EFFECT OF PARTICIPATION IN ARTISANAL AND SMALL-SCALE MINING ON THE OUTPUT, INCOME AND STANDARD OF LIVING OF FARMERS IN KADUNA STATE, NIGERIA

BY

Ishaku Usman GADZAMA

DEPARTMENT OF AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY,
AHMADU BELLO UNIVERSITY,
ZARIA - KADUNA STATE,
NIGERIA

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BY

Ishaku Usman GADZAMA, **BSc (UNIMAID), MSc (ABU)**
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A THESIS SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, AHMADU BELLO UNIVERSITY, ZARIA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF DOCTOR OF PHILOSOPHY IN AGRICULTURAL EXTENSION AND RURAL SOCIOLOGY

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

DECEMBER, 2015

DECLARATION

I hereby declare that the work in this Thesis entitled: **Effect of Participation in Artisanal and Small-Scale Mining on the Output, Income and Standard of Living of Farmers in Kaduna State, Nigeria** has been carried out by me in the Department of Agricultural Economics and Rural Sociology. The information derived from literature has been duly acknowledged in the text and a list of references provided. No part of this Thesis was previously presented for another degree or diploma at this university or other institution.

Ishaku Usman GADZAMA **Date**
Student

CERTIFICATION

This Thesis entitled: **Effect of Participation in Artisanal and Small-Scale Mining on the Output, Income and Standard of Living of Farmers in Kaduna State, Nigeria** by **Ishaku Usman GADZAMA** meets the regulations governing the award of the Degree of Doctor of Philosophy (PhD) in Agricultural Extension and Rural Sociology of the Ahmadu Bello University, Zaria and is approved for its contribution to knowledge and literary presentation.

Prof J. G. Akpoko	**Date**
Chairman, Supervisory Committee	
Prof M. O. Akinola	**Date**
Member, Supervisory Committee	
Prof Z. Abdulsalam	**Date**
Member, Supervisory Committee	
Prof Z. Abdulsalam	**Date**
Head of Department	
Prof K. Bala	**Date**
Dean, School of Postgraduate Studies	

DEDICATION

I dedicate this Thesis to my lovely wife **Mrs. Jagila Ishaku Gadzama** who stood firmly by me during this programme.

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LIST OF ACRONYMS AND ABBREVIATIONS

AIDS: Acquired Immune Deficiency Virus

ASM: Artisanal and Small-Scale Mining

CDC: Commonwealth Development Corporation

CTM: Consolidated Tin Mines

DFID: Department for International Development

DRC: Democratic Republic of Congo

ECA: Economic Commission for Africa

FAO: Food and Agriculture Organization

FEPA: Federal Environmental Protection Agency

FGD: Focus Group Discussion

GDP: Gross Domestic Product

HDR: Human Development Report

HIV: Human Immune Virus

IDI: In-Depth Interview

IDS: Institute of Development Studies

IIED: International Institute for Environment and Development

ILO: International Labour Organization

IUCN: International Union for Conservation of Nature

KADCCIMA: Kaduna Chamber of Commerce, Industry, Mines and Agriculture

KNP: Kamuku National Park

LGA: Local Government Area

MEM: Ministry of Energy and Minerals

MMSD: Mining Minerals and Sustainable Development

NGOs: Non-Governmental Organizations

NPC: National Population Commission

PRA: Participatory Rural Appraisal

PREM: Poverty Reduction and Economic Management Network

RBA: Royal Bafokeng Administration

SLA: Sustainable Livelihoods Approach

SRI: Standford Research International

SWOT: Strengths, Weaknesses, Opportunities and Threats

UNCED: United Nations Conference on Environmental Development

UNDESA: United Nations Department of Economic and Social Affairs

UNDP: United Nations Development Programme

UNEP: United Nations Environment Programme

WCARRD: World Conference on Agrarian Reform and Rural Development

WCED: World Commission on Environmental and Development

WHO: World Health Organization

WWF: World Wildlife Funds

ZANU (PF): Zimbabwe African National Union (Patriotic Front)

ABSTRACT

The study was carried out to investigate the effect of participation in artisanal and small-scale mining on the output, income and standard of living of farmers in Kaduna State, Nigeria. A multi-stage sampling technique was used for sample selection. The first stage was purposive selection of Birnin Gwari, Jema'a and Kajuru Local Government Areas based on the participation of farmers in Artisanal and Small-Scale Mining (ASM). Random sampling technique was employed to select 30% of the sample frame. A total of 381 farmers were included in the study. Primary data were collected from 381 respondents with the aid of structured questionnaire, in-depth interview and focus group discussion. The data collected were analyzed using descriptive and inferential statistics such as Tobit regression model and Z-test statistic. The results of the study showed that a significant proportion (68%) were male while 32% were female respondents. Many (61%) were in the age category of 20 and 35 years with an average age of 30 years and their highest education was secondary. Seventy five per cent of the respondents were married and had sizeable members in their households. Significant proportion of the farmers owned land and 20% each of the respondents had about 11 - 15 years, 16 - 20 years and 21 - 25 years in farming. The study revealed that the respondents had no access to credit and they were not members of cooperatives but had about 6 - 10 times access to extension contacts. The study showed that 93% of the respondents were aware of government policies on ASM while 58% of the respondents were not involved in its formulation and however, the policies were not properly enforced. The study further confirmed that a significant proportion of the respondents' perceived these policies as not effective. The findings of this study showed that age, sex, household size, farming experience, membership of cooperatives, access to credit, extension contacts and land ownership significantly affected the output, income and standard of living of farmers at ($P \leq 0.10$) level of probability. The SWOT analysis showed the strengths of ASM that it has improved the standard of living of the respondents in the mining communities while the weaknesses of ASM indicated that 33% of the respondents lacked modern equipment for mining activities. The results on the opportunities of ASM indicated that the informal sector has created employment to the farmers and they earned good wages from participation in ASM while the threats of ASM revealed that a significant proportion (83%) of the respondents said that it has destroyed their farmlands. The results showed that 34% of the respondents cope with the negative effects of ASM by utilizing the farm lands not used for ASM, while 0.7% sold their livestock and products to cope with the effect of mining activities. The study recommends that for the environment to be sustainable there is a need for the participating farmers to carry out mining activities at virgin lands that are far away from residential areas and people's farm lands.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Mining and the use of different kinds of mineral resources by man is an activity that is as old as human civilization, as indicated by the names given to certain periods in human development like stone-age, bronze-age and iron-age. Artisanal and Small-Scale Mining (ASM) refers to mining by individuals, groups, families or cooperatives with minimal or no mechanization, often informally. It is practiced by low levels of production, poorly skilled labour, poor technology, small claims, subsistence and illegality (Hentschel, Hruschka and Priester, 2003). ASM is any extraction of mineral substances which use manual, traditional methods and processes. The nomadic nature of mining promotes the spread of diseases (Phiri, 2012).

Artisanal and small-scale mining occurs in approximately 80 countries across the globe (World Bank, 2013). This sector accounts for more than 20% of the world's non-fuel mineral production (Hilson and Banchirigah, 2009). For instance, in Africa, the mining of gold and other minerals were the cornerstone economic activities in most ancient civilizations (D'Souza, 2002). Likewise, the British colonial name of Ghana, the "Gold Coast", aptly referred to the presence of gold in the region (Hilson, 2001). Ghana is considered as the second largest producer of gold in Africa after South Africa. The huge European interest in Ghana's gold and other natural resources culminated finally in the

colonization of the territory by the British imperial powers in the nineteenth century (Agbesinyale, 2003).

In sub-Saharan African, artisanal and small-scale miners produce over 60% of the world gold (World Bank, 2013). This sector is generally labour intensive and requires small capital and technical investments, with modest levels of production and efficiency. It means ASM does not require formal training but low level of technology for people to participate. ASM typically provides a substantial contribution to local development through employment and cash income. Apart from participating in mining, some miners are often simultaneously engage in agricultural activities (World Bank, 2013).

In Zimbabwe, it has been observed that 100 million people are indirectly dependent on ASM for their livelihoods. For instance, Maponda and Meck cited in Alexander and Mcgregor (2013) described the extent of ASM, and relate it to local nomenclature like *galamseys* in Ghana, *makorokoza* in Zimbabwe and *garimpeiros* in Brazil. It appears that many people resort to ASM as a way of improving their output, income and standard of living, which in turn has negative effect on farm crops of farmers in mining communities.

Nigeria has over 500 known mineral deposit sites of over 34 different minerals across the 36 States and Federal Capital Territory, Abuja (Nigerian Minerals and Mining Act, 2007). ASM is largely a poverty-driven activity, and despite the fact that it is subsistence, unlicensed and illegal, the sector provides sustainable livelihoods to a large population of farmers in rural areas. In the contemporary Nigerian society, for instance,

many youths are self-employed in this sector. According to Alhassan and Umar (2013:10):

> *The youths are making a lot of money from mining. In 2011, three miners in the same mining pit made six million naira. There is a ready market for the gold because dealers from even neighbouring countries armed with money flooded the mining sites. A gramme of gold is sold at ₦6, 000.00.*

Adekoya (2003) noted that Sofon Birnin Gwari in Kaduna State was once thrived on gold mining between 1914 and 1938 but was abandoned due to exodus of miners to the Jos Plateau tin fields in the early forties. Incidentally, the miners between early 2000 and 2005 have returned to the Gwari area as a result of a new discovery of gold deposits in the place. Yunana and Banta (2014) also pointed out that extensive illegal mining activities are also carried out in Sanga Forest Reserved of Kaduna State. According to them, ASM has caused the loss of farmlands due to erosion. Other problems associated with ASM are land disputes, loss of soil fertility, drunkenness, drug addiction and social harassment in Kaduna State.

In spite of the effect of participation in ASM on the output, income and standard of living of farmers, they still manage to farm. However, the activities of these miners had affected the development of communities where mining take place. In order to investigate this, it is important to understand the effect of participation in ASM in Kaduna State.

1.2 Problem Statement

The effect of participation in artisanal and small-scale mining are increasingly acknowledged after decades of being overlooked due to its criminalization, informality and lack of legal status (Sinding, 2005; Siegel and Veiga, 2009). Some rural dwellers who engage in farming also attempted ASM in communities where mining take place. Other people had arrived communities where ASM take place as migrants or foreigners due to the discovery of mineral resources. Their participation in ASM has effect on agricultural activities because of the damages they cause to farmlands and virgin lands. Mining activities also reduces soil organic matter, increases erosion and deforestation in rural areas. Studies carried out by Kareem and Owao (2000) and Yunana and Banta (2014) revealed that ASM has negative effects on agricultural farmlands, vegetation and above all, the socio-economic development of communities in Antang District of Jema'a Local Government Area (LGA) of Kaduna State.

The participation of some rural dwellers in ASM to improve their limited livelihood options had affected their output, income and standard of living. Apart from contamination of water by mining activities in Kaduna State, social tensions are alarming due to the arrival of migrants, which may cause higher pressure on infrastructural facilities such as health, economic, education and other essential public services. ASM, for instance, also posed more harm to nearby localities that do not receive any social and economic benefits of it. Heemskerk (2005) further observed that:

> *Most miners are not formally trained in mining and have received little education in general. Using rudimentary exploration and extraction techniques, mining is expected to increase household cash income and to supplement meager farming income. While helping the rural poor to make a living, artisanal and small-scale mining also tends to generate negative effects, including environmental degradation, poor health and sanitation, hazardous working conditions, child labour, uncontrolled migration, and the spread of HIV/AIDS and other sexually transmitted diseases (STDs) due to overpopulation as well as an increase in commercial sex workers surrounding mines.*

In quite a number of places, the mining sites and residential areas overlap and the pits dug are uncovered. This makes most miners, animals and farmers vulnerable to death in the underground tunnels the miners had dug. This scenario causes more threats to host mining communities in Kaduna State. According to Mallo (2012) out of the 33 child workers interviewed by Human Rights Watch in 2011, 21 of them suffered from regular pain in their limbs, back, head or neck, while others were plagued by coughing and respiratory diseases.

In spite of in-depth studies, artisanal and small-scale mining communities are not too common in Kaduna State. There has been little exploration of the effects of ASM on farmers' output, income and standard of living and how participation in the sector has affected livelihood security, wealth creation, and employment generation; thereby creating additional latent functions of mining as opposed to the manifest. In Kaduna State, ASM participants are faced with so many challenges, including lack of training and information on geology, methods of mining, methods of processing minerals, business skills to improve mining operations, safety and health practices and environmental management. To this end, the following research questions served as guide:

i. What are the socio-economic characteristics and institutional variables of farmers?

ii. What are the perceptions of farmers on government policies on mining activities?

iii. What are the effects of participation in small-scale mining on the output, income and standard of living of farmers?

iv. What are the strengths, weaknesses, opportunities and threats (SWOT) of ASM?

v. What are the strategies adopted by farmers in the mining communities to cope with the challenges of ASM?

1.3 Objectives of the Study

The aim of this study was to investigate the effect of participation in artisanal and small-scale mining on the output, income and standard of living of farmers in Kaduna State of Nigeria. The specific objectives are to:

i. describe the socio-economic characteristics and institutional variables of farmers;

ii. examine the perceptions of farmers on government policies on mining activities;

iii. determine the effect of participation in artisanal and small-scale mining on the output, income and standard of living of farmers;

iv. describe the strengths, weaknesses, opportunities and threats (SWOT) of ASM; and

v. examine the strategies adopted by farmers in the mining communities to cope with the challenges of ASM.

1.4 Justification of the Study

Studies on the effect of participation in artisanal and small-scale mining on the output, income and standard of living of farmers have not been adequately carried out in Kaduna State. Not minding the traditional methods and size of ASM operations, the informal sector has contributed immensely to creating of jobs and mineral exploration in Nigeria. The contribution has made ASM a social and economic venture for some people to participate.

Although the Nigerian government is discouraging this sector because of the negative effect it has on human and ecological environment. For instance, some solid minerals like lead that was discovered in Zamfara, Ebonyi and Niger States in the country are poisonous, yet they are seen as a source of livelihood for a reasonable proportion of rural dwellers. ASM could significantly contribute to the Gross Domestic Product (GDP) of Nigeria if the conservation of the environment for farming is taken into consideration.

This research would add to existing knowledge on literature on ASM and farmers as well as the State and Federal Ministries of Agriculture and Rural Development, Solid Minerals Development, Environment and Youth Development policy makers would find also the outcome of this study significant. Others include Institutes for Agricultural Research, extension professionals, agricultural extension agencies, health practitioners and disaster managers when it comes to policies on ASM and its effect on agricultural farmlands in Kaduna State in particular and in the Nigerian mining communities in general.

Specifically, the study would be useful to Kaduna Chamber of Commerce, Industry, Mines and Agriculture (KADCCIMA) and Non-Governmental Organizations (NGOs) working on ASM and agriculture. Researchers, students and other stakeholders that would be interested on the effect of participation in ASM on the output, income and standard of living of farmers would also find the findings of this study relevant. The study would further give insights on the threats of ASM on farmers in the study area.

In terms of geographical coverage, for example, Kaduna is one of the States in north western Nigeria that has the largest proportion of participating farmers in artisanal and small-scale mining and yet it is the least covered by literature, while some rural areas in Ghana, Zambia, South Africa and Zimbabwe have received a lot of attention despite Nigeria's population density and landmass in Africa. The study would equip the affected farmers with empirical information on how to mitigate the hazards and adopt strategies to cope with the challenges of ASM in the mining communities.

In fact, there are many studies related to this topic such as Kogbe (1989), Fwatshak (2010), Falola and Paddock (2010), Bleasdale (2011), Akwarandu (2013), Onoja (2013) and Yunana and Banta (2014) but they were not able to capture or relate the activities of participating and non-participating farmers in the communities where mining take place for sustainable rural development. Thus, the research focused on some selected mining communities in Birnin Gwari, Jema'a and Kajuru LGAs of Kaduna State. This study used these communities in understanding the phenomenon of ASM and its effect on the

output, income and standard of living of farmers in the study area. It is against this backdrop that this research eventually serves as an eye opener for further studies.

1.5 Hypotheses

The following hypotheses were tested in null form:

Ho_1 There is no significant effect on the output of participating and non-participating farmers in artisanal and small-scale mining.

Ho_2 There is no significant effect on the income of participating and non-participating farmers in ASM.

