifest.

This therefore means that the level of literacy or exposure could therefore have significant impact on the ways rice farmers perform certain rice farming activities such as enhancing their

level of understanding and desirability of adopting new farm technologies or interacting well with extension agents. However, the study also contradict contrary to the present study of Mustapha *et al*., (2011) who revealed that majority of the rice farmers had only adult education with very low formal education in Pategi, Kwara State. Finding on financial status by Ulumba and Rahji (2014) found relationship between income and adoption by the farmers in the study area.

Household size was positive significance given that the larger the family, the need to utilize more of the services to meet the demand of the household. Household size was significant and with the model which align with survey carried out by the Nigeria Demographic and Health Survey (NDHS, 2018). As Household size increase there may be corresponding increase in adoption of the technologies stimulated by desire for increased production. House hold size could have implications for rice farming activities in the area, such that the more the number of household, the more involved they become in rice farming activities.

On the significance of extension visit in line with the model, the study was significant and consistent with the study of Akinagbe, Ezeuzo and Onwubuya (2017) who reported that farmers were visited by extension workers at different time of the years. While the findings of the present study showed that rice farmers were visited ASTC at different times of the year, the frequency of the visit did not align with the recommendation of Food and Agricultural Organization (FAO). The organization recommended that farmers are expected to be visited at least once in every two weeks (forth nightly), which translates to a minimum of 15 extension contacts in a farming season (Idrisa, Ogunbameru, Ibrahim, and Bawa, 2012). Idrisa *et al*., (2012) suggested that

farmers are expected to be visited at least once in two week which translates to a minimum of 15 extension contacts in a farming season. Also, credit accessed is important and significant for farmers as noted by scholars (Abdullahi *et al*., 2015; Akinnagbe and Adonu, 2014).

The findings further highlight the importance of farmers' socio-demographic factors in building empirical knowledge and understanding the patterns about ASTC services and other extension services utilization. The findings could also provide a pool of insights to policy makers and interventionists on demographic characteristics to look at in designing efficient policies for rice farming in Nigeria.

Table 19. Tobit regression showing the influence of socio-economic/institutional characteristics of rice farmers on the utilization of ASTC services

Independent variable	**Est. Coefficients**	**Standard Error**	**T-Value**
Age	.02598918	.00835373	3.111***
Marital status	.07229876	.01548342	4.669***
Education level	.03363265	.00730034	4.607***
Financial Status	.05825729	.00632714	9.208 ***
Household size	.00929333	.00475444	1.955*
Farming experience	.00428167	.00797811	.537
Size of land	-.00435654	.00584144	-.746
No of Extension visits	.01077330	.00339234	3.176***
Year of cooperative	-.10877104	.00010617	-.102
Amount of credit assessed	.01382682	.00535828	2.580 ***
Sigma	**10490800**	**.00521937**	**20.100**

Field Survey (2019).

*** coefficient statistical significant at 1%

** coefficient statistical significant at 5%

*coefficient statistical significant at 10%

Percentage prediction R^2 = 52%

Likelihood function = 168.8181

Test of Hypothesis 1

H_0. Socio-economic characteristics of small-scale rice farmers' have no significant influence on utilization of ASTC Services.

H_1. Socio-economic characteristics of small-scale rice farmers' have a significance influence on utilization of ASTC Services.

Tobit regression analysis was used to test if socio-economic status of rice farmers significantly predicted level of utilization of ASTC services. The data were analysed using the R software package. Adoption index was used as the dependent variables while the socio-economic/institutional characteristics served as independent/predictor variables to determine the rice farmers' level of ASTC services. The result from analysis of the tobit regression indicates that socio-economic status has influence on ASTC services. Thus, regarding the null hypothesis which states that socio-economic/institutional characteristics have no significant influence on the utilization of ASTC services by the small-scale rice farmers was rejected while the alternative hypothesis was accepted. Invariably, it means that socio-economic/institutional variables have significant influence on utilization of ASTC services. Therefore, H0 is rejected at 5% level of significance while the alternative hypothesis was accepted.

4.4 Effects of ASTC Services on Income of Rice Farmers

Finding in Table 20 shows that close to half of the rice farmers (47.0%) felt that the ASTC services have much improved their income. Some 36.1% and 9.9% of the rice farmers also respectively reported that the ASTC services have very much and fairly much improved their income as a result of their rice farming activities. However, the remaining 5.0% and 2.0% of the

rice farmers respectively noted that the ASTC services have 'not much' or 'not at all' improved their income.