Ho_3 There is no significant effect on the standard of living of participating and non-participating farmers in artisanal and small-scale mining.

1.6 Scope of the Study

This study focused on only members of the communities or villages where mining was taking place or had taken place and has affected farming activities. Therefore, the survey was restricted to only the mining communities in Janruwa ("Abuja"), Kakini and Yankan Dutse in Birnin Gwari LGA while Antang, Godo Godo and Nisama were selected from Jema'a LGA and Maraban Kajuru, Kasuwan Magani and ancient town of Kajuru in Kajuru LGA of Kaduna State, where mineral resources were found in abundance. This is because ASM does not take place in all the 23 LGAs of Kaduna State and thus, the study did not cover other communities.

CHAPTER TWO

LITERATURE REVIEW

2.1 Concepts of Participation and Artisanal and Small-Scale Mining

2.1.1 Participation

The concept of people's participation came to influence a broad spectrum of development activities-resource conservation, agricultural extension, forestry development and health. Participation also brought about a re-examination of existing assumptions and practice. In essence, participation is concerned with a broad commitment to redress the imbalances of development activities. It provides the conditions in which people can take an active role in the development process. For instance, in practice, people's participation has been interpreted in a number of different ways. These interpretations range from the narrow scope of development programmes. On the one hand, participation is often passive and consultative while on the other hand, it can be broad and active participation of people in all aspects of socio-economic development (Oakley, 1995).

In 1979, it was agreed at the World Conference on Agrarian Reform and Rural Development (WCARRD) that the interpretation of people's participation provided a broad framework which has influenced the activities and thinking of many development agencies. It means that participation by people in the institutions and systems which govern their lives is a basic human right and also essential for realignment of political power in favour of disadvantaged groups and for social and economic development.

Rural development strategies can realize their potential only through the motivation, active involvement and organization at the grass-roots level of rural people, with special emphasis on the least advantaged, in conceptualizing and designing policies and programmes and in creating administrative, social and economic institutions, including co-operative, and other voluntary forms of organization for implementing and evaluating them (Oakley, 1995).

2.1.2 Mechanisms of participation in policy-making

Bass, Dalal-Clayton and Pretty (1995) identified the following mechanisms of people participation in policy-making:

i. Participants listen only by receiving information from a government public relations campaign or open database.

ii. Participants listen and give information through public inquiries, media activities, and/or "hot-lines".

iii. Participants are consulted through working groups and meetings held to discuss policy.

iv. Participants are involved in analysis and agenda-setting through multi-stakeholder groups, round table discussions and commissions.

v. Participants reach consensus on the main strategy elements through national round tables, parliamentary/select committees, and conflict mediation.

vi. Participants involved in decision-making on the policy, strategy or its components.

At each level, participation may be narrow (few actors or participants); or broad (covering all major groups as well as government). Carley (1994) has observed that good decisions come about from a steady improvement of the process of decision-making and participation to enhance human resource and institutional capabilities at national, regional and local levels.

2.1.3 Artisanal and small-scale mining

The International Labour Organization (ILO) reported the complexity of the mining sector, stating that small-scale mining means different things to different people. To some it is dirty, dangerous, disruptive, and something that should be discouraged, while to others, it is profitable, productive or simply the only way out of poverty (ILO, 1999). There is a lack of an agreed international definition of artisanal and small-scale mining. However country-specific explanations do exist, reflecting locally relevant situations and development processes.

Although, ASM has generated numerous possibilities for socio-economic development in poorer rural areas, mining laws and policies often are not adequately defined to give it recognition while focusing instead on the large and medium-sized corporate mining. For instance, artisanal miners are those who employ manual, low technology mining conducted on a small-scale (World Bank, 1995). They are often considered illegal and have some degree of mechanization. Artisanal miners are organized in some form of mining association (D'Souza, 2002; Quiroga, 2002). While different concepts of artisanal and small-scale mining exist, it is generally conceived as the use of rudimentary

extraction practices; gold is the most commonly extracted mineral in this sector (World Bank, 1995).

2.1.4 Parameters and tools used for ASM operations

According to the International Labour Organization (1999) parameters use in some countries' definition of ASM include: level of employment, annual production output, capital investment, size of claim, artisanal operations (low levels of mechanization and/or the use of simple equipment) as well as the depth of mining operations. Small-scale mining is any extraction of mineral substances which use manual and traditional methods and processes or it is a semi-industrial mining of any extraction of mineral substances which use simple and little mechanized methods and processes (Economic Commission for Africa (ECA) and United Nations Department of Economic and Social Affairs (UNDESA), 2002). According to Hilson and Potter (2003), artisanal and small-scale mining participants extract a broad range of minerals that have the advantage of being relatively simple to transport and sell legally or illegally.

According to Hughes and Furamera (1999), there are limited numbers of micro-level socio-economic studies that have been carried out on ASM in some developing countries. Other studies (Madulu, 1998; Carney, 1998; Labonne and Gilman, 1999; Heemskerk, 2002; Walsh, 2003) concentrated on the Sustainable Livelihoods Approach (SLA) of specific communities whose members engaged in mining sector. Whilst some studies (Heemskerk, 2000; Hilson, 2002a), seek only profile of the needs of people that are living in mining communities. The main emphasis of some literature hitherto has

been the macro characteristics of the sector and there are few social analysts like Dreschler (2001), Veiga and Hinton (2002), Uka (2011), Mallo (2012) and Akwarandu (2013) who considered ASM from the perspective of the miners. In addition, others have concentrated on a specific aspect of the industry, for example, the environmental effects of artisanal and small-scale activities (Veiga and Hinton, 2002), regulatory frameworks (Barry, 1996) and technical issues (Bugnosen, 1995).

Artisanal operations are those activities that are common in communities where gold, sapphire, tin or lead and other mineral resources are found in abundance. These activities include a large number of pits each being operated by a team of artisanal miners. Small-scale miners on the other hand, include those that operate in licensed claim-holdings through either leasing specific areas to pit owners or developing the pits and employing miners. Such operations range from purely manual operations to those utilizing drilling machines, compressors, water pumps and most people grind the ore by using ball mills. The miners use simple and crude implements or tools which often include shovels, pickaxes, hammers, head pans, simple crushers, sluice boxes, rolling mills, sieves and other hand-made tools for mining gold and other precious stones.

Other simple tools were also used as subsidiary to the heavy machines in the colonial era that dominated the post-colonial tin industry as the major mining tools. These are: bucket wheel excavators, diggers, shovels, wheel barrows, head pans, calabashes, spoons and water pump generator were recently introduced, although dry season farmers first used them, and then also the tin miners. Medium-scale miners used water pumps in the post-

independence period to pump water to mining points. Consolidated Tin Mines (CTM) used the bucket wheel excavators for its skeletal operations in Rim, Plateau State, Nigeria whereas artisanal and small-scale miners use it in the dry season (Fwatshak, 2010; Falola and Paddock, 2010).

In Barkin Ladi, Rayfield, Sabon Kanar, Ya'u said that his informants confirmed that as from 1990s, the miners mine on old mining sites and riverbeds by digging the gangue left by heavy machines because the soil might still contain some particles of tins (Fwatshak, 2010; Falola and Paddock, 2010). An entrepreneur claimed that three boys worked for him and he paid the sum of ₦500 daily on the gangue he hired and ₦1, 000 daily for his three labourers. The entrepreneur also paid between ₦50, 000 and ₦200, 000 as compensation to the land owner. However, nothing was paid when it was family land mined (Fwatshak, 2010).

In the dry season, when non-gangue mining was practiced; the miners usually discovered the presence of tin by collecting samples of the soil and wash it or stripe away the soil to expose the mineral extraction (Fwatshak; 2010; Falola and Paddock, 2010; Ezeaku, 2011). Moreover, mining during the rainy season did not necessarily require old mining sites but by riverbeds or on farmlands where rain water exposed the mineral on the top of soil.

2.1.5 Size and scope of ASM

The size and scope of ASM varied. Some common characteristics ranged from informal to formal and could be unorganized or well-organized. It is strongly linked to rural poverty and lack of alternatives that would provide better opportunities for income generation. Participation often fluctuates with commodity prices. ASM is sometimes seasonal, with mining alternated to farming, fishing, or another activity. It is typically labour intensive, yet it may have complex labour structures, processes, and relations. ASM usually applies to low levels of technology because of poor capitalization and a lack of knowledge and skills. It offers very low wages, insecure and unsafe jobs, and it may involve exploitative labour relations (for instance, regarding children and vulnerable persons). ASM frequently has negative environmental repercussions, often damaging the health of the local ecology, and may affect other rural livelihoods, such as farming and fishing. It often includes a series of intermediary buyers who are often operating illegally themselves. ASM involves the mining of precious stones and metals such as (diamonds, rubies, gold, and silver) as well as industrial minerals such as (stone aggregate, sand, clay, and salt) and some base metals such as (tin, tungsten, or tantalum) (World Bank, 2013). Hence, these kinds of solid minerals particularly sapphire are known as *(kwaranda),* gold *(zinari)* and tin *(kuza)* in Hausa language in the mining communities of Kaduna State.

2.1.6 Types of artisanal and small-scale mining

a. Permanent ASM

These miners are involved in mining throughout the year as their productive careers to sustain their livelihoods. Some of the miners spend all their lives working in the same region; others move to new areas, at times due to the discovering of gold or any other solid mineral in a particular location where it is found in abundance. It is also difficult to categorize these miners because they often have substantial incomes than to participate in agricultural sector. To this end, they can use their subsistence incomes for entrepreneurial and educational developments of their children. For example, artisanal and small-scale mining is found in many well-established areas and the incomes realized from this sector are reported to be many times higher than the miners' previous occupations. Communities that were interviewed during the course of a study conducted in Indonesia by McMahon, Elly, Jean, Aziz, Giovanna, and Ramanie (2000) re-affirmed the increased incomes they received as a result of direct and indirect mining rather than being compensated for the problems associated with mining activities. A different scenario was reported by Mukhtar (2013) in Zamfara State. According to him, the miners had on several occasions asked for compensation from the federal government for lead poisoning incident that destroyed many business activities and killed a lot of people but their demand has not been acknowledged.

Interestingly, Ya'u study revealed that young miners learned the art from their fathers or older persons with mining experience. In some cases, according to him, a gangue is hired by the miners for some specific fee which is a common practice in Barkin Ladi, where

tins are found in abundance and there is even a place called “Kuwait” (Fwatshak, 2010; Falola and Paddock, 2010). In fact, a similar scenario exists in Birnin Gwari LGA of Kaduna State. Due to high concentration of gold, a village is named “Abuja” after the federal capital of Nigeria.

b. Seasonal ASM

As the name implies, seasonal type of mining is done on a regular basis which often refers to “life-long source of income”. Agricultural labour usually moves to the mining areas during the off-season, generally to relatively high-value minerals, notably gold and precious stones. This practice is common in the Sahel countries of West Africa. In addition to the incomes directly generated from this sector, seasonal artisanal and small-scale mining may lead to significant entrepreneurial development among the miners, traders, and shops that supply the mining communities. The resultant savings generated by those who earn above-subsistence incomes can be an important source of funds for developing other businesses. For example, in East Kalimantan of Indonesia, with the abatement of the timber boom in 1960, majority of Dayaks in the Middle Mahakam area alternated their incomes by mining the river beds and turning to agriculture during rice planting season. Whenever gold prices dropped, the miners participate fully in agricultural activities, while during the periods of drought or harvest failure, they usually go back to the rivers to supplement their incomes.

According to Shelley (2007), labour providers are intrinsic to the structure of agriculture and farm-based food packing. The farmers have always required a surge of labour at

certain times of the year, principally around harvest, but they do not mind the costs of retaining that labour. For example, the ILO cited in Shelley (2007) found that in Italy the use of seasonal migrant labour had become "a fundamental component of Mediterranean agriculture", replacing marginal Italian workers in temporary labour as well as working in greenhouse and on livestock farms.

c. Poverty - driven ASM

This is another type of mining which is practiced by a largely itinerant, poorly educated populace with few employment alternatives, typically as a result of loss of employment in other sectors or other regions. According to Chambers and Conway (1992) artisanal and small-scale miners are typically poor, and have remained poor despite working for many years as miners. Many of them barely make enough money to establish and support their families. The World Bank (1997) stated that the number of rural poor in Nigeria is roughly twice that of the urban poor. According to Ivbijaro (2012a) poverty statistics shows that 54.41% of Nigeria's population is poor. Among the ten poorest States in the North, incidence of poverty is highest in Zamfara State with 80.93%. While at the national level, the percentage of population in poverty is 43.19% urban and 63.27% rural. Incidence of poverty is highest in the northern geo-political zones with 66.97% in the north-central, 71.17% in the north - west and the highest incidence in the north-east with 72.16% (Ivbijaro, 2012a).

According to Ivbijaro (2012a) poor people are the main victims of a bad environment. Empirical evidence has shown that poor people are commonly bound to

reside in areas with poor environmental quality. It has been described as ecologically vulnerable areas which include rural areas of low agricultural potential and squatters settlements within urban areas. Urban squatters are commonly exposed to polluted air, contaminated water and hazardous and social wastes, while the landless people among the rural population are forced for their survival to settle on marginal lands and cultivate poor soils. Both the rural and urban poor are subject to aggravated risks such as soil degradation, floods, drought and landslides.

There is synergy between poverty and ASM in Africa and elsewhere. In 2003, for instance, estimates of the number of people employed globally as artisanal and small-scale miners ranged from 60 to 100 million. Approximately, 3 - 15 million of these are in the people republic of China while about 555, 000 are in Tanzania and 500, 000 are found in India (Maponda and Meck cited in Alexander and McGregor, 2013).

In South Africa, for example, droughts in 1973-1974 and 1984-1985 destroyed many farmers' crops. This drove large numbers of rural population into small-scale mining sector as a source of survival. In Bolivia, the collapse of the tin industry in the 1980s also drove many workers out of the commercial industry into artisanal and small-scale tin mining. However, this sector's actual economic potential is lost most often as a result of the absence of a legal or a fiscal framework. This is due to its rudimentary production and processing techniques (unprotected handling of mercury in small-scale gold mining) that also cause serious health risks for the miners and their families. There is also a weak position of typical poor educated small-scale miners in purchase, sales, and marketing of

precious stones due to an extremely low pay and income. Many miners that participate in this sector have no other choice but to remain trapped in a low-revenue cycle (Moore and Mawowa, 2010).

Since few of them pursue their activities vigorously with a long-term view, the mining methods that the miners employed often cause grievous environmental damage. For instance, Zimbabwe's economic declined in 1990 due to structural adjustment policies it has experienced. This scenario facilitated the development of a financial and service based on capitalist class whilst unemployment, inequality and poverty increased (Kanyenze, 2004). In early 2009, 5 million people in the country were starved and more than 3 million Zimbabweans were in exile. Employment statistics indicated that less than 10% people were working in the formal sector and there was an outbreak of cholera due to poor water and sewage infrastructure (Moore and Mawowa, 2010).

Initially, migrant labour was the most satisfactory option for many peasants in Northern Nigerian. The purchasing power of a miner's wage tended to decline, but social forces continued to throw up cheap labour. During the Second World War, Plateau State instituted forced labour to mine tin, but the scheme was expensive, unproductive and opposed by business. The 1940s represented the lowest level of workers poverty and the First World War was followed by a period of heightened social and political resistance to capital and the State. The tin mines both helped to cause and profited from the decay of the older mode of production in Northern Nigeria (Freund, 1981).

d. “Gold rush” ASM

This is the last type of mining that often leads to a short-term concentration of artisanal and small-scale practitioners. It consists of both miners normally operating in the sector and those temporarily leaving their regions and traditional occupations, such as farming and micro-economic entrepreneurial activities. Typical examples to note are the gold rushes in Brazil, the Philippines, and Papua New Guinea. The concentrations of gold in these regions occur when mining failed to meet up the demands of miners. As regards to poverty-driven mining, one of the types of mining, the lack of a long-term perspective frequently leads to the application of mining methods that cause serious environmental damage. While some artisanal and small-scale miners might enjoy new and significant enhanced opportunities, their exploitation of natural resources and land has direct potential as well as negative effects on the indigenous people’s opportunities. After the discovery of a mining prospect, the transitory nature of this sector may lead to a tendency by intruders to simply occupy lands and water systems that traditionally belong to the indigenous inhabitants. It is observed that with the emergence of ASM, the village youth have concentrated on the mining sector, neglecting the agriculture sector. The elderly and women are left to man the agriculture sector. The new gold rush in Amani, Tanga in September 2003, has seriously affected the tea plantations production of Amani as most casual labourers join the gold rush (TAN Discovery, 2003).