Table 20. Extent to which ASTC services have improved income

Extent	Frequency	Percentage (%)
Very much	73	36.1
Much	95	47.0
Fairly much	20	9.9
Not much	10	5.0
Not at all	4	2.0
Total	**202**	**100.0**

Field Survey (2019)

Table 20a shows Gross Margin of rice production values for the three years. The total income earned by farmers is the total revenue less total cost (variable cost plus fixed cost). The value of income from rice farming is the final value in a single production process. Revenue earned is a description that rice farmers are able to manage farming, so the results obtained provide income as expected. Revenue earned by farmers, gives an indication that farming can be used as a picture if farmers are able to manage farming well.

The 3 years activities were analysed to determine the effect of the services on the income of rice farmers. For instance, in 2016, the total income was N16,834,296,700. In 2017, there was an increase in the total income to N27,163,614,100 and in 2018, the total income reduced to N26,346,695,505. The value of income from rice farming is the final value in a single production process. The changes in the total income over the years earned by farmers, gives an indication that farmers could have reacted to socio-economic reality of their time such as increase in the cost of services, economic reality of the present time and other external factors.

Further findings shows that Return on investment is the value of income divided by the total cost of production. For every N1 spent in rice farming by the rice farmers, it was expected that there

was an investment return of N2.90 for 2016, N2.60 for 2017 and N1.44 for 2018. Using the exchange rate of 1$ = N360 as at 2019**.** This study is in tandem with finding by Arifin and Muhammad (2018) in Efficiency and Income of Rice Farming in Rainfed Lowland were technologies utilized lead to increase in the income of the farmers and vice-versa.

Table 21A. Rice farmers budget from 2016-2018 farming season

	Description	**2016**	**2017**	**2018**
A	**Production**	8,687	10,665	10,207
B	**Production price**	1,939,800	2,549,700	2,586,200
C	**Revenue**	**16,851,042,600**	**27,192,550,500**	**26,397,343,400**
D	**Variable cost:**			
	Survey	150,000	185,000	175,000
	Soil laboratory	60,000	170,000	55,000
	Cultivation	2,079,000	3,837,000	8,298,575
	Planting	1,574,900	2,835,700	9,209,500
	Seedling	1,758,800	5,229,000	2,582,200
	Fertilizer	1,936,500	3,291,600	5,818,500
	Spraying	911,000	1,683,100	2,899,460
	Harvesting	2,250,000	3,944,000	9,150,000
	Workshop	1,036,000	1,195,000	2,200,000
	Marketing	15,000	20,000	35,000
	Storage	10,000	15,000	10,000
	Miscellaneous	2,549,700	3,637,000	2,799,660
	Land (purchase/rent)	2,415,000	2,894,000	7,415,000
E	**Fixed cost**	-	-	-
F	**Total cost (D+E)**	**16,745,900**	**28,936,400**	**50,647,895**
G	**Income (C-F)**	**16,834,296,700**	**27,163,614,100**	**26,346,695,505**
H	**Return on investment(G÷F)**	**2.90**	**2.60**	**1.44**

Significant relationship between ASTC services and the income of Rice farmers and Hypothesis two

Findings in Table 21b shows the result of effects of ASTC services on the income of the participating rice farmers. Linear regression analysis was used to test if small-scale rice farmers' utilization of ASTC services significantly predicted income of farmers. The data were analysed using SPSS 23. The Linear regression indicates that variation in the income of rice farmers was

accounted for by the variables specified in the model. It can be deduced from the table above the adoption of more services were found to influence the total income earned by the respondents in the study area. While services utilized by of ASTC farmers formed the independent/predictor variables or as a model, the Gross margin served as the dependent variable of the farmers (level of income).The income earned by farmers is the total revenue less total cost (variable cost plus fixed cost).

The result from the three years shows whether if significant relationship exist between utilising ASTC services and the income of rice farmers in the study area. In the first year (2016, the R value was 67% and only two variables had significant values (Survey = -2.100; Tractor hiring = 5.582), while in 2017, The R value was 68% and five variable were found to have significant effect on the income of small-scale rice farmers. The variables are; Tractor hiring (=2.277), Input supply (=2.886), Spraying (=2.008), harvesting (=-1.973) and workshop/Seminar (=2.768). While in the final year (2018) The R value was 76% and it was observed that seven variables were significant. They are Survey (=1.766), soil laboratory testing (=-2.544), input supply (=8.284), Spraying (=3.606), workshop/Seminar (=4.496), market linkage (=-2.802) and storage (=2.291).

Test of Hypothesis II

H_0. There is no significant effect of small-scale rice farmers' utilization of ASTC services on their income in the study Area.

H_1.There is a significant effect of small-scale rice farmers' utilization of ASTC services on their income in the study Area.

The null hypothesis (H0) which stated that there is no significant effect of ASTC services on the income of small-scale rice farmers in the study Area. Using the result of the linear regression

analysis it therefore indicates that ASTC made significant contribution to the level of income of participating farmers; therefore H0 is rejected at 5% level of significance while the alternative hypothesis was accepted. This may imply that as farmers adopt more services, there is the probability that changes in income of the farmer is bound to occur. Though initial phobia may arise but as time pass, the benefit becomes evident to the famer and hence the desire to adopt more services to increase output and income. This is because farmers who were exposed to the adoption of agricultural technology witnessed much higher increase in the average income at a given period of time in comparison to those who did not (Tologbonse, Jibrin, Auta and Damisa, 2013).

Finding of this study also extend beyond the issue of mere effect to the significant roles workshop training, inputs, harvesting services and many more could have on farmers' income, especially in the area of rice farming. It can be inferred that information acquired by farmers during workshop organized by the organisation could serve as reservoir for knowledge to get more inputs, which can help in translating ideal or theory to reality even in the face of economic down turn on the farmers. Overall, it implies that the model presented was fit and significantly explained the relationship between ASTC services and income of the participating farmers.

Also, Momoh *et al*., (2018) noted a significant increase in the income of ASTC, tomato farmers in Plateau state.

Table 21B Summary of significant table 2016-2018

Model	2016 Coefficients	T-value	2017 Coefficients	T-value	2018 Coefficients	T-value
(Constant)	-337847.774	-1.568	-339934.797	-.2.096	-1443042.956	-8.309
Survey	-22.000	-2.101**	.368	.013	19.980	1.766*
Soil Lab. Testing	17.817	1.167	31.063	1.158	-52.592	-2.544***
Tractor Hiring	34.240	5.582***	13.217	2.277**	.612	1.180
Planting	6.891	.908	7.092	.793	1.708	1.913*
Input supply	-.848	-.252	10.360	2.886***	56.901	8.284***
Spraying	-5.350	-.951	9.643	2.008**	10.186	3.606***
Harvesting	4.502	.544	-11.708	-1.973*	-1.106	-1.383
Workshop/seminar)	55.907	1.220	51.617	2.768***	71.567	4.496***
Market Linkage	24.703	.846	-9.502	-.262	-60.791	-2.802***
Storage	-40.430	-1.143	-2.542	-.064	121.648	2.291**
Correct Prediction	**R-value 2016:** .669[a]		**R-value 2017:** .679[a]		**R-value 2018:** .761[a]	

Field survey (2019)

***** coefficient statistical significant at 1%

** coefficient statistical significant at 5%

*coefficient statistical significant at 10%

4.5 Constraints Faced in Utilizing ASTC Service

Result in Table 22 shows challenges faced in utilizing ASTC services. The challenges identified by respondents were averaged and later ranked accordingly. The challenges were therefore rated by respondents in the following order and they include the following: inadequate finance (M=4.81, SD=0.40),High Cost of services (M=4.35, SD=0.69), late arrival input (M=4.14, SD=0.90), poor extension services (M=3.83, SD=0.79), poor storage facility (M=3.81, SD=1.14),frequent break down of tractors (M=3.59, SD=0.75), poor access to market (M=3.53, SD=0.66), flooding (M=3.52, SD= 0.76), inadequate fertilizer/agro-chemical (M=3.45, SD= 1.12), fragmented farm land (M=3.31, SD= 0.96) and pest and disease(M=2.80, 1.12). Findings

suggest that finance was a major challenge facing the effective utilization of ASTC services in the study.