2.2 Concept of Development

The concept of development is a process that increases choices. It means new options, diversification, thinking about apparent issues differently and anticipating change. That is development involves change, improvement and vitality - a directed attempt to improve participation, flexibility, equity, attitudes, the function of institutions and the quality of life. It is the creation of wealth. Wealth use in this sense means the things people value, not just dollars or naira.

Development leads to a net addition to community assets. It is also aimed at improving the living conditions of people through effective management of both the human and material resources. Thus, development is defined as the capacity and creative capability of a people to effectively transform the natural resources of their environment into goods and services through the imaginative and practical application of their creative talent and productive power. This implies that people must be empowered to be able to meet their basic needs of food, housing, health, transport, education, employment, reduction in poverty level and increased per capita income among others. According to Egbe (2014) this is what is lacking in the rural areas of Nigeria and elsewhere in Africa where about 80% of the population live. A critical examination of the definition of "development" must necessarily include the reduction or elimination of poverty, illiteracy, disease, malnutrition and joblessness. Development has an objective and strategy aimed at transforming the citizens in the rural areas from being the victims of poverty, ignorance and disease into contented human beings, able to earn an income capable of sustaining a reasonable standard of living for themselves and their families. It also means the ability

to provide the basic necessities of life such as food, jobs, affordable and accessible health care, good roads, water, electricity and education, among many other things for the people (Egbe, 2014).

This word "development" is very difficult to define because it is multifaceted and value loaded. It is often equated with economic growth or economic development. In fact, the two concepts are often used interchangeably, but they do not mean the same thing. Economic development is an essential component of development, yet it is not the only one. There are many other aspects of development. For example, Rodney (1972) sees development with so many-sided processes. He argued that "at the level of individuals, development implies increased skills and capacity, greater freedom, creativity, self-discipline, responsibility and material well-being". On the other hand, Todaro (1977:96-98) opined that:

> *Development must therefore be conceived as a multi-dimensional process involving changes in structure, attitudes and institutions, as well as the acceleration of economic growth, the reduction of inequality and the eradication of absolute poverty. In essence, development must represent the entire gamut of changes by which the entire social system turned to the diverse basic needs and desires of individuals and social groups within the system moves away from the conditions of life regarded as materially and spiritually "better".*

This means that development involves the re-organization and re-orientation of the entire economic and social system. It also means an improvement of income and output, radical changes in institutions, social and administrative structures, popular attitudes, customs and beliefs. The implication of these two definitions is that "development" goes beyond economic indicators. It is both a physical process and a state of mind. The institutions or structures like construction of railways, schools and hospital are aspects of development.

The second aspect of development is that people in a community must change their attitudes for good. To substantiate the concept of development, Seers (1969:3) asked certain questions. He said that:

> *The questions to ask about a country's development are therefore, what has been happening to poverty? What has been happening to unemployment? What has been happening to inequality? If all three of these have declined from high levels then beyond doubt this has been a period of development for the country concerned. If one or two of these problems has been growing worse, especially if all three have, it would be strange to call the result development even if per capita income doubled.*

It therefore means that development alone cannot be tied to economic advancement but a general improvement in the living conditions of the people over a certain period of time. Development is also aimed at improving the living conditions of people through effective management of both the human and materials resources. Thus, Gana (1996:2) noted that:

> *Development is concerned with the capacity and creative capability of a people to effectively transform the natural resources of their environment into goods and services through the imaginative and practical application of their creative talent and productive power*.

This implies that people must be empowered to be able to meet their basic needs of food, housing, health, transport, education, employment, reduction in poverty level and increased per capita income among others.

2.2.1 Sustainable development

The concept of sustainable developoment draw its roots from environmental issues that emerged in the 1980s with experience of several decades of development efforts. For instance, in the past, the focus of economic progress was purely on growth and increase in output, based mainly on the concept of economic efficiency. However, due to a large

and growing number of the poor in the developing economies of the world, and the inadequacy of "trickle-down" benefits to these groups, emphasis moved towards greater improvement in income distribution. Thus, the developoment paradigm shifted towards equitable growth, where social (distributional) objectives were recognized as distinct from, and as important as economic efficiency (Munasinghe, 1992). There is a large body of evidence that environmental degradation is a major barrier to development. Thus, the concept of sustainable development has evolved to encompass economic, social and ecological issues. Three approaches to sustainable development were identified namely; the economic, ecological and socio-cultural approaches. For instance, the economic application to sustainability is based on the concept of Hicks-Lindahl of "maximum flow of income" that could be generated, while at least maintaining the stock of assets or capital which yield these benefits (Maler, 1990; Munasinghe, 1992). This approach holds that there is an underlying concept of optimally and economic efficiency applied to the use of scarce resources. The implication of this approach centres on the problem of interpretation especially in the areas of identifying the kinds of capital to be maintained (e.g. manufactured, natural and human capital) as well as in valuing these assets, particularly ecological resources (Pearce and Turner, 1990).

The ecological application to sustainable development focuses on the stability of biological and physical systems. The emphasis is on preserving resilience and dynamic ability of the overall ecosystem to adapt to change, rather than conservations of some "ideal" static state. A socio-culturalist sees sustainable development to maintain the ability of social and cultural systems, including the reduction of destructive conflict

(United Nations Environment Programme (UNEP) *et al.,* 1991). Both the maintenance of intra-generational equity (especially elimination of poverty), and inter-generational equity (improving the right of future generations) are important aspects of this application. Also inclusive is the need to encourage and harness pluralism and grassroots participation in a more effective decision-making framework for socially sustainable development.

In comparing the concepts of ecological and economic sustainability however, Githinji and Perrings (1992) pointed out that it may be more relevant to examine the maintenance of the set of opportunities, as opposed to the preservation of value assets base. This is because preferences and technology are not constant through successive generations, so preserving a constant value of the assets could be redundant. By concentrating on the size of the opportunity set, the importance of the conservation of biodiversity becomes more evident, both in terms of ecological and economic approaches to sustainability. The preservation of biodiversity allows the systems to retain resistence by protecting it from external shocks in the same manner that preservation of the capital stock protects assets for future consumption. Thus, the difference in both approaches to sustainable developoment lies in the consequences of a loss in ecological resilience. Under the Hicksian income measure, for example, a society that consumes its fixed capital without replacement is not sustainable. Also, under the ecological application, loss of resilience implies a reduction in the self-organization of the system, but not necessarily a loss in productivity.

Sustainable development is seen as the capacity, to improve the quality of human life to support the ecosystems. It is aimed at improving the quality of living and to enable people to realize their potentials in order to lead lives of dignity and fulfillment. This is in tandem with the universal goals that people would set for themselves a long and healthy life, education, access to the resources needed for a decent standard of living, political freedom, fundamental human rights that are guaranteed and freedom from violence. Interestingly, development is real only if it makes lives meaningful in all these respects. For instance, sustainable development must therefore balance the needs of society, the economy and environment. Sustainable human development means that development is pro-people, pro-nature and pro-jobs. Ivbijaro (2012a) sees sustainable development as that which generates economic growth and distributes its benefits equitably. Thus, sustainable development according to the World Commission on Environmental and Development (WCED), (1987) is development which meets the needs of the present without compromising the ability of the future generations to meet their own needs.

The concept of sustainable development has three principal dimensions namely; economic growth, social equity and protection of the environment. Underlying the economic dimension is the principle that society's well-being would have to be maximized and eradicate poverty through the optimal and efficient use of natural resources. The social aspect deals with the relationship between nature and human beings, uplifting the welfare of people, improving access to basic health and education services, fulfill food security needs and respect for human rights. The environmental

dimension, on the other hand, is concerned with the conservation and enhancement of the physical and biological resource base and ecosystems. For instance, sustainable agriculture must meet economic, social and ecological challenges that are closely related. The features of sustainable agriculture should be considered as a package, and no single feature should predominate over the others. Sustainable agriculture needs to protect the natural resource base, prevent the degradation of soil and water; conserve biodiversity; contribute to the economic and social well-being of all; ensure a safe and high-quality supply of agricultural products; and safeguard the livelihood and well-being of farmers and their families.

The effect of participation in ASM to sustainable development and agricultural activities are enormous. For instance, the sector helps the poor people in rural and urban areas to reduce their problems. In Nigeria, the people that are involved in gold and semi-precious minerals, the mining sector facilitates the process to "get-rich-quick syndrome" in the society. While others view this sector with high contempt which is based on the belief that it represents the greatest environmental disaster in the making. However, the sector produces both positive and negative effects to some individuals and the larger society. Positive effects include job creation and income generation leading to better standards of living. Negative effects include displacement of people, loss of livelihood, changes in population dynamics, environmental degradation, child labour, water scarcity and drug addiction. Other problems associated with ASM which has effect on agriculture are erosion damage and deforestation, landscape destruction, garbage and solid waste, tropical diseases, improper closure of mining pits and death.

2.2.2 Environmental sustainability

Environment means surroundings, circumstances or influences. It is seen by most people as physical conditions of landscape such as the topography, drainage, climatic conditions and the vegetation of a given area or territory. For instance, the physical/natural environment is made up of land, water and air, along with all the resources including the soil, plants, animals and minerals. The second type of tangible or material environment is the man-made environment, which is basically the natural environment that has been modified or transformed by human activities. There is a third type of environment namely the socio-economic environment, which encompasses the political environment. Often, it is these intangible environments that play a major role in determining what proportion of the natural resources is used for the economic development of a territory and for the material benefits of the inhabitants (Udo, 2012).

Mining of minerals is an unfriendly activity and has thus attracted global attention from the standpoint of its environmental effects (Maponga, 1995). Generally, mining affects all the components of the environment and the effects are either permanent/temporary, beneficial/harmful, repairable/irreparable or reversible/irreversible. However, the effects of artisanal and small-scale mining on the livelihood of farmers are mostly on the ecology, land and atmosphere. For instance, adverse effect of mineral extraction and processing activities which may not be immediately felt according to Aigbedion and Iyayi (2007) disturbs the ecosystem with direct consequences on the floral and faunal community in general. Deforestation of an area during the mine development may cause the elimination of some plants and the exodus of some animals that feed on such plants

or depend on them for cover. While Brooks (1974) noted that in the Younger Granite Province at Jos Plateau, tin mining has resulted in the destruction of scenic landscape replaced by unsightly large irregular holes and heaps of debris produced by the open cast method of mining.

Elaborating on some of the linkages between poverty and the environment, the World Bank (1992) stated that a declining natural resources base largely caused by poor people, who are deprived of access to other resources, exacerbates the conditions of the poor by limiting their already restricted production possibilities. This applies in particular to water and soils in rural areas. It is suggested Mink (1993), Dasgupta (1995), Ekbom and Bojo (1999), Ekong (2010) and Ivbijaro (2012a) that poverty limits people's options and induces them to deplete resources faster than is compatible with long-term sustainability. Hence, the poor themselves aggravate the process of environmental degradation. Dasgupta (1995) further described how poor people are closely dependent on the environmental resource base that surrounds them for their livelihood and concludes that poverty can be a driving force to environmental degradation. Mink (1993) also argued that the living environment of the poor sanitation and polluted indoor air, and poor production practices, impact negatively on the poor themselves and on others.

Vegetation in the form of natural forest or crop plantation is usually the first casualty to suffer total or partial destruction or degradation during the exploration and exploitation of minerals in a locality (Aigbedion and Iyayi, 2007). The causes of these severe environmental effects are numerous such as lack of knowledge, education and training

(technical and environmental), inefficient technology and limited techniques, inefficient administrative management, errors in human control, economic limitations, lack of access to better techniques, lack of information about good practice, control, enforcement and inadequate environmental legislation.

During the pre-colonial period, it was documented that subsistent agriculture and extractive resources were an important part of the Nigerian economy. Environmental knowledge was closely tied to economic success or failure. David Northrup argued that in the early 1600s, West Africans made economic decisions based on market value and that they were not duped by European traders. For instance, Hopkins cited in Falola and Paddock (2010) clearly stated the importance of environment to man and how Africans modified it to achieve economic goals. However, negative environmental externalities of mining as observed by Ezeaku (2011) in selected areas of Nasarawa State of North-Central Nigeria might constrain livelihood to host communities by hampering agricultural resource uses. On the negative side, mining is said to exert more pressure on the village livelihood systems through deforestation or vegetation destruction leading to fewer pastures for livestock grazing, low wood harvesting for home use and sale and declining arable land area. According to him, in Obi communities, the respondents identified some specific positive impact of mining. Sixty per cent said that it provides employment while 80% of the population earned higher income than realized from farm produce sales. Scholars like Ezeaku and Anikwe (2005) further stated that contaminated ground water can have negative impact when consumed or it can contribute to surface water degradation by moving laterally into streams.

In the 1940s, the British colonial office proposed a plan of propaganda to try and keep the younger generations on rural farms instead of migrating to towns. It was also observed that migration patterns were part of shifts in the relationships between people and their environment. Younger Nigerians sought out the advantages of the urban environment in large numbers but colonial policy limited their movement (Falola and Paddock, 2010).

According to Gonyok, in 1939, estimation showed that 458 square miles representing 46% of Berom land had been alienated to miners just like in 1955 where about 590 square miles represented 54%. For instance, destruction to land occurred in varying degrees in mining communities like Naraguta, Kuru, Heipang, Vwang, Foron, Gashish, Rop, Ganawuri, Kwal, Bassa and Jere districts and a host of other areas in Plateau State of Nigeria.

As regards the influence of environment on livelihoods, Falola and Paddock (2010), stressed that there is a new historiography focused on how man used techniques to control the environmental landscape to suit his own needs or how human decisions lead to long-term ecological changes. For instance, there are two main groups within this model. In fact, one argues that "man lived in a constant state of war against nature until he was introduced to modern agriculture and industry through the imposition of western science and technology" whereas others succinctly argue that "pre-colonial Africans lived in harmony with their surroundings".

A society is sustainable when it enables individuals to achieve a high quality of life in ways that are ecologically sustainable (Ivbijaro, 2012b). Progress towards a sustainable society is measured by indicators of the quality of human life and of ecological sustainability. Environmental sustainability can be presented as a function of five dimensions namely; the state of the environmental systems, such as air, soil, ecosystems and water; the stresses on those sytems, in the form of pollution and exploitation levels; the human vulnerability to environmental changes in the form of loss or damage of natural resources or exposure to environmental diseases; the social and institutional capacity to cope with environmental challenges and the ability to respond to the demands of global stewardship by cooperating in collective efforts to conserve international environmental resources such as the atmosphere, land and water. These five dimensions are the core components of environmental sustainability. In Zamfara State, for example, Suleiman cited in Abutu (2015) noted that:

> *Gold is very precious and expensive. Hence, people in remote areas, mined gold from the field and took it to their homes to extract the gold from the rock. During the extraction, the lead poisoning started. In extracting, you need to crush the rock, wash and grind. In that process, a lot of children get involved. As the grinding takes place inside the house, the dust will be all over the house and that contaminates the environment. Continuous work in that house makes it unsafe for children to play.*

However, despite the negative effects of lead poisoning associated with gold mining, the artisanal miners have expressed no intention of quitting the practice. Many of them described gold mining as the source of their livelihoods which they had to resort due to lack of employment, hunger and hardship. Other factors that encouraged them to engage

in gold mining, is the lack of organization and insufficient regulations in the sector (Abutu, 2015).

A country is therefore, environmentally sustainable to the extent that its vital environmental systems are maintained at healthy levels and to the extent to which standard of living is improving rather than deteriorating. This requires that the levels of anthropogenic stress are low enough to engender no demonstrable harm to its environmental systems; that the people and social systems are not vulnerable to environmental disturbances in the way of basic needs such as health and nutrition. Becoming less vulnerable is a sign that a society is on the track to greater sustainability (Ivbijaro, 2012b).