This implies that finance is a key factor in the utilization of ASTC services in the area, farming activities requires large financial outlay which is needed to acquired the various technologies needed for improve rice production and profitability. Where this become a problem, the farmer could be faced with poor uptake of the available services due to inadequate finance as this may go a long way in discouraging farmers from using the facilities. This is in consonance with studies by Sri, Acip, Qorri, Quonitta and Nur (2018) claimed that farmers hardly get financial assistance owing to the fact that the agricultural sector poses an investment risk characterized by high transaction costs, asymmetric information, low profits, lack of collateral, education of farmers is relatively low and fluctuating market prices.

Also, Momoh *et al*., (2018) revealed that supply of input, high cost of purchasing the equipment, inadequate access to water for irrigation farming, lack capital in form of credit, among others accounted for the challenges the tomato farmers experienced in utilizing ASTC services. The present findings also agreed with other authors (Gushit *et al.,* 2013; Girei *et al*., 2017) who observed that fertilizer, water availability, capital, high cost of labour, tractor hiring, pest and diseases, marketing and prices were constraints to farmers in Plateau State. Specifically, the findings once again highlighted the possible consequences could have if the desired efforts are not put in place to mitigate these challenges in order to boost farmers income and productivity in the study area.

Table 22. Constraints faced in utilizing ASTC services

		SD		D		UD		A		SA				
	Items	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**Total(%)**	**M(SD)**	**Rank**
1.	Inadequate finance	0	(0.0)	0	(0.0)	1	(0.5)	36	(17.8)	165	(81.7)	202(100)	4.81(0.40)	1st
2.	High cost of services	0	(0.0)	3	(1.5)	16	(7.9)	90	(44.6)	93	(46.0)	202(100)	4.35(0.69)	2nd
3.	late arrival inputs	0	(0.0)	20	(9.9)	10	(5.0)	94	(46.5)	78	(38.6)	202(100)	4.14(0.90)	3rd
4.	poor extension services	0	(0.0)	8	(4.0)	58	(28.7)	96	(47.5)	40	(19.8)	202(100)	3.83(0.79)	4th
5.	poor storage facility	15	(7.4)	0	(0.0)	64	(31.7)	52	(25.7)	71	(35.1)	202(100)	3.81(1.14)	5th
6.	Frequent breakdown of Tractors	0	(0.0)	9	(4.5)	88	(43.8)	81	(40.3)	23	(11.4)	202(100)	3.59(0.75)	6th
7.	poor access to market	0	(0.0)	3	(1.5)	105	(52.2)	78	(38.8)	15	(7.5)	202(100)	3.53(0.66)	7th
8.	Flooding	1	(0.5)	3	(1.5)	83	(41.1)	85	(42.1)	30	(14.9)	202(100)	3.52(0.76)	8th
9.	inadequate fertilizer/ agrochemical	17	(8.4)	10	(5.0)	80	(39.6)	56	(27.7)	39	(19.3)	202(100)	3.45(1.12)	9th
10.	fragmented farm lands	0	(0.0)	39	(19.4)	92	(45.8)	39	(19.4)	31	(15.4)	202(100)	3.31(0.96)	10th
11.	pest and diseases	25	(12.4)	57	(28.2)	72	(35.6)	30	(14.9)	18	(8.9)	202(100)	2.80(1.12)	11th

Field Survey (2019) Note. SA= strongly agree, A= agree, D= disagree, SD= strongly disagree and U= undecided.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary

The main objective of this study was to examine the factors influencing utilization of ASTC services by small–scale rice farmers in some selected LGA of Plateau State. In order to achieve this objective, multistage sampling technique was employed to select the rice farmers in the study area. A total of two hundred and two structured questionnaires were administered in the selected study areas. Information for analysis was based on rice farmers' experience and perception. The result was analyzed through the use of descriptive statistics (simple percentage and mean), inferential statistics such as tobit regression and linear regression were equally used.

Finding on the socio-economic and institutional characteristics of the farmers showed that the highest proportion (40.1%) of rice farmers were between ages 41-50 years. Also, finding revealed that a great majority (86.6%) of the rice farmers were males, with an overwhelming majority of the rice farmers (90.1%) were married. Result indicated that years spent in formal education were distributed across most categories. Further finding indicated that more than half of the rice farmers (56.9%) admitted being full time farmers while the highest proportion of the rice farmers (40.1%) had 7 or more persons in their households and the highest proportion of respondents (41.6%) admitted spending between 6-10 years. Accordingly, results showed that more than half of the rice farmers (55.9%) started using ASTC services between the years 2014-2018 and that more than a quarter (28.7%) and close to a quarter (24.8%) of the rice farmers admitted that they cultivated 1.50-2.0 hectares and 0.60-1.0 hectares respectively. More finding showed that the highest proportion of rice farmers (45.0%) admitted that they inherited their land while more than a quarter (28.2%) of the rice farmers admitted being members of the

organisation for the past 1-5 years. Furthermore, there were more rice farmers (78.7%) who did obtain loan in the past planting season. Meanwhile, farmers association was identified by an overwhelming majority of the rice farmers (75.2%) as their source of credit loan; also, a great majority of the rice farmers (78.2%) alluded to have accessed one form of loan or the order. While more than a quarter of the rice farmers (26.2%) reported visiting the ASTC quarterly, a majority of the rice farmers (66.8%) identified the extension agents as their sources of ASTC information. Study also discovered that co-operative and farmer association (20.3% and 20.3%) were equally mentioned as the type of association rice farmers belong to.

Further finding showed that input supply (M=4.21), workshop/seminar (M=4.17), tractor hiring (M=3.65), planting (M=3.48), harvesting (M=3.36.), survey (M=3.21), Soil laboratory testing (M=3.0), spraying (M=2.43), warehousing (M=2.05) and marketing (M=1.76) were utilized and ranked at varying degree by rice farmers in the study area.

Also, finding indicates that age (=3.111), marital status (=4.669), education level (=4.607), financial status (=9.208), Household size (=1.955), extension visit (=3.176) and amount of credit accessed (=2.580) significantly and statistically influences farmers utilization of ASTC Services. Meaning that 52% of the variation in the utilization of ASTC services by rice farmers was accounted for by the variables specified in the model.

Findings equally showed that the highest proportion of rice farmers affirmed that the ASTC services have much improved their income over a given period of time. Tractor hiring (=2.277), Input supply (=2.886), Spraying (=2.008), harvesting (=-1.973) and workshop/Seminar (=2.768)

among others had a considerable effect on the income of the farmers. Three years activities were pooled and analysed to determine the effect of the services on the income of rice farmers using Gross margin analysis. Return on investment is the value of income divided by the total cost of production. For every N1 spent in rice farming, it was expected that there was a return on investment of N2.90, N2.60 and N1.44 for the period between 2016 to 2018 years using the exchange rate of 1$ = N360 as at 2019. The changes in the total income over the years earned by farmers, gives an indication that farmers could have reacted to socio-economic reality of their time such as increase in the cost of services, economic reality of the present time and other external factors.

Finally, it was observed that inadequate finance (M=4.81, SD=0.40), high cost of services (M=4.35, SD=0.69), late arrival input (M=4.14, SD=0.90), among others were discovered to hamper effective utilization of ASTC services by the small-scale rice farmers for the period under study.

5.2 Conclusion

Based on the findings of the study, it can be established that socio-economic/institutional factors have influence on ASTC rice farmers. It was found that Age, Marital status, financial status, educational level, household size, extension visits and credit accessed were observed to determine the intensity of utilization or adoption of ASTC services in the study area especially among rice farmers. The study concluded that certain socio-demographic/institutional variables were crucial to the understanding factors influencing the utilization of ASTC services in the study area.

The research further concludes that Input supply, workshop/ training, tractor hiring among others were the most utilized services by the rice farmers. Although rice farmers had moderately subscribed to ASTC services but could not attain high level of utilization due to financial constraints coupled with the High cost of services were the major constraints to ASTC services utilisation. The study concluded that the few of the services utilized had a significant increase in the income of the rice farmers for the duration under study. Thus, certain socio-economic/institutional variables are crucial factors that can influence the level of ASTC utilization and income in the study area.

5.3 Recommendations

Based on the findings of the study, it is hereby recommended that stakeholders should strive to implement the following:

i. Finding on the socio-economic and institutional characteristics indicates that farmers were able to access credit of between 10,000 -50,000. Financial institutions can make interest rate on framing attractive to encouraged farmers association to access more funds for their agribusiness activities.

ii. Finding on the level of utilization of ASTC services were moderate. High cost of inputs was one of the constraints to the level of utilization as reported by farmers. Farmers patronage can be encourage through given of discount by ASTC to enhance optimum utilization level in the study area

iii. Management should ensure that more tractors are procured and made available at the right time (especially rainy season) to meet farmers demand as against what is presently obtained. This is because majority of the farmers complained of late arrival

of inputs, inability of tractors to meet farmers demand as at when due because farming is a seasonal occupation in Nigeria.

iv. ASTC should reinforce awareness campaign among non-participating rice farmers in the State so as to further widen its scope of activities and market share in the area

v. Farmers can increase their savings scheme in order to have access to more credit from farmers cooperatives with lower interest rates, easy registration processes and flexible payment terms. This will encourage more rice farmers to access loans and enable them expand their production which will ultimately lead to improve standard of living of families and the nation as a whole.