There are nine prominent ecological problems that affect the quality of the Nigerian environment, human health and economic growth. These are deforestation, soil degradation, drought/desertification, floods/erosion, water pollution, urban waste, industrial pollution, biodiversity loss and invasive nuisances species. Soil degradation is ranked high by the World Bank (1990) because of its impact on the sustainable income of Nigerians, on a large number of people, the poor and overall environmental integrity, human health and renewable resources. Soil degradation may occur in the form of nutrients loss, loss of soil micro organisms, of agricultural land, pollution of surface and ground water, soil erosion and loss of human settlements, and other infrastructure such as highways and bridges. For instance, over 8% of the total land area of Nigeria is degraded by severe sheet, rill and gully erosions. Others include insidious, sheet erosion occurs throughout Nigeria wearing away fertile top soil with unquantifiable loss of agriculture.

2.2.3 Rural area

The word "rural" connotes a place with agricultural orientation; farms, barns, sheds and other structures of similar purposes. Olisa and Obiukwu (1992) also pointed out that population is the main characteristic that differentiates rural area from urban centre, especially in developing countries. In this regard, in Nigeria, an area with a population of 20,000 people and below is classified as a rural area. However, this is not adequate to depict a rural area. Olisa and Obiukwu (1992:65) further maintained that:

> *The main features of rural areas are depression, degradation and deprivation. Many rural areas are immersed in poverty so palpable that the people are the embodiment of it. In most rural area in Nigeria, basic infrastructure where they exist at all, are too inadequate for meaningful development.*

In other words, the rural areas lack virtually all the good things of life like roads, medical and health facilities, portable water, electricity among others. Consequently, these characteristics are not limited to rural areas alone but are also found in urban areas in Nigeria and other developing countries. The people engage in subsistence agriculture and their standard of living is very low, earning only a few thousands of naira annually, they are poorly served by almost all public amenities and they generally show considerable resistance to change in any form.

2.2.4 Rural development

The concept of rural development is used interchangeably to mean the same thing with community development in this research. The scope of the concept of rural development or community development is very wide. It is a multi-dimensional process involving areas like agriculture, health, education, provision of rural infrastructures, social life, political and economic issues, commerce and industry, among others, and their

integration with the national economy. Since the scope of community development is wide and it is the pivot on which a sound national development in all its ramifications can effectively be achieved. It is, however often assumed by policy makers and development planners that rural development is synonymous with agricultural development. For instance, rural development means that a community itself engages in a process aimed at improving social, economic and environmental situation of the area. The community, in this regard, is both the means and the end of community development. The members of a community take action and participate together. It is through this action that the community becomes more vital, not just economically but as a strong functional community in itself. Rural development improves the ability of communities to collectively make better decisions about the use of resources such as infrastructure, labour and knowledge. According to the United Nations (1976:4):

> *The concept of integrated rural development implies that it is a composite or comprehensive programme for rural development in which all relevant sectors such as agriculture, education, housing, health and employment are conceived as interlinking elements in a system having horizontal as well as vertical linkage in operational and spatial terms.*

Accordingly, Jibowu (2000) and Nwosu (2009) views rural development as the transformation of rural community into a socially, economically, politically, educationally, orderly and materially desirable condition, with the purpose of improving the quality of life of the rural dwellers on a self-sustaining basis. Hence for the actualization of the concept of development, it is suggested that these factors have to be integrated with local government policies and plans with the objectives of improving the quality of life of people in the rural areas. Thus, rural development can be defined as the

outcome of a series of quantitative and qualitative changes occurring among a given rural population and whose converging effects indicate, in time, a rise in the standard of living and favourable changes in the way of life of the people concerned. For instance, most rural dwellers in Nigeria according to Abbass (2014) have remained poor with inadequate standard of living. The poverty and various degrees of inequality in and within rural communities have called for a reassessment of development priorities and hence challenged adopted development policies.

Rural development can be defined as the outcome of a series of quantitative and qualitative changes occurring among a given rural population and whose converging effects indicate, in time, a rise in the standard of living and favourable changes in the way of life of the people concerned. The concept of rural development in Nigeria lacks a unified definition as different scholars tend to view it from varying perspective. Rural development in general denotes economic development and community development actions and initiatives taken to improve the standard of living in non-urban neighbourhoods, remote villages and the countryside. Economic activities typically relate to the primary sector production and processing of food stuffs and raw materials

Mabogunje (1981) noted that rural development is concerned with the self-sustaining improvement of rural areas and implies a broad based re-organization and mobilization of the rural masses so as to enhance their capacity to cope effectively with the daily task of their lives and with the changes consequent upon this. While Gana (1996) opined that rural development is important not only for its impact on rural areas and people but also

for its contribution to the overall development of the nation. In the Nigerian experience where the bulk of the people and land are rural, and where the level of rural output is very low, rural mobilization provides the quickest and most direct route to national development. This would require the adoption of appropriate technology for raising rural productivity and efficient utilization of resources, creation of efficient transport network for rural and urban areas to ensure easy transportation of agricultural products for massive food production and supply of industrial raw materials.

This suggests that the ambit of rural development is very wide indeed, and it requires a comprehensive approach. It includes generation of new employment, more equitable access to arable land, equitable distribution of income, widespread improvement in health, nutrition and housing, creation of incentives and opportunities. It also involves the ability of the local government to create wider opportunities for individuals to realize their full potentials through education and sharing in the decisions and actions which affect their lives. Aslam (1981) further defined the concept of rural development as "a process aimed at developing the rural poor, their economy and institutions from a state of stagnation or low productivity equilibrium into dynamic process leading to higher levels of living and better quality of life". Similarly, Schumacher (1983) conceived rural development as "developing the skill of the masses to make them self-reliant through instruction which supply appropriate and relevant knowledge on the methods of self-help". It can be seen that while some definitions laid more emphasis on the development of human resources others focused on the development of the environment rather than human beings.

The contribution of self-help development activities to rural development depends largely on the existence of committed local leaders in the rural areas concerned as well as the extent to which government encourages local planning and participation. The wide variations in the scope and impact of self-help activities on the welfare of rural dwellers reflect the nature of community leadership and their inclination towards self-help programmes. This implies that in those areas where there are no effective self-help groups, community development activities have not made much impact on the social welfare of the rural population. However, the challenges confronting the rural areas are numerous and they cover all spheres of life. The major ones are the basic need approach, occupation, infrastructure and poverty. Umebali and Akubuilo (2006) enumerated some of them like vicious cycle of poverty, poor infrastructure and high population density. Others include high level of illiteracy, low social interaction/local politics and rural-urban migration.

2.3 Empirical Studies on Socio-economic Characteristics

People are considered as the real wealth of a nation and development is primarily and fundamentally about people. That is human development is seen as a process of encouraging people's choices emphasizing the freedom of health, education and decent standard of living. On the other hand, the Human Development Report (HDR), (2010) sees the key elements to human development as comprising equity, sustainability and respect for human rights. Human development is about sustaining positive outcomes steadily overtime and combating processes that impoverish people and underpinned oppression and structural injustice. For instance, it means that human development is the

expansion of people's freedom to live long, healthy and creative lives. People are both the beneficiaries and the drivers of human development as individuals and groups.

High population density does not, however, always provide the right information about the actual state of population pressure on land in various parts of Nigeria. Mabogunje (1970) substantiated this with examples from three ethnic territories in West Africa. According to him, resources which may be adequate for a "decent living" or "level of living" in one area may be grossly inadequate in another. Mubogunje noted that the vital variable to use in judging the standard of living of people is what they expect to derive from their resources. For instance, according to Walsh (2003), in Madagascar, what miners earn in a day is what a farmer in the same area earns in a month. However, this does not automatically translate into sustainable well-being, given the consumption behaviour of the people. The rates of widowhood stood at 1.9% and divorce 2.7% are both below the national rates of 5.6 and 4.8% respectively. Married couples within the age categories of 15 - 29, 30 - 44 and 45 - 64, which are the eligible groups in this case, are high at 46.5%, 88.1% and 88.8% respectively. This can probably be explained through the predominance of children who are under the age of 15years with the assumption that those are outcomes of the marriages. Moreover, 54% of the elderly are married and hence the lower widowhood remarried after a demise of a couple, could not be ruled out (Fisher, Mwaipopo, Mutagwaba, Nyange and Yaron 2009).

Yunana and Banta (2014) in a study in Jema'a LGA of Kaduna State found that adults between the ages of 55 and 65years participate in illegal mining activities and the least

age group was 15-25years. Their findings further show that 81.44% are male miners, while 18.56% are females. The respondents' marital status reveals that 88.7% are married, 6.19% are widowed while 5.15% are singles. The study also indicated that literacy level among the miners is low. The illegal mining according to Yunana and Banta (2014) is dominated by farmers. It was observed that farmers spend most of their time on the illegal mining activities during the dry and rainy seasons.

Migration flows into and out of rural communities are differentiated by age, income and social class. The evidence for these trends suggests that there are a number of complex dynamic factors that influenced the migration direction of different social groups at different times. There is, for instance, some evidence of in-migration to rural areas by low income groups (Woods, 2009). However, other migrants who left rural communities to find work in urban centres but having been unsuccessful had to return home jobless.

Traditionally, the class structure of rural society was based on property relations. The ownership of land brought not just status, but also power relations in a rural economy based on the exploitation of land, through agriculture, forestry, mining and quarrying. These "traditional" rural economic activities have experienced a similar evolution in their fortunes and decline in their level of employment. Similarly, employment rose in rural areas in manufacturing, tourism and the service sector (Woods, 2009).

A survey carried out by Mwaipopo, Matagwaba, Nyange and Fisher (2004) in Mabuki, Mgusu and Nyarugusu of Tanzania showed that about 75% of households of miners live in their own houses, 12.8% in rented houses, 4.6% in guest houses, and 3.6% in mining

camps. The rest live in free houses provided by an employer or a friend/relative. Mabuki has the highest proportion of rented houses (17.9%), while Mgusu has majority of mining camps (4.8%), and Nyarugusu has the highest levels of self-owned houses (80.4%). Within these figures 68.2% of immigrant households own houses, which are far less than 90.3% for natives.

According to the Head teacher of Mgusu Primary School, his pupils' engagement in mining and related activities has not necessarily deterred them from performing well in class. Since 1996 when the first students sat for National Primary level examinations, the school has been producing graduates in almost every year. This highlights an important point also apparent in Nyarugusu, that many children participation in ASM-related work does not prevent them from attending primary school. In general terms, 29.8% of main houses have walls made of cement or baked blocks, 46.5% are purely earth walls with supporting poles, 23.1% of earth blocks and 0.7% are just thatched with grass. The performance here is above the national average for households with modern walls which stand at 25%. Mgusu has the highest proportion of earth walls (76.7%), while Mabuki has the highest proportion of earth block walls and Nyarugusu is highest in cement or baked blocks walls. Mgusu houses are the most temporary of the three and this is explained by the threat of eviction and impermanence (Mwaipopo *et al*., 2004).

Over 50% of the households that were surveyed fetch their drinking water from an unprotected source, a feature of particular concern in parts of gold mining villages where there is an increased threat of pollution. These figures are quite below the national

average of 55% of households accessing protected water source. Interestingly, Mabuki has been fortunate for about 37% of her households enjoy piped-water, while in Nyarugusu and Mgusu it is less than 2%. The advantage for Mabuki is probably due to its proximity to Misungwi District Headquarters, which attracts donor support. While in Nyarugusu, 8.9% of households have privately owned boreholes, although this does not mean that the water is not polluted because of the link between ownership of boreholes and private processing of gold. In Mgusu, the majority of people access water from the river that runs through the valley, upstream from where the gold is processed. Generally, the main fuel for cooking is firewood and charcoal as they are used by over 65% and 30% respectively of the households. Mabuki has the highest rate of firewood use of 91.4% whereas Mgusu has the highest rate of charcoal use of 50.8% (Mwaipopo *et al*., 2004).

In Tanzania, it is also observed that (Mwaipopo *et al*., 2004) about 14.6% of household members across the three villages are uneducated i.e. they have not attended a formal education class, whereas 56.2% have either partially or fully attended formal primary school education. The national figure for illiteracy level is 25.0% of all adults. Whilst, Hilson (2002b) describes many Ghanaian small-scale miners as having low educational levels and low technical know-how, other studies indicate that ASM operators have above-average education.

Gender composition is at a ratio of 1:0.92 giving 52.0% and 48.0% for males and females respectively, contrary to expectations whereby one would anticipate a higher

percentage of women than men. Interestingly, mining is more attractive to males, even though their female counter-parts find employment in mining-related activities. Female-headed household is rated 0.7% and 28.3%, respectively; such difference in housing quality might be explained by the fact that more immigrants live in rented houses which are likely to be of higher quality. Female-headed households, for instance, in the villages stand at Nyarugusu (54.1%), Mabuki (35.1%) and Mgusu (10.8%) (Mwaipopo *et al*., 2004). The issue of female-headed households was not central to the research, the researchers do not have a good explanation for the differences between villages, although interviews did suggest that women could make a living in Nyarugusu through provision of other services and they were not necessarily amongst the poorest households. The study also found that there is also a high dependence ratio in ASM households in the communities being studied. The dependency ratio is extremely important because high dependency ratios significantly increase the likelihood of household poverty. The broad age grouping has it that majority of the household members are of the age below 15 as they form 47.9% of the entire sample. This implies that there is high dependence ratio taking into account that 3.4% are elderly (Mwaipopo *et al*., 2004).

In a study of artisanal mining in Southern Zimbabwe, Mabena (2012) found changes in land ownership patterns due to the land reform programme, which has increased the scale of participation in non-crop activities, particularly artisanal mining. In a wake of droughts and lack of farming inputs, artisanal and small-scale mining became the only viable alternative for the newly resettled farmers. According to him, in Totororo, there were no resettled farmers but significant proportion of former farmers among the

artisanal miners. Interestingly, most of the artisanal miners were aged between 17 and 35years. For instance, children start washing gold from the age of three but when they have attained the age of six, they can break rocks with hammers or washing ore. Some children as young as nine work underground, and by 12 boys are working underground in many countries and do the same work as adults. In the Cerro Rico in Potosi, Bolivia, half of the 8,000 miners are children and adolescents.

Children and women's participation in artisanal and small-scale mining is common, with both positive and negative social and health implications. According to Heemskerk (2005), two and a half million men, women as well as children in more than 25 African countries including Nigeria engaged in mining solely to sustain their livelihood. The miners working conditions differ depending on geographic (e.g. location), geological (e.g. mineral mine), demographic (e.g. gender, age), socio-economic background (e.g. alternative employment option), cultural (e.g. taboos) and assets (e.g. pentagon model). In fact, the miners also have some things in common.

Women are frequently obliged to bring their children to the mines and live with them in mining camps. Perhaps, it was in the realization of this scenario that the United Nations agency launched a campaign against children working in mining in 2005. It is called one of the world's worst forms of labour. Although countries like the Democratic Republic of Congo (DRC) has ratified the UN Convention on the Worst Forms of Child Labour, and it is illegal for children under 18 to work in mines; however, between 800,000 and one

million children are engaged in ASM. In Mali, an estimated 20,000 children toil in artisanal gold mines, and injury is common (Mallo, 2012).

The expectations of a community are crucial factors in understanding the issue of population pressure on resources. Population pressure is therefore presented as a product of the interaction between the three variables of resources: land, population and expectations. According to Udo (2012) rural areas which have very high population densities experience acute shortage of farmlands. The pressure of population on cultivable land is such that fallow periods have been reduced to two years and in many cases, the land is cultivated every year. For instance, permanent cultivation has lavish the application of household manure and fertilizers in many localities. In a less favoured locality, farm output per capita is very low and soil impoverishment has contributed greatly to soil erosion. Many inhabitants of these congested rural areas migrated to farm in distant areas, and to work in neighbouring towns (Udo, 2012).

A skewed distribution of wealth and income has implications for environmental pressure. For example, if small-scale farmers are compelled to utilize marginal land areas because large-scale land owners occupy the best agricultural land, the inequitable land distribution may be an important driving force behind deforestation and land degradation. Dasgupta and Maler (1994) further argued that poverty and other environmental problems are exacerbated by inequality. Where inequality exists many local common property management seems breakdown.

2.4 Policies on Artisanal and Small-Scale Mining

The government and international partners' roles on ASM specifically focus on mining legislation. The recognition of small-scale mining, as an important sector of the economy and an engine for poverty alleviation, has led many countries to draft specific laws for its management. However, there are still some countries that have not followed this trend. In Sudan, for example, more than 100,000 miners are engaged in the Southern Blue Nile and Eastern Bayuda Desert areas, where there is no single legislation for managing the mining activities (Mutagwaba, 2000). Miners in Sudan are required to enter into agreements negotiated according to the provisions of Section 10 of the "Mines and Quarries Act of 1972" and the associated regulations, "Mining and Quarries Regulations of 1973", with the Ministry of Energy and Mining through the Geological Research Authority of Sudan (Mutagwaba, 2000). Deviants among these miners operate illegally.

Therefore, many of the international, national and local developmental partners have stressed that to improve policies for ASM, there is the need for prioritization and adoption of new strategies to manage its effects on the environment (Spiegel and Hoeung, 2011). In 1940, there was a new legislation enacted on mining companies to reclaim mined lands through filling mining shafts, but this remained only in principle not in practice and thus, the mining companies did not adhere to the laws. It was observed that eucalyptus trees were planted on the few lands reclaimed; however, the trees grew tall and produced forests which caused havoc on agricultural activities in the mining communities. Surprisingly, no crops yielded bumper harvest under the trees shade due to inadequate chlorophyll (Gonyok, 1986; Fwatshak, 2010; Falola and Paddock, 2010).

However, there are other countries that have enacted mining laws with specific provisions for managing artisanal and small-scale mining that are detrimental to the development of the sector. The Côte d'Ivoire mining law, for instance, recognizes "small-scale mining" and "semi-industrial mining". It states clearly that an authorization for minerals exploitation for the two categories gives no right to the beneficiary for obtaining a mining title and that "it is a real estate right that may not be transferred or mortgaged". For instance, selected best practices in small-scale mining must be declared to the Minister of Mines to decide on the conditions under which they can be exploited. These are definitely counter-productive measures that are aimed at controlling rather than encouraging development of the sector.

In addition, the Nigerian government and international development partners often see the mining sector as only a threat, although it could be a source of sustainable livelihoods for millions of marginalized people (Onoja, 2013). For example, experts and other international institutes, spear-headed by the International Institute for Environment and Development (IIED), have launched a report that identified gaps in knowledge in the artisanal and small-scale mining sector and sets out options for new project. A project that is designed to help policymakers to ensure that the mining sector meets people's potential as well as improving their livelihoods to take up the local environments (Onoja, 2013).

In Nigeria, the current mining legislation shows that there are six (6) classes of licenses in the mining sector. These are reconnaissance permit, exploration license, small-scale mining license, mining license, quarrying license and water use permit. For instance, artisanal and small-scale miners can obtain license for only the first-three classes of licenses. However, even for these three classes of licenses, artisans may fail to obtain a license because of the requirements to show "proof of sufficient working capital" and "technical competence to carry on the purpose". These provisions have unintended negative consequence which push many artisans into illegal mining when they fail to get a license (Nigerian Minerals and Mining Act, 2007).

The mining policy and legislation of Tanzania is a typical example of the best practice that is required for development of a mining sector. In addition, the legislation with its regulations has established an appropriate regulatory framework for the management of the sector. Notwithstanding, the lack of adequate human resources and infrastructural support at the local level to administer the system and to provide assistance to the miners, have to a large extent, rendered these laws and regulations less effective in practice (ECA/UNDESA, 2002).

In North Province of South Africa, Manson (2013), a study found that occupants of villages removed to make way for mining ventures have objected to the conditions of the removals, due to inadequate compensation, loss of grazing, poughing of lands, and the provision of inadequate or inferior housing at the new sites. In addition, acquisitions have also been leveled at the Royal Bafokeng Administration (RBA) for what is

perceived to be an increasing level of authoritarianism. In 1999, another study on the social effects of a population relocation as a result of mining expansion revealed that the RBA exercises an "increasingly centralized and autocratic form of power" and as a consequences they encountered "dwindling legitimacy" in the face of growing resistance and rising discontent.

The artisanal and small-scale mining sector is expected to connect stakeholders, miners and the mining communities to ensure that better quality of information is generated and used effectively in policy making at the local, corporate, national and international levels. For example, the vulnerable people that are involved in mining are women and children and the sector is renowned for its severe pollution and harsh working conditions (Onoja, 2013). However, the Nigerian government and international agencies have historically given little attention to the sector and how to make it sustainable. In Nigeria, instead of the government to play its role of encouraging the small-scale mining, it keeps on formulating policies against the sector which are ineffective. Again, the Nigerian government and development partners have failed over the years to create more awareness on the socio-economic effects of artisanal and illegal mining forgetting that the sector could contribute positively to Nigeria's rural development.

The Zamfara State Government and the Federal Government of Nigeria, for instance, are obligated under the international law to protect the right to health of children. In 1993, the country became a party to the International Convention on Economic, Social and Cultural Rights, which obligates Nigeria to protect the right of everyone's, physical and

mental health. The committee to this convention interprets the right to health as inclusive, extending not only to timely and appropriate health care, but also to the underlying determinants of health, such as access to safe and potable water, adequate sanitation, adequate supply of safe food, nutrition and housing, healthy occupational and environmental conditions, and access to health-related information and education. The convention on rights of the child also seeks to protect children from work that is likely to be hazardous or harmful to the child's health, physical and mental development. Similarly, the International Labour Organization Convention No.182, which is binding on Nigeria, prohibits the worst forms of child labour, including work in an unhealthy environment that exposes the children to hazardous substances (Bleasdale, 2011).

2.5 Empirical Studies on the Effect of Participation in ASM

Jacques Rousseau, for example claimed that "it is the rural people who make a nation" Woods, 2009). Therefore, ASM is an important source of local income and often drives local development. Artisanal miners participate in mining to earn a living, while industrial mining is driven by corporate economic considerations. Miners focus on industrially not economic small high-grade mineral deposits in "open access" condition, and employ a "common pool resources" management approach. Low technologic levels, at the budget of rural communities, have however had serious effects on health, safety and environment. According to Abutu (2015) in Zamfara State, for instance, the participation of local miners made them to earn between ₦4, 000.00 and ₦100, 000.00 daily from gold mining. To this end, gold mining to the young miners is better than farming. While Yunana and Banta (2014) study conducted in Kaduna State revealed that

the participation of miners in ASM affected the farmlands of people in Antang District. Their study has further shown that mining had affected the crop yield of majority farmers and some animals had lost their lives. For instance, sixty seven per cent of the respondents declared that for the past 10 years, they were getting fewer yields from their farmlands. The respondents complained of the death of animals, human beings and many people who had injuries in the illegal mining pits dug by miners.

Consequently, Oyedokun and Igonor (2013) noted that the decline in solid minerals development in Nigeria can be attributed to the discovery and total dependence of the country's economy on oil since 1956. This factor alone has affected not only the mining sector, but agriculture which was the major occupation of Nigerians. The Nigerian civil war on one hand and the dis-interest of the Nigerian Government in mining have caused a great number of the miners/investors (who were mostly foreigners) to leave the country. Thus money and manpower were no longer available to drive the sector forward; the depression experienced by the world economy in the 1970's and a consequent crash in the mineral/metal prices further negatively affected mining as the few miners left the country. Similarly, the fleeing of the expatriates who had the investment funds and technical know-how led to an almost zero level of exploration activities for solid minerals in the country.

Most farmers and few students use simple technology. They participate in mining only as a part-time dry season or what they called leisure time-occupation. Abubakar Ya'u's study in Jos Plateau showed that none of his informants knew the uses of tin but they

only knew the local markets where to sell it. For instance, Ya'u maintained that majority of the farmers who participate in tin mining use the proceeds generated from the sale of tins to buy chemical fertilizers and other necessities of life while the students use the money to supplement their education (Fwatshak, 2010; Falola and Paddock, 2010).

Colom (2006) stressed that the Europeans became uninterested in the tin industry owing to the indigenization law of the 1970s, which gave them the status of minority shareholders. The decree which was promulgated by General Yakubu Gowon in 1972 has killed the mining industry because the aim was to encourage more participation of Nigerians in her economy. The law classifies Nigerian businesses into Schedule I, which is characterized by low-scale, less capital intensive and 100% were reserved for Nigerians while Schedule II reserved 40% for Nigerians and those in the categories of others were meant for large-scale and high technology were exempted. For instance, the indigenization decree was reviewed in 1973 and 1976 respectively and the category of others was removed and all businesses were classified by creating Schedule III, which also reserved 40% for Nigerians and Schedules I and II were expanded and Schedule II was forced to allocate 60% shares to Nigerians who must equally retain 100% in Schedule I (Colom, 2006; Fwatshak, 2010; Falola and Paddock, 2010).

The environmental effects of tin mining are indeed negative and significant to livelihood. One of the negative effects includes damage to farmlands. In 1940s, J. G. Davies carried out a survey on the extent of damage to land owing to tin mining in Gyel and Zawan villages of present Jos South LGA of Plateau State. He concluded that 2,033.9 acres or

3.10% of the original arable land in Gyel had been destroyed due to lack of land reclamation techniques but less than that of Shen with 10% and more than a total of 10.8% of land in Zawan. For instance, one of the post-colonial mining activities in Jos, Plateau State is tin. Although, after independence in 1960, tin mining continued to be practiced on large-scale using heavy machineries which have environmental effects (Fwatshak, 2010; Falola and Paddock, 2010). However, mining activities have significantly impacted on the environment in Nasarawa State of Nigeria. It is said (Ezeaku, 2011) that mining exert pressure on the livelihood systems of people in the rural areas through deforestation. It also destroys the vegetation leading to fever pastures for livestock grazing, low wood harvesting for home use and sale and declining of arable land for farming. According to Gutti, Aji and Magaji (2012) degradation arising from mining includes; air pollution, water pollution, land and forest degradation, noise pollution, solid and liquid waste disposal of toxic substances, as well as socio-cultural problems like health complication, conflicts, alcoholism, drug abuse, communal clash and inequality.

The debate concerning labour supply on the mines field was decisively settled in favour of “voluntary” labour. However, the Berom and other Plateau communities in the vicinity of the mines field could supply the cheap, abundant, dependent labour of which the mines companies dreamt, without destroying their agricultural system. It is also established that the recruitment systems of southern Africa were expensive. Even in Rhodesia, the recruitment system so admired by Nigerian tin capitalists was dismantled when market forces were sufficiently developed to push workers to the mines and farms

in large numbers. Nigerians endured the suffering but the production hardly increased from the immediate pre-compulsion period, and the expenses incurred by management rose enormously. Capital was pleased at the end of forced labour in 1944 (Freund, 1981).

According to Mallo (2012) in Nigeria, unlike in Cameroon, mining began in 1903 when the mineral survey of the northern protectorate was conducted by the British colonial government. Forty years after the discovery, the mining industry witnessed an influx of British and German foreign mining companies like the Amalgamated Tin Mining Company of Nigeria, Ex-lands Technology Company Limited, Gold and Base Metals - Saudi Arabian Mining Company. These companies introduced mechanized mining, which led to higher productivity. In the same vein, laws were also enacted by the colonial government to guide mineral extraction. Interestingly, by the 1940s, Nigeria became a major producer of minerals such as tin, columbite and coal (Mallo, 2012). Prior to independence in 1960, the mining industry became dominant and was controlled by British firms in Nigeria. It could also be argued that the country's mining industry has been abandoned for some time due to the discovery of oil. Ironically, the colonial companies and production never recovered until recently when the issue of solid minerals became paramount to the Nigerian government.

Zimmermann (1951) noted that the human population is exposed to vagaries of the environment and could satisfy the basic needs as opposed to cultural needs of man. According to him, human beings exist at the animal and supra-animal levels. At the animal level, they are part of nature or the natural ecosystem. At this primitive stage, the

human population has very little or no means to subdue the environment. For example, it is at the supra-animal or human level that human beings develop culture as the driving force in the transformation of the natural environment. Culture, which encompasses the level of technology, helps man to emancipate himself from the environment by exploiting and creating resources. The more advanced the level of technology, the greater the demand for cultural wants as distinct from basic needs and consequently the greater the level of consumption of natural resources, the greater the transformation and destruction of the environment by man (Udo, 2012). In a Third World country like Nigeria, for instance, the most basic resource is the land and the unknown minerals under the ground like gold, tin, zircon, lead and iron ore.

In considering "population pressure" on resources in Nigeria therefore, the first point that comes to mind is that the land is fixed while the population size increases every day (Udo, 2012). Equally important is the fact that land, the "free gift of nature" to man, is immobile and cannot be transferred from areas with abundant supply to land deficit areas. What can be transferred is the population, but this is not an easy task to make in a multi-cultural society like Nigeria. Pocket of areas of extreme population pressure on the land therefore exist side-by-side with extensive areas of inhabited or very sparsely populated districts (Udo, 2012).

Many studies revealed that the wealthier members of the community that are better placed take advantage of the opportunities offered by ASM. For example, in Bolivia, it was the landed members of the community that were able to engage in small-scale

mining rather than the landless ones, who were unable to take the risks associated with employment in mining (Godoy, 1988).

According to Udo (2012) the state of human environment at a given time is therefore largely a product of human activities involving the production and consumption of goods and services. Thus, these are the activities that also result in the generation and accumulation of domestic and individual wastes in the society. Living things, including human beings effect upon or modify the environments where they live, just as the environment impacts on living things. There is no problem in this relationship for as long as the total ecosystem is made up of a great variety of species remains balanced, such that no one organism is able to cause excessive damage or harm on the environment. However, trouble starts when nature's balance is upset by a dominant species, usually the human population, or by natural disaster. For example, Fatubarin (2014) sees the natural environment as important not just because it is a natural repository of wealth, but it is an environment designed by God, to sustain life.

As to the effect of participation in ASM, Harrison (1993) noted that human beings like other living things, ralate to their environments in three ways. Firstly, the environment provides the resources needed for the existence and survival of human beings (livelihoods). Secondly, the environment also provides the site for the physical presence of all living organisms, their homes, defences, and so forth with human beings occupying more space per capita. Thirdly, the environment serves as the sink for wastes and once again, human beings produce the greatest amount of wastes.

In addition, population as one of the demographic variables occupies a unique and dominant position in the intricate relationship that exists between the environment and development. It is defined as the total number of people who live in a specified area or territory such as a country, province, ethnic territory or a town. As a component part of the environment, the place of population in the ecosystem is clearly spelt out in the divine injunction which states that "be fruitful and multiply, and replenish the earth (i.e. the environment), and subdue it; and have dominion over the fish of the sea, and over the fowls of the air, and over every living thing that moves upon the earth" (Udo, 2012).

In the process of creating development, the cultured human being has turned out to be the "most dynamic" agent of transformation and destruction of the environment. For instance, the destruction of the environment by the miners is an important point to note because it affects the development of mining communities. Interestingly, all development is targeted at people. It means that human beings are the main beneficiaries of the products obtained from the exploitation of the environment. It is of course the continued growing demand for resources by an ever-increasing population (population pressure) that has created the age-long concern over the state of the environment and the adequacy of resources for future generations (Udo, 2012).

The effect of population pressure on resources is an important and critical developmental issue. It is at the centre of the population debate and is pollution crisis. The population debate itself has a long history that can be traced back to ancient Greece and the epic treatise. However, it received little attention not until the United Nations Conference on

Environmental Development (UNCED) referred to as "the Earth Summit" that took place at Rio de Janeiro from June 2-14, 1992 (Udo, 2012).

2.6 Concept of Strengths, Weaknesses, Opportunities and Threats (SWOT)

This section discusses the SWOT analysis technique which is alternatively called "SWOT Matrix". It is a structured planning method used to evaluate the strengths, weaknesses, opportunities and threats involved in a project or business venture. A SWOT analysis can be carried out for a product, place, industry or person (Humphrey, 2005). Albert Humphrey led a convention at the Stanford Research Institute (now SRI International) in the 1960s and 1970s using data from Fortune 500 companies and applied the SWOT model. In addition, the SWOT framework was described in 1960 by Edmund P. Learned, C. Roland Christiansen, Kenneth Andrews, and William D. Guth in "Business Policy, Text and Cases". It concentrates on issues that potentially have the most effects and it is useful when a very limited amount of time is available to address a complex strategic situation. This method can also be used to analyze the implications of ASM in the study communities.