5.4 Contribution to Knowledge

1. The study showed that age (3.11), marital status (4.669), educational level (4.607), financial status (9.20), extension visit (1.95) and amount accessed (3.176) collectively contributed 52% to the total variation in rice farmers level of utilization of ASTC services in Plateau state
2. The study revealed that input supply, workshop/seminar, tractor hiring, planting, harvesting, survey, Soil laboratory testing, spraying, warehousing and marketing services from ASTC collectively contributed about 70% to the total variables in rice farmers household income.
3. Further result revealed that ASTC services led to an average increase in rice farmers output of 1,520kg, which is about 18% per hectare of the participating household
4. The study also revealed that ASTC services made an average increase of N281,565.31 in the income of rice farmers which is about 56.7% among the participants.

5.5. Limitation of the Study

The idea of no work without limitation is not exempted in this study. The first limitation of this study is a limitation to the generalization of the findings. This is because only 202 samples in the three LGAs were covered. This has some limitations like memory recall, secrecy of information and finance which may ultimately allow causal inference to be made in any study

5.6. Suggestions for Further Study

Studies can be conducted on any of the following suggested topics:

1. Factors militating against women participation in rice farming in Plateau South senatorial District of Plateau State
2. Impact of ASTC programme on the livelihood of participants and non-participant rice farmers in Plateau State
3. Comparative analyses of profitability of ASTC rice farmers in Plateau and Kaduna States.
4. Future studies should increase both the area of study and the number of the participants to be sampled for the studies;
5. This type of study should be replicated in other states for comparative purposes.

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APPENDIX

DEPARTMENT OF AGRICULTURAL EXTENSION AND RURAL DEVELOPMENT,

FACULTY OF AGRICULTURE,AHMADU BELLO UNIVERSITY, ZARIA.

TOPIC: ANALYSIS OF FACTORS INFLUENCING UTILIZATION OF ASTC SERVICES BY SMALL-SCALE RICE FARMERS IN SOME SELECTED LGA OF PLATEAU STATE, NIGERIA.

Dear Sir/Madam,

I am Sunday Adole AGADA, a post graduate student with number P16AGAE8029 carrying out a research on ***Analysis of Factors Influencing Utilization of ASTC Services by Small-Scale Rice Farmers in Some Selected LGA of Plateau State, Nigeria.*** Please this study is designed purely for academic purposes and you are assure that any information provided will be treated with strict confidentiality, as the study is set out to achieve the aforementioned objective.

Thank you in anticipation.

Yours faithfully,

Adole Sunday AGADA

INSTRUCTION: PLEASE TICK OR FILL IN THE GAP IN THE OPTION MOST APPROPRIATE TO YOU

SECTION A: SOCIO-ECONOMIC/INSTIUTIONAL CHARCTERISTICS OF RESPONDENTS

1. Name of village---------- LGA----------
2. Phone no----------
3. What is your age? (1) 20-30yrs (2) 31-40yrs (3) 41-50yrs (4) 51-60yrs (5) other (specify)-----
4. What is your sex? (1) Male (2) Female
5. What is your marital status? (1) Married (2) Single (3) Divorce (4) Separated
6. How many years did you spend in formal education? (1)None (2) 1-6 (3) 7-12 (4) 13-18 (5) others (specify)
7. What is your financial status? (1) None (2) 10,000-50,000 (3) 51,0000 -100,000 (4) 101,000-150,000 (5) 151, 000-200,000 (6) 210,000 -Above
8. What is your main occupation? (1) Full time farmer (2) Civil servant (3) Business (4) Artisan (5) Others (specify)
9. What is the number of your household? (1) 2 (2) 3 (3) 4 (4) 5 (5) 6 (6) 7 above (specify)----------
10. How many years have you spent in rice farming? (1)1-5yrs (2) 6-10yrs (3) 11-15yrs (4) 16-20yrs (5) others (specify)----
11. How long have you been using ASTC services? (1) 12 (2) 9 (3) 6 (4) 2
12. What size of land did you cultivate for rice in 2017/ 2018 farming season? (1) 0-50 (2) 0.60-1.0 (3) 1.50-2.0 (4) 2.50-3.0 (5) 3.50-4.0 (6) others (specify)----