2.6.1 Strengths

It is said that in over 400 locations, Nigeria has a proven economic reserve of 33 types of minerals like (Tourmaline, Cabochon, Limestone, Feldspar, Tantalite, Coal, Barites, dolomite, etc). With increasing interest in ASM and emphasis on sustainable development, the recognition of effective environmental management strategies in mining operations is crucial and the need to understand the intricate relationship among

small-scale mining, sustainable livelihood and agricultural production is paramount. In Nigeria, a large number of families earn their livelihood from environmental resources like the mining sector (Akwarandu, 2013).

The significant economic benefits reap from ASM activities have recently been recognized by several African countries like Nigeria. Indeed, the sector contributes significantly to socio-economic development in terms of poverty alleviation in rural areas; reducing rural-urban migration especially for the unemployed youth; maintaining a vital link between people and the land; creating alternative economic activities; and contributing to national incomes/state revenues. From a technical standpoint, it encourages the regulated exploitation of otherwise uneconomical reserves and provides a lead to many discoveries of large-scale deposits. In addition, ASM is labour intensive because it offers a greater opportunity for direct and indirect job creation than large-scale operations, especially in rural areas. At the micro level, revenues generated from these activities could increase local purchasing power as well as the demand for local products, e.g. food, working tools, housing and furniture. In turn, this creates more employment in other economic sectors such as agriculture, carpentry, fabrication and foundry (Gutti *et al*., 2012; Oyedokun and Igonor, 2013).

Essentially therefore, the discourse on livelihood cannot be disconnected from an understanding of the environment as societal nexus. From antiquity, the quests for land and land-based resources have triggered various kinds of conflict. Today, the matter is worsened with an increasing shortage of environmental resources including land per

capita, owing to global population increase, leading to land use and environmental conflicts. The current global environmental realities such as climate change with its effects cutting across different socio-economic and natural systems, transcending geographic boundaries that affect multiple livelihood sources (Akwarandu, 2013).

In Rhodesia, the huge and heterogeneous labour force was partly the creation of forced labour and allied State mechanisms, but the dominant theme in its emergence has been the intensification of market pressures which have progressively disintegrated peasant-artisan households (Freund, 1981). The first European mining camp was established at the foot of the Jos Plateau in 1903 by the Niger Company. During the following years, the Company proved and obtained exclusive prospecting rights over the richest ground and induced the State to terrorize the Plateau people into accepting the advent of European miners while the legal basis for capitalist enterprise was worked out. From 1910, speculative and then productive capital moved in and the government-built railway permitted export of metal on a larger scale (Colom, 2006; Fwatshak, 2010; Mallo, 2012).

2.6.2 Weaknesses

In Niger State of Nigeria, about 28 children died as a result of drinking water poisoned by lead (Adebayo, 2015). Of the surviving children who were tested, their blood samples indicated that there was lead poisoning. Water from the well has been contaminated with a reasonable amount of lead. The case of Zamfara State in 2010 was more worrisome with 163 people reported died from lead poisoning through illegal mining (Adebayo, 2015). As hazardous as ASM operations are, the miners do not see the need to take any

precautionary measures, subjecting themselves and their families to environmental pollution. Toddlers are most vulnerable affected by lead poisoning because they crawl or play on the contaminated ground and perhaps might develop intellectual deficits and blindness or could easily develop nervous systems problems. The outbreak of deaths could have been caused by an increase in the number of grinding machines in villages where mining activities take place in November, 2009 in Zamfara State, which contributed to the widespread contamination. The implication was that children could have also had a higher risk of deaths if they were under the age of 24 months, their parents used a community well as the primary source of water and their family compound had high lead concentration in the soil (Abutu, 2015).

Researchers from the Commonwealth Development Corporation (CDC) and the World Health Organization (WHO) visited two villages in Zamfara State where there was a higher child mortality rate than expected between May, 2009 and May, 2010. It was observed that many families processed ore in their compounds but because of lead poisoning, most of them had stopped processing it and the operations have been moved a short distance (Bleasdale, 2011). For example, children usually bathe in ponds; wash clothes and feed their flocks of sheep or herds of cattle in lakes, rivers and wells that are highly contaminated with lead from ore-processing (Abutu, 2015; Adebayo, 2015).

However, in spite of all these, the mining sector is beset with other serious problems. Even where some practices could have had long-term effects, because of poor institutional effectiveness and capacity, as well as limited funding, they could not be

sustained overtime. In the past, some initiatives were ad-hoc in nature and not part of a comprehensive plan to promote the mining sector. The problem was further compounded because there had been poor understanding about the livelihoods of small-scale miners. Likewise, gender, environment, health, human/institutional wealth creation, other social variables and community dynamics have not been considered as integral parts during the design and implementation of programmes to support the sector (ECA/UNDESA, 2002).

To this end, the challenges faced by miners are insufficient knowledge of mechanization while the demand for physical work, low level of occupational safety and health care are on the increase coupled with deficient qualification of miners during operation, inefficiency in exploitation and processing of mineral production, exploitation of marginal and/or very small deposits, which are not economically exploitable by mechanized mining. Others are low level of productivity/salaries and income, periodic operation by local peasants, lack of social security, insufficient consideration of environmental issues and hence significant effect of the mining sector on the environment, chronically lack of working and investment capital and some of the miners mostly work without legal mining titles (Charkravorty, 2001; Jennings, 2001; Gunson and Yue, 2001).

In Nigeria, for instance, the first strike in mines field history occurred when Archbold, a Niger Company engineer, tried to push down the daily wage. Further attempts simply led to the workers drifting away, provoking a labour shortage. Mining capital in Nigeria had no definitive view of migrant labour. Migrancy had one characteristic which was sharply

attractive because it enabled labour to disappear at no cost to the companies when business was slack. It also made feasible wage rates low enough to yield good profits while competing with other tin-producing areas and other metals despite ground quality inferior to South-east Asian mines and high transport costs (Freund, 1981).

In Ghana, despite passing of the Small-Scale Gold Mining Law in 1989, which legalized the sector and the establishment of demonstration centres aimed at encouraging miners to acquire training and have access to technology, there are still serious problems affecting the sector. One of these problems includes lack of trust among authorities, small and large-scale miners. Competition of land use and disputes are apparently the order of the day among them. On the other hand, the demonstration centres established by the government have not improved the productivity of ASM operations and some had even closed-down. The provision of technical assistance to the miners, which was assigned to the Mines Department and to the Geological Survey Department, has been fraught due to financial constraints. To a large extent, the same problems have affected the Minerals Commission in most countries (ECA/UNDESA, 2002).

2.6.3 Opportunities

The geology of Nigeria is comparable to those of other countries where world class deposits have been found. The mineral spread is in significant quantity with evidence of 34 different minerals distributed in Nigeria's richly endowed geology. However, not all the minerals have enough reserves to be of viable interest to mining companies, but the Nigerian government is leaving no stone unturned in its increasing sustained efforts to

delineate and objectively demonstrate the potential and encourage investments to be interested in all the minerals. Thus, this would significantly increase the country's mining potential (Nigerian Minerals and Mining Act, 2007). However, the development of tin mining in Plateau State of Nigeria was slow due to poor transport and other facilities. An opportunity flourished with the construction of the Bauchi railway in 1914, and an increase in the demand and price of tin in the world. The requirement of tin for military purposes between 1914 and 1919 (i.e. during the First World War) and the arrival of a branch railway line at Kafanchan in Kaduna State in 1927 had made the production of tin to increase (Kogbe, 1989).

Consequently, it has been argued that community actions and the nature of relationships with resource developers are informed by a number of perceptions. As it is further observed, whether these perceptions are correct or not is not relevant, as over time such perceptions have become facts for community members and a basis for action. Hence, the negative perceptions of the environmental consequences of governments and companies' activities have inevitably resulted in protracted conflicts between the communities and the companies on one hand and between the communities and the government on the other. Generally therefore, identifying community environmental perception and the various factors influencing and shaping these perceptions present a fertile ground for a better understanding of community actions and hence the possibility of manipulating or shaping those perceptions and actions, especially of miners with obvious environmental consequences (Akwarandu, 2013).

In Zimbabwe, the Shamva mining centre was publicized to facilitate access to appropriate technology and equipment. The essence was also aimed at developing the people mining skills, which has failed to operate in a sustainable manner. This was done to encourage the disengagement of its main funding agency, mismanagement and lack of institutional support. This in essence illustrates how complex the artisanal and small-scale mining sector is and how difficult it is to have practices that holistically contribute to its development (Svotwa and Bugnosen, 1993; Magalela, 1999; Svotwa, 2000).

2.6.4 Threats

As with many economic activities, ASM has its negative implications. A large number of itinerant, poorly educated populace with few other employment alternatives, living mostly in remote rural areas, participate in mining activities. Often, the technology employed as it was noted by Offiong (2012), Alhassan and Umar (2013), Abutu (2015) and Adebayo (2015) is rudimentary, which has effect on the local environment and miners' health. Health and safety standards as well as productivity are poor; and hence earnings are low. There is no adequate security in mining camps and its surrounding communities, while illegal mining and marketing activities, and the use of child labour is prevalent.

Environmental concerns arising from mining can be deleterious especially if not well managed. For example, a study carried out by Akwarandu in Ikpeshi community of Akoko Edo Local Government Area of Edo State, Nigeria revealed that excavation of sand in the mining process has resulted in large and unmanageable heaps of sand in the

mines sites and adjoining farms. These heaps of sand occasionally cause river siltation and reduce availability of land for farm activities and have significantly messed up the landscape (Akwarandu, 2013).

In the immediate post-war boom, the mine companies raised the demand for recruited labour for the last time and in 1920 several companies negotiated with the Gombe Native Authority (Bauchi Province) to procure cheap labour from what was already a major source of migrants. This again was unsuccessful due to corruption. Before the end of 1921, the tin industry suffered the worst slump since it had developed under the capitalist auspices in Northern Nigeria. The demand for mines labour fell off very sharply and, for the first time, many workmen did not find it easy to return to their fields and take up other opportunities (Freund, 1981).

It was also found that mining and quarrying has many noise-generating activities ranging from the use of bulldozers and excavators, explosives in rock blasting, vehicular movements; and noise from pulverizers/mills that can sometimes be deafening and could cause physical and social environmental threats. Fifty two per cent of respondents estimated that more than 20 people in the community have lost their lives and many more have been injured from mining activities. Perhaps, such number of deaths may not be unconnected with unplanned opening and abandoning of pits in the quarry, stone blasting and ‘knocking’ (a term used to denote the process of using hammer to break stones into pieces) and vehicular accidents. The danger of unplanned and unprotected pitting in quarries has been recognized and the effects on livestock rearing remain

negative. In Ikpeshi community of Akoko Edo Local Government Area of Edo State, Nigeria, it is estimated that there are more than 1000 active open pits of different sizes, ranging between 10-70ft deep and 20-120ft wide, littering the quarries and mine sites, leading to loss and degradation of farm lands/landscapes (Akwarandu, 2013). Noise and air pollution through dust and blasting fumes are additional negative side effects of participation in ASM, which adversely impact on the health and the well-being of miners, as well people residing in adjacent communities (ILO, 1999).

Another threat that the participating farmers faced in ASM is that there has been little consultation and participation at the grass roots level in the process of promoting the sector. As a result, the participants have not been empowered and do not have ownership of the processes. ASM does not allow the generation of more accurate data because there are no available official figures at the ministries and other governmental institutions. Also, the fact that the sector is extremely mobile and flexible hinders accurate estimations. This is because some mining communities have thousands of miners who can appear and disappear overnight. Perhaps, this could be what makes it very difficult to monitor, control and police them by local authorities and Non-Governmental Organizations (NGOs) working in the sector (Falola and Paddock, 2010; Fatubarin, 2014).

In addition, without financial resources, technical and management skills, miners can neither conduct systematic exploration in the mining areas nor acquire adequate technico-economic information to allow long-term planning and adequate mining

development. There are a number of factors that contribute to poor performance of the small-scale mining sector. These include lack of simple and transparent legal and fiscal frameworks, weak institutional structures, lack of capacity to implement existing regulations, and sometimes lack of political will. Inadequate support services and access to information and technology as well as restrictive marketing systems further contribute to making ASM, not only unproductive, but also counter-productive (Gutti *et al.*, 2012; Manson, 2013; Fatubarin, 2014).

It was also revealed that the rate of mineral smuggling in Zimbabwe rivaled the proportions found in Africa's conflict societies. In 2007, the Zimbabwe's Central Bank noted that gold smuggled out of the country over a period of 5years averages 15 tonnes per annum which is worth over US$ 400m/year. Fertilizers, chemicals, fuel and other items have been smuggled or traded in corrupt ways to the tune of not less than US$ 250 million per annum (Gono, 2007). The informal gold mining in the central Zimbabwe town of Kwekwe gave credence to Gono's concerns. For instance, in early 2000, the informal mining and trade of gold virtually eclipsed the formal mining, although agriculture is the major economic activity in this area. In October 2001, the Midlands Observer estimated the number of people involved in gold panning activities in Kwekwe and surrounding areas to be nearly 600, 000 (Moore and Mawowa, 2010).

In 1998, for instance, heavy rains in the region of Arusha, in north-east Tanzania, led to flooding of Tanzanite mines, which killed about 70 people. After the accident, the Arusha Miners Association and the Mines/Construction Workers Union in collaboration

with the Mines Zonal Office assembled and drafted regulations aimed at avoiding similar accidents in the near future. However, the regulations, might not be ideal and did not impede on the occurrence of another fatal accident in 2002 (Mkapa, 2001; Ministry of Energy and Minerals (MEM), 2002).

The illegal mining was characterized by "syndicates" consisting of groups of miners. These often developed to become a form of organized resistance unit against law enforcers and rival groups. Others cooperated with various police and army officers. Syndicates were linked to members of the party-state elite working with a regional business partner, and a local villager (Moore and Mawowa, 2010). For instance, in Kwekwe, police charged illegal gold panners an equivalent of 200 South African Rand per hour digging for gold in a tunnel. At one mining site, in rural Kwekwe, the police operated in two day shifts in order to accommodate each other. Off duty officers usually visit the mining sites unceremoniously. In May 2008, the standard bribe rate for a panner caught in a police/army raid was US$ 100. The security personnel believe that they can't die of thirst while standing in water. There were several cases where members of the ruling elite clashed on farms, mining interests and other business spheres (Moore and Mawowa, 2010).

2.7 Review of Strategies Used to Cope with the Challenges of ASM

According to Ekbom and Bojo (1999) as a survival strategy, poor people depend more directly on biological resources for their livelihood than richer people. The poor that are particularly dependent on biological resources include small-scale farmers, hunters,

transhumance pastoralists, nomadic pastoralists and artisanal fishermen. In effect, ecological sustainability, for instance, requires that the prevention of pollution is combined with restoration and maintenance of the integrity of the ecosystems. It also requires that people should conserve the ecological processes that keep the environment fit for the lives of many Nigerians. These processes are the natural environment that shapes the climate, cleanse air and water, regulate water flow, recycle essential elements, create and regenerate soil and enable ecosystems to renew themselves. In Nigeria, estimates of biological diversity indicated that there are 22,090 animal species (vertebrates and invertebrates), 5,081 plant species and 1,489 species of micro organisms (Federal Environmental Protection Agency (FEPA), 1992).

In early colonial Northern Nigeria, the migrant character of mines field work was not necessarily disadvantageous to labour. Most miners were actually working with little supervision selling tin to the companies which monopolized land licenses and exports but intervened only superficially in production. So long as working for a mining company could be balanced off against the possibilities of rival employers, agriculture, trade and craftwork. A man could feel some independence from the strictures of wage labour. Workers were ready and able to be retained by their employers for a certain period of time, and more than one company found that labour brought in especially to the Plateau took advantage of the free fare only to be integrated into the urban camp population (Freund, 1981).

Zimbabwe's formal mining sector, for instance declined precipitously throughout the 2000s and seven mining companies closed operations in the month of November 2008 alone. Interestingly, but in 2000, Zimbabwe produced almost ten times more gold as it did in 2008. In 2000, the country became Africa's third largest producer of gold, which was sold at 2,259 kilogrammes to the international market but in 2008, it only sold 267 kilogrammes of gold (Business Times, 2008 cited in Padayachee, 2010).