13. How did you acquire your land? (1) Inheritance (2) Rent (3) purchase (4) gift (5) others(specify)
14. What Membership of Association/co-operatives do you belong? (1) Co-operative society (2) Farmers Association (3) Community Development (4) Thrift and Credit Society (5) Workers Union/ Welfare (6) Others (specify)
15. How many years have you spent as membership of organisation? (1)1-5 (2) 6-10 (3) 11-15 (4) 16-20 (5) others (specify)
16. Did you obtain credit/loan from any formal financial organisation in the last planting season? (1) Yes (2) No
17. what other sources do you source of your credit/loan from (1) Bank (2) Friends/Family (2) Farmers Association (3) Community Development (4) Workers Union/ Welfare (5) others (specify)
18. How much Credit/Loan did you accessed? (1) None (2) 10,000-50,000 (3) 51,000-100,000 (4) 101,000-150,000 (5) 151,000-200,000 (6) 201,000-250,000 (7) 0thers (specify)-----
19. What is the frequency of extension visit you get from ASTC in a year? (1) Weekly (2) Fortnightly (3) monthly (4) bimonthly (5) quarterly (6) Annually (7) Others (Specify)
20. What are the sources of your information on ASTC services? (1)Extension agents (2) Radio (3) TV (4) Bulletins (5) Workshop/Seminar (6) Text messages (7) Others (specify)

SECTION B: LEVEL OF ASTC SERVICES UTILIZED

21. Level of ASTC utilized from ASTC?

Services Rendered	Always	Sometimes	Rarely	Never	Undecided
i. Survey services					
ii. Laboratory/soil testing services					
iii. Tractor hiring services					
iv. Planter hiring services					
v. Spraying/Agro-chemical services					
vi. Workshop/training services					
viii Input supply					
Xix Harvesting services					
X Warehousing services					
Xii Marketing services					

22. What do you think is responsible for not utilizing each of the services?

(1) financial implication (2) technical know-how (3) poor service delivery (4) small land-holding (5) poor access to credit facilities (6) other (specify) --- ----------

23. How effective are the ASTC services you utilize? (1) Highly effective (2) Effective (3) fairly effective (4) not effective

SECTION C: EFFECT OF ASTC ON RICE FARMERS

Please indicate rice farming activities for 2016 - 2018 planting seasons in the table below

No of plots	Year	Size of plot	Quantity harvested	Quantity sold	Price per bag (kg)	ASTC services	Prices Paid

24. To what extent do think has ASTC services improved your rice yield per hectare? (1) Very much (2) much (3) Fairly much (4) not much (5) not at all
25. To what extent has ASTC services improved your income? (1) Very much (2) much (3) fairly (4) not much (5) not at all ( )

SECTION D: CONSTRAINTS FACED IN UTILIZING ASTC SERVICES

26. The challenges faced in utilizing ASTC services (tick appropriately SA= Strongly agree, A=Agree, D= Disagree, SD=Strongly Disagree and U= Undecided)

S/N	ITEM	SA	A	D	SD	UD
i.	High cost of services					
ii.	Inadequate finance					
iii.	Late arrival of inputs					
iv.	Poor storage facilities					
v.	Frequent breakdown of tractors					
vi.	Inadequate fertilizers/agrochemical					
vii.	Pest and diseases					
viii.	Flooding					
ix.	Poor extension services					
x.	Poor access to market					
xi.	fragmented farmlands					

27. What do you think can be done to improved rice farmers income by ASTC in your area?

    (1) timely delivery of inputs (2) reduction in the cost of services (3) availability of improved rice varieties and other inputs (4) linking rice farmers to prospective markets (5) supply of fertilizers and insecticides/pesticides (6) soft loans from the government (7) Regular supply of high yielding rice varieties should be made available to farmers at subsidized rate (8) prices of tractors and other implements should be reduced to motivate farmers utilization and participation in the programme (9)others (specify)

28. What are your suggestions on the effective utilization of ASTC services by rice farmers?