Artisanal and small-scale mining has significantly affected land degradation, deforestation, health and safety. Although the miners are only interested in free minerals like (gold, lead, tin, zircon, tantalite, sapphire, etc), however inaccessible minerals are abandoned. In addition, as a coping strategy, the miners shift from one place to the other once the high grade ores are exhausted or when the extraction becomes impossible without rehabilitating the mined out areas. This behaviour also has effect on the lands farmers supposed to use for agricultural activities, which is invariably wasted by activities of these miners. From all indication, ASM is unlikely to disappear unless there are other substantial economic opportunities within the mining communities. It is observed that entry into this mining sector is largely as a result of lack of other economic opportunities. It is also facilitated by low start-up cost and substantial avenues for employment of participating farmers (Ezeaku, 2011; Fatubarin, 2014; Yunana and Banta, 2014).

It was also observed that most of the artisanal and small-scale miners are poor men, women and children from rural areas (Ofei-Aboagye, 1995; MMSD, 2002). They often

work seasonally, for example, subsistence farmers mine gemstones in the dry season when there is less-farm work to cope with challenges in mining communities. Some of the miners take up mining as a last resort during periods of economic recession. For instance, in the Nigerian society, it occurred during the mid-1980s and late 1990s. This period witnessed an illegal mining boom just like the 1970s oil glut in Nigeria. That is, many people were suddenly drawn into mining following the discovery of new mineral resources like the case of gemstones mining in Nigeria in the late 1980s. Similarly, in 1998, coltan (i.e. the minerals columbite-tantalite) rush in the Democratic Republic of Congo (DR Congo) was a typical example worth noting and it is also a primary source of tantalum metal use in capacitors.

Zimbabwe's ASM sector is thus one of the worlds' largest (Hilson and Banchirigah, 2009). However, associating ASM only with informality and casting it as a survival strategy for the poor is clearly inadequate in the Zimbabwean context. In fact, in Zimbabwe, senior civil servants, Zimbabwe African National Union (Patriotic Front) alias ZANU (PF) politicians and the military figures play a crucial role in ASM and the informal economy more actively. Consequently, ASM is conceptualized as part of development, sustenance and reproduction of a patronage system controlled by those with State and/or party positions (Mawowa, 2013). Castells and Portes's (1989) pointed out that informality, far from being an euphemism for poverty alleviation; it entails a specific form of relationships of production amongst individuals in the society.

Migrant labour in Nigeria cannot be understood in the context of a pure peasant-worker dichotomy; the migrant worker was also involved in a vast mercantile network that stretched down from the European firms and major comprador figures to a plethora of petty traders and commodity producers. It was highly rural-home-based skills and the growth of a reserve army of labour, the cheapening of labour power and the intensifying valorization of the economy that provoked mass participation in political and union struggles on the mines field from 1945. These struggles were led by clerks, artisans and labour contractors and were eventually diverted into ethnic and regional antagonisms, represented a new social consciousness for mine workers. A fundamental aspect of this struggle needs to be directed against the network of contractors and other parasitic intermediaries who stand between labour and capital. Their strength, rather than the migrant nature of labour, is most crucial for explaining the weakness of class struggle by mine workers, especially during the inter-war years (Freund, 1981).

According to Saunders (2008) one of the Zimbabwe's paradoxes was witnessed in the late 2008 when South African owned Metallon Gold's five mines, the monopoly buyer of gold in the country was suspended, which led to the decline in total gold production to 55%. Metallon Gold was closed because of the monthly remittance of US$ 23million needed to run two Metallon's mines. It failure did not affect mining activity but it was a shift to 'informal' means of production. However, several mines were shut down due to the operational constraints within the legal and policy regime.

It may also be salutary to recall Lenin's view that in Czarist Russia, many wage employment was migrant in nature. Migrant labour represented a progressive emancipation from the narrow limits of village life that would transform completely into a proletarian urban working class. There is a fundamental crisis in rural West Africa, brought about by the changes of the colonial era, which urgently calls for solution. In this light, the history of migrant labour in West Africa may contain seeds for hope as well as regret (Freund, 1981).

CHAPTER THREE

THEORETICAL FRAMEWORK

3.1 Concept of Theoretical Framework

A theoretical framework is the structure that holds or supports a theory of a research. It introduces and describes the theory which explains why the research problem under study exists. A theoretical framework also specifies which key variables influence a phenomenon of interest. It alerts a researcher to examine how they might differ and under what circumstances (Trochim, 2006). On the other hand, a theory is a set of interrelated concepts, constructs, and propositions that presents a systematic view of a domain of study for the purpose of explaining and predicting phenomena.

Due to the extent of participation in ASM by farmers, they used different types of methods in processing solid minerals such as gold, tin, sapphire and so forth. Participation here take place in a direct interpersonal basis, that is, the unit for participation and the primary forum for the expression of views comes mostly from the people in the rural areas. However, the participation of farmers in mining activities has negative effects on the mining communities. Therefore, this study used ecological modernization theory, Marx's labour theory of value and theory of social change to understand the effect of participation in ASM on the output, income and standard of living of farmers in Kaduna State.

3.2 Ecological Modernization Theory

This theory is one of the mainstream environmental sociological perspectives. The pervasiveness of ecological modernization can be gauged by the fact that a broad range of environmental social scientists have found it necessary to address issues related to ecology (Buttel, 2000). From a North American and British perspective, Arthur Mol and Gert Spaargaren are recognized as the key figures of this school of thought. It is observed that in Germany, Netherlands and elsewhere, ecological modernization model is still very closely associated with the work of scholars such as Joseph Huber and Martin Jänicke (Buttel, 2000).

The theory was first developed in the early 1980s primarily among a small group of scholars at Free University and the Social Science Research Centre in Berlin, Germany. Among these scholars are Joseph Huber, Martin Jänicke and Udo E. Simonis. Various scholars like Arthur H. Rosenfeld, Amory Lovins, Donald Huisingh, René Kemp and Ernst Ulrich von Weizsäcker shared similar ideas. Substantial contributions were made by Arthur P. J. Mol, Gert Spaargaren and David A. Sonnenfeld (Mol and Sonnenfeld, 2000; Mol, 2001).

Not only has ecological modernization model very rapidly gained a foothold in environmental studies, but it has made some inroads into general sociological scholarship. For instance, the theory rose to prominence because it is a well-developed and highly-codified social theory in sociological discourse. The theory's basic assumption is that most sophisticated and persuasive versions of human activities revolve

around the notion that political processes and practices are particularly critical in enabling ecological phenomena to move into the modernization process (Mol, 1995). The proponents suggested that a full-blown theory of ecological modernization must ultimately be a theory of politics and the State. That is, a theory of the changes in the State and political practices (and a theory of the antecedents of these changes) which tend to give rise to private eco-efficiencies and overall environmental reforms. While the second logic of ecological modernization theory suggests that, it has very close affinities to several related literatures - particularly embedded autonomy, civil society, and State-society synergy theories in political sociology - which have not yet been incorporated into the model's literature (Buttel, 2000).

One basic assumptions of ecological modernization model is related to environmental re-adaptation of economic growth and industrial development. On the basis of enlightened self-interest, economy and ecology can be favourably combined. Environmental productivity suggests a productive use of natural resources while environmental media suggests air, water, soil, ecosystems as sources of future growth and development in the same way as labour productivity and capital productivity. This includes increase in energy and resource efficiency as well as product and process innovations such as environmental management and sustainable supply chain management, adequate technologies, benign substitution of hazardous substances and product design for environment. Radical innovations cannot only reduce quantities of resource turnover and emissions, but also change the quality or structure of the industrial metabolism. In the co-evolution of humans and nature, and in order to upgrade the environment's carrying

capacity, ecological modernization theory gives man an active role to play, which may entail conflicts with nature conservation.

However, in spite the criticisms of this theory, there is a common understanding that ecological modernization model could result in innovative structural change. In spite of the negative effects of ASM on standard of living, most farmers still participate in it. Thus, researches are still focused more on environmental innovations, or eco-innovations, and the interplay of various societal factors (scientific, economic, institutional, legal, political, and cultural) which foster or hamper such innovations (Huber, 2004; Olsthoorn and Wieczorek, 2006). Notwithstanding, ecological modernization theory shares a number of features with overlapping approaches like the concept of sustainable development and the approach of industrial metabolism.

3.2.1 Application of ecological modernization theory

Ecological modernization theory tended to be appropriated by environmental sociologists, geographers, and political scientists mainly because of its provocative and challenging views about the malleability of the institutions and technological capabilities of industrial capitalism. It is also observed that environmental science and engineering could fairly readily be achieved within the framework of continued modernization of capitalism and the application of modern experimental science. Ecological modernization theory, is a new and in many ways an improved, synonym for sustainable development. For instance, the livelihood of a man or a woman is sustainable when he or she can effectively use the assets at his or her disposal to deal with shocks or stresses and

increase assets and capabilities in the short and long term. For instance, it simply means that ASM has provided the foundation for most of the participating farmers to improve their standard of living in the mining communities of Kaduna State. Therefore, the sustainability of the natural resource base therefore, must be protected. It is argued that in a people-centred development process, any intervention must be embedded in a locally-owned institutional mechanism, and have minimal reliance on external funding and support. Although minerals are finite resources there is a need to promote sustainability of mining activities, communities and environments. This is partly because ASM has a significant potential in enhancing the livelihoods of many people and in addressing rural poverty in general, by placing much reliance on mineral production in the study area.

Ecological modernization has become attractive as a concept because it provides alternatives to the pessimistic connotations of frameworks such as the treadmill of production and the growth of machine. The theory expresses hope, and makes it more readily possible to identify and appreciate the significance of environmental success stories.

3.3 Marx's Labour Theory of Value

Another theory that adequately explains the phenomenon of the study is the labour theory of value employed by Karl Marx (1818-1883) to explain the value of a commodity. For instance, a commodity used in this sense could be any of the solid minerals such as tin, gold, iron ore, sapphire, zircon and so forth dug by farmers in the rural areas where mining is their predominant occupation in Kaduna State. This theory

holds that capitalists do not pay workers the full value of the commodities they produce; rather, they compensate the worker for the necessary labour only (the worker's wage, which cover only the necessary means of subsistence in order to maintain him working in the present and his family in the future as a group). As necessary as labour is, Marx supposes, only a fraction of a full working day - the rest, the surplus-labour, would be pocketed by the capitalist. This means that in the mining communities of Kaduna State, most of the labourers were exploited by gold, sapphire or tin agents and dealers. That is, they usually buy the minerals dug by the participating farmers at cheaper rate and sold to companies or some individuals who specialized in exporting it abroad in order to make more profits.

Marx theorized that the gap between what value a worker produces and his wage is a form of unpaid labour, known as surplus value. Moreover, Marx argues that markets tend to obscure the social relationships and processes of production; he called this "commodity fetishism". People are highly aware of commodities, and usually don't think about the relationships and labour they represent. That is, in the mining communities of Kaduna State, most young and old rural dwellers participate in ASM as a family business. Thus, family whose members participate in mining as a primary occupation do not expect any amount to be paid to them, because it is a family labour. The rural dwellers participate in ASM for economic sustenance and to cater for their family of orientation (i.e. the family an individual was born into).

Temporary and permanent migration, for instance, are also confined to capitalist development. This was witnessed in the history of Europe and Africa. The historical accumulation of capital, however, made it possible to situate labour migration in the context of the relationships between capital and labour. Marx's theory of a capitalist mode of production for instance hinges on the process of progressive proletarianization, the detachment of peasants from production for use value, and the creation of a reserve army of labour. For instance, a veritable whirlpool of geographical and occupational mobility is inevitable to the extent that capital can only develop by continually decomposing those sectors which are backward compared with the most profitable forms. Capitalist social relationships by the 20th century have eroded or subsumed the existing production relations throughout the world. The tendency towards fully transformed relations has proceeded unevenly and is very far from complete. The characteristics of the 20th century "combined uneven development" which have brought a massive intensification of labour migration, notably in Africa (Freund, 1981).

Petty commodity production, although largely integrated into production for use value, was quite highly developed, and both wage labour and specific labour migration existed. The Hausa custom of *cin rani*, (i.e. people working during the dry season) by migrants, is apparently pre-colonial in origin. This suggests that some of the rural dwellers in the mining communities of Kaduna State were migrant labourers. They participate in ASM only during the dry season in these communities to improve their income and standard of living. Consequently, the income they realized from ASM could be used to boost their output during the rainy season when majority of these farmers engage in farming.

In the first years of capitalist mining operations, managers were very dependent on skilled Nigerian workmen, particularly for prospecting; a highly significant element in the labouring population were those who had acquired their skills as miners in the pre-colonial system and then went over for employment to the mines companies (Freund, 1981). Accident records and the 1931 census, for instance, suggest that at least 20% of the workforce in the 1930s came from French territory - Chad, Niger and the northern part of Cameroun - where colonial conditions were very oppressive and cash incomes extremely low. In 1958, the 'Union of French Lake Chad men' in Jos claimed that they had begun to arrive from Chad in 1914, presumably in association with the great drought. It was also linked to the French wartime conscription drive. The mines were not so easily able to secure employment for the indigenes of the Plateau itself for the first generation after their establishment. On the Plateau, commodity relations had only developed to a moderate extent before the conquest and the delicate balance of agricultural production was easily upset by the withdrawal of labour. Whenever possible, the Berom and other Plateau indigenes preferred to meet cash demands by growing foodstuffs or selling firewood. Even then little Plateau labour was available for the mines during the farming season until the Depression (Freund, 1981).

Migrant labour, which continued to be extensive after Second World War, was thus a fundamental social reform in the process. It has created a cheap dependent reserve army of labour in Northern Nigeria. Given the uneven and combined character of capital penetration under the aegis of colonial conquest that had taken place, it reflected the response of tens of thousands of workers to the possibilities of a transitional economy, to

the massive labour needs of industrial capitalism internationally on the one hand and to the surviving, if gradually decaying, social relations of pre-capitalist production locally. On the other hand, due to the very late development of industrialization in Nigeria and the stagnation of tin production after Second World War as a result of considerations by mining capital reflecting both the international tin market and the changing political conditions in West Africa, the miners of Jos have only slowly settled into a fully "proletarian" way of life (Freund, 1981).

3.3.1 Application of Marx's labour theory of value

From the workers' perspective, migration was a "rational" response to specific circumstances, including cash tax demands which at first gave wage labour much of the character of a corves, and the disarticulation, or complete break-up of rural households, and increasingly exploitative and cash-orientated relationships within households. While many West Africans were transformed (or transformed themselves) from peasants into workers, the impact of capital was typical to create an army of casual labour, characteristically but not inaccurately described in colonial British sources as a "floating population". This scenario was also witnessed in the study area. For instance, some farmers or aged farmers participate in ASM as casual labourers because it is not their primary occupation and mining has become the activity of the people in the rural areas. Thus, it is their way of life.

Migration is a response by individuals to avail the opportunities presented by the colonial economy; which is notably true on the Nigerian tin mines with regard to artisanal and

particularly clerical labour. For capital, migrant labour was the most important ingredient fed into its furnace. The colonial state, however, did not necessarily back the interests of individual capitalists unconditionally. Generally, it promoted conservative policies towards pre-capitalist social reforms in the interest of stability and social control. Moreover, it often intervened in favour of household production and petty commodity production as means of supporting a peasant-produced cash crop flow. If colonial policies were meant to sustain capitalist enterprise, they sometimes acted as a force for restraint, notably in the famous clash over land alienation for plantations between the British government and Lever Brothers in the 1920s. The State was thus seen as a considerable importance in the development of migrant labour, forever in flux, as a means of breaking proletarianization while continuing to provide a large, cheap and available labour reserve. This dovetailed with some business views in the colonial period, since capital was either unable or unwilling to intervene massively to press the establishment of capitalist agriculture or to industrialize West African production. The Northern Nigerian tin mines are interesting vantage point for viewing the development of labour migration in West Africa.

3.4 Theory of Social Change

Social change was first systematically analyzed with the concept of evolution by Auguste Comte and Herbert Spencer. The concept of social change is used for socio-cultural analysis and is predicated on the belief that all organic, in-organic and super-organic phenomena were subject to the same natural laws and on the argument that sociology explains super-organic phenomena (Afonja and Pearce, 1986). Ekong (2010) defined

social change as the process by which alterations occur in the structure and function of a social system. It means that the social system may be a social group. According to Moore cited in Ekong (2010) social change is the significant alteration of social structures (i.e. of patterns of social action and interaction), including consequences and manifestations of such structures embodied in norms (rules and conduct), values, cultural products and symbols.

The concept of "stages of development" is only one way of looking at social change and the family. There are other explanations like those based on whether the factors responsible for social change are endogenous or exogamous. For example, writers such as Weber, Simmel, Pareto and Meade have attempted to formulate sociological theories based on "social action and interaction theories" posit that change occurs in the society as a result of exogenous factors (Cohen, 1968).

Given these premises, one can easily say that social change pervades all aspects of social life and may manifest for instance as economic and behavioural change like that which occurs in the mode of production, economic relations and statuses of people or the discovery of mineral resources in northern Nigeria. Ekong (2010) holds that this may provide employment opportunities, increased incomes, and a general change in the people's statuses and social relations as a result of unequal access to surplus values in the society.

3.4.1 Application of theory of social change

Change is the consequence of interaction among members of different cultures. This suggests that interaction among the participating and non-participating farmers exists as a result of this interaction; they are faced with a lot of changes in the study area. This interaction has positively and negatively affected the people's way of life as migrants or bonafide indigenes in the mining communities of Kaduna State. For instance, anthropologists having carried out research on small-scale societies posited that a process of change is either normative or structural. That is, normative changes are those alterations in the norms of behaviour and roles, which occur through the interaction of individuals within the social institutions like the family. The family in any society is the unit of production and as such the members participate in ASM to supplement their income. For instance, the researcher has observed in the mining communities in Kaduna State that there is no family that most of its members did not participate in ASM. Majority of the children were integrated into ASM from their childhood. This has affected their mind-set on farming and made them to emulate the occupation of their parents as they grow up in the mining communities of Kaduna State. Similarly, Radcliffe-Brown for instance refers to "a network of actually existing social relations", leaving the suggestion that change in what people actually do is important in the society (Ekong, 2010). This simply means that the farming and mining are significant sources of livelihoods to many rural dwellers for family sustenance. It changes overtime the farmers' ideas, norms, values, roles and social habits or the composition and organization of their society.

3.5 Conceptual Model

A conceptual model is a collection of interrelated concepts. It guides researchers to determine what to measure and what statistical relationships to look for. A conceptual model is used to limit the scope of the relevant data by focusing on specific variables and defining the specific viewpoint that the researcher will take in analyzing and interpreting the data, understanding the concepts and variables according to the given definitions, and building knowledge by validating or challenging theoretical assumptions (Trochim, 2006).

A conceptual model shows the relationships that exist among variables and most often they are depicted schematically and mathematically. It shows causal relationships between one variable and the other. Figure 1 presented a conceptual model of the inter-relationships among the variables of the study. The model consists of three columns.

The first column presented the socio-economic characteristics of farmers such as sex, age, level of education, marital status, household size, ownership of land and farming experience. Others include institutional variables like access to credit, membership of cooperatives and extension contacts. These variables are assumed to be associated with changes on the effect of participation in artisanal and small-scale mining. For instance, it is expected that the higher the number of years spent in farming, the higher the extent of participation in mining activities and consequently, the more damage it would cause to agricultural crops and farmlands. It is also expected that the lower the chance of a participating farmer to be a member of cooperatives, the lower chance he or she would

have access to credit to boost his or her output, income and standard of living and by implication, the likelihood that crude implements would also be used. The greater the number of years in mining communities, the higher the intensity of participation in ASM by farmers and consequently, the more damage to farm crops and the environment.

The second column indicated the dependent variables which are processes/methods the participating farmers used in ASM which were grouped into four activities as the minimum and sixteen activities as the maximum level of participation. These are Y_1 = dredging, trench digging, drilling and dipping. Y_2 = panning, sluicing, pounding and slicing. Y_3 = caving, scooping, mine ventilation and tailing. Y_4 = saltation, sieving, kiln (heating and drying) and weighing. These variables are affected by changes in the mining activities and its consequences on the output, income and standard of living of farmers as shown in Figure 1.

The third column focused on the observable effects caused by the independent and dependent variables. For instance, crop yield, damage to farmland/crops, crop output, level of income, standard of living, loss of lives, deforestation, land conflict, environmental pollution (air, land, noise and water), health, infrastructures, livelihood pattern and so forth. As such, this study is interested in both the positive and negative effect of participation in ASM on the output, income and standard of living of farmers in the communities where mining take place in Birnin-Gwari, Jema'a and Kajuru LGAs of Kaduna State.

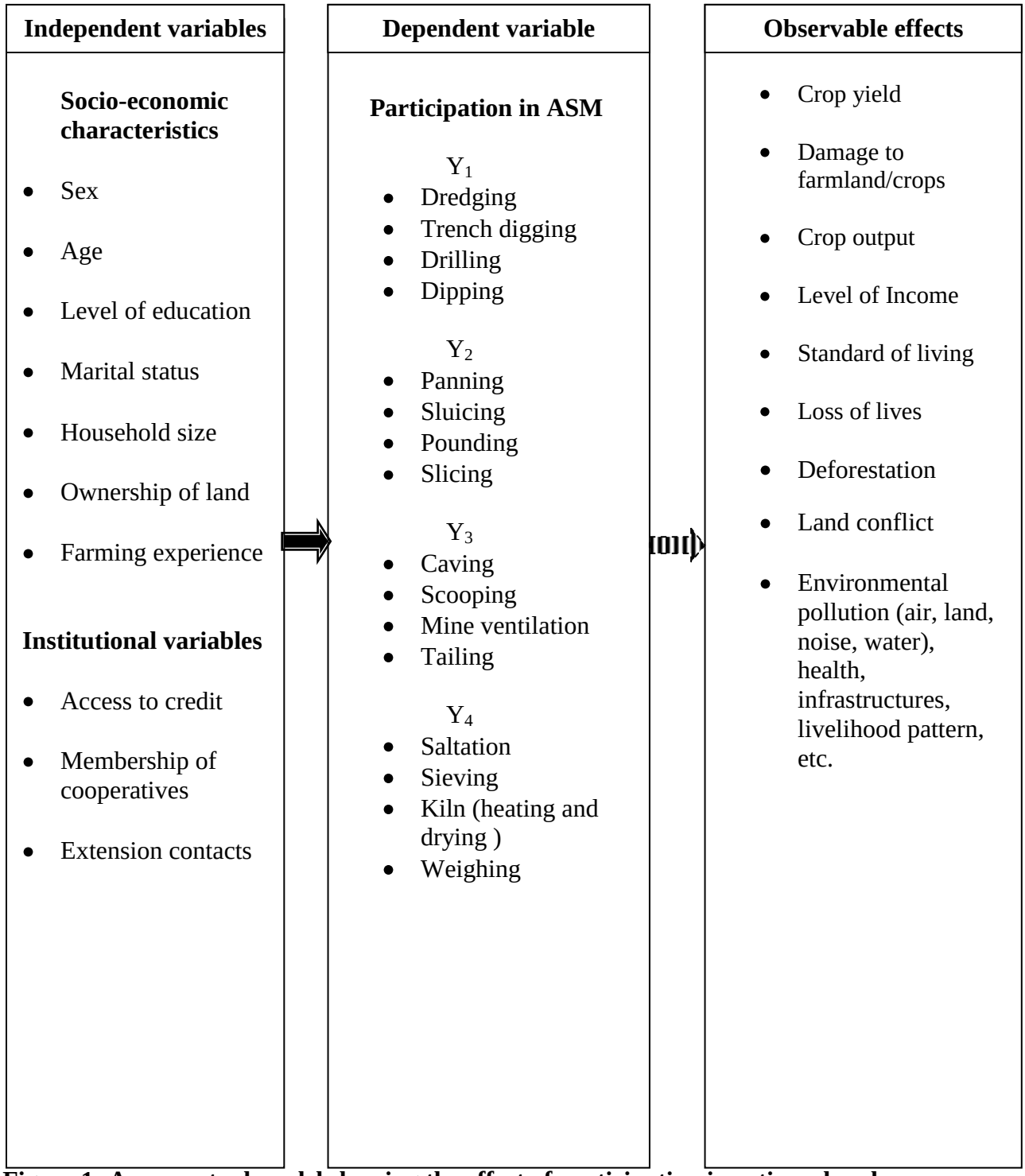


Figure 1: A conceptual model showing the effect of participation in artisanal and small-scale mining on the farmers' output, income and standard of living

CHAPTER FOUR

METHODOLOGY

4.1 The Study Area

The study was conducted in Kaduna State of Nigeria (Figure 2) showing the State and the maps of Birnin-Gwari, Jema'a and Kajuru Local Government Areas (Figures 3).

4.1.1 Kaduna State

Kaduna State is the first and last administrative headquarters of Northern Nigeria (1912 - 1966). The State is the successor to the old Northern Region of Nigeria which had its capital at Kaduna. Kaduna State evolved from Hausa language referring to many crocodiles (*kada*). On the 27th May, 1967, the Kaduna State became the capital of former North Central State (Invest in Kaduna State - Nigeria, 2014). The State was made up of the two colonial provinces of Zaria and Katsina. On the 17th March, 1976, when the General Murtala Mohammed administration created seven new States in Nigeria, the then North Central State, with its capital at Kaduna, was renamed Kaduna State. In 1987, after the creation of twenty-one States, Katsina Province became Katsina State, while the old Zaria Province became the new Kaduna State. Kaduna is one of the States that occupies the landmass of northern Nigeria and it shares borders with Zamfara, Katsina, Niger, Kano, Bauchi, Nasarawa, Plateau States, and the Federal Capital Territory to the South-West (Invest in Kaduna State - Nigeria, 2014; www.kadunastate.gov.ng).

Kaduna State is located between latitudes 9˚ 03¹N and 11˚ 32¹ north of the equator and longitudes 6˚ 05¹ and 8˚ 38¹ east of the Greenwich Meridian. The total land mass of the

State is estimated at 46,053 square kilometres, which is about 5% of the total land area of Nigeria. The State experiences a tropical continental climate with two distinct seasonal climates, dry and rainy seasons. The wet season (May - October) is heavier in the southern part of the State than in the northern part. There is mean annual rainfall in the southern part (in places like Kafanchan and Kagoro) with over 1,524mm while in the northern part (Makarfi, Ikara and environs) is about 1,016mm. This climatic pattern is suitable for the cultivation of subsistence and cash crops round the year, although dry season farming often needs to be complemented by irrigation. Kaduna State's topography is favourable for small, medium and large-scale farming and for tourism (www.kadunastate.gov.ng).

In 2006, the National Population Commission (NPC) estimated the population of the State at 6,066,562. Using 3.2% growth rate as allowed by the Commission, the projected population of Kaduna State stood at 8,054,896 (2015 projection). Kaduna State is the third most populous State in the country. About 2 million people live in the two towns of Kaduna and Zaria. The population is culturally very diverse with distinct differences in religion, ethnicity, traditions and social norms between the predominantly Hausa/Muslim population in the northern part of the State and Christians of a variety of ethnic groups to the south. The population is spread across 23 Local Government Areas, 11 federal constituencies and 255 political wards across the three senatorial zones (Invest in Kaduna State - Nigeria, 2014; www.kadunastate.gov.ng).

Economic growth in Kaduna State is centred on the sectors of agriculture, mining, manufacturing, education, commerce, and other support sectors in the State. Kaduna State contributes on average 3.3% of Nigeria's GDP and it is the third producer of maize, legume, gold, and other important minerals in the country (Invest in Kaduna State, 2014). The following mineral deposits can be found in Kaduna State, Muscovite, Granite, Gold, Manganese, Clay, Sand, Zircon, Kyanite, Sapphire, Kaoline, Surpentinite, Asbestos, Amethyst and Graphite (partially investigated). Others include Silhnite, Mica (traces), Rock Crystal, Topaz, Flosper, Tourmalime, Tentaline, Tin Ore, Limenite, Gemstone and Columbite (Uka, 2011; Mallo, 2012; Alhassan and Umar, 2013).

Birnin Gwari is a Local Government Area in Kaduna State, Nigeria with its headquarters in Birnin Gwari. The LGA has a landmass of 6,185 km² and a population of 252,363 estimated by the 2006 census, but with a projected population of 335,076 in 2015. Birnin Gwari LGA is located along Kaduna - Lagos Express way at about 125km from Kaduna. Birnin Gwari is located at 12 20 North and Longitude 9 10 East of Greenwich (Fadama Report, 2008). It lies in the western part of Kaduna State and shares boundaries with Zamfara State to the North, Kogo forest reserve of Kastina State to the East and North East of Giwa LGA and to the West Niger State (Kamuku Park Report, 2010).

The LGA has sixteen districts namely; Birnin Gwari central, Gayam, Bugai, Kutemeshi, Tabanni, Dogon Daa, Kakaangi, Randagi, Kzege, Kungi, Maganda, Saulawa, Saminaka, Gwaska, Bagoma and Kuyello. The crops grown in the area are maize, rice, wheat, groundnut and guinea corn. The people of Birnin Gwari are famous for being very

hospitable and accommodating and they are mostly farmers, herders, miners and traders. They have been enduring the bruises occasionally inflicted on them by cattle rustlers in the last five years.

Jema'a is one of the Local Government Areas in Kaduna State, Nigeria with headquarters at Kafanchan. It has an area of 1,661 km² and a population of 278,735 at the 2006 census with a projected population of 370,091 in 2015. Jema'a LGA is located between latitude 90 10' and 90 30'N and longitude 80 00' and 80 30'E. The LGA is bounded in the East by Kagoro in Kaura LGA, in the North by Zonkwa and Ungwar Rimi District of Zangon-Kataf LGA, in the West by Jaba LGA and in the South by Nasarawa State and in the South-East by Sanga LGA (Ishaya and Abaje, 2008).

Jema'a LGA has twelve wards, namely: Jagindi, Godogodo, Atuku, Gidan-Waya, Maigizo, Kaninkon, Kagoma, Asso, Kafanchan 'A', Kafanchan 'B', Bedde and Takau (Ishaya and Abaje, 2008). The area is has two distinct seasons namely; a wet season in summer and a dry season in winter. Rainfall occurs between the months of April to October with a peak in August. The mean annual rainfall is about 1800 mm, and the mean monthly temperature is 250C, while the relative humidity is about 62%. The orographic effects of the Jos - Plateau and the Kagoro Hills have positive influence on the climate influencing rainfall, temperature and relative humidity. Ferruginous tropical soil is the type of soil found in this LGA which is related to the climate, vegetation, lithology and the topography of the area (Ishaya and Abaje, 2008).

Kajuru LGA is another LGA of Kaduna State, Nigeria located on longitude 9° 59'N and 10° 55'N and latitude 7° 34'E and 8° 13'E with an area of 2,464 km^2. The LGA was carved out of Chikun LGA in March 1997 during the regime of Gen. Sani Abacha. At creation, the LGA was made up of two traditional districts which are Kajuru and Kufana. Additional districts were created bringing the number to 14 districts. The study area experiences high temperature all year round, which is a characteristic of the tropics. The mean daily temperature in the area can be as high as 34 °C between months of March and May. Temperature could be as low as 20 °C during the December to January. This low temperature is intensified by humidity due to dry harmattan wind (www.kadunastate.gov.ng).

The LGA shares boundaries with Igabi LGA to the north, Chikun LGA to the west, Kaura LGA to the east, Zangon Kataf and Kachia LGAs to the south-west and south respectively. The LGA has an estimated population of 110,868 in 2006, but with a projected population of 147,205 people. The major ethnic group is the Adara, others include Hausa, Fulani, Gbagyi, Yoruba, Igbo and Jaba among others. The three major religions namely Christianity, Islam and traditional in the country is practiced in Kajuru (www.kadunastate.gov.ng).

Kajuru LGA is an agrarian based with agriculture as its major economic activity which serves the bedrock of other activities such as food and cash crop production, livestock rearing, poultry trading and crafts making. The major system of farming practiced is the subsistence farming by peasant farmers with few people who invested in commercial

farming produces large quantity of agricultural products. A little dry season farming is practiced in the area by people living close to the rivers in the study area. Tomatoes, pepper, vegetables, onions, okro and sugar-cane are grown in the Fadama areas. These additional products attract traders from 1surrounding urban centres like Kachia, Kafanchan and Kaduna town thereby constituting the major source of their income (www.kadunastate.gov.ng).

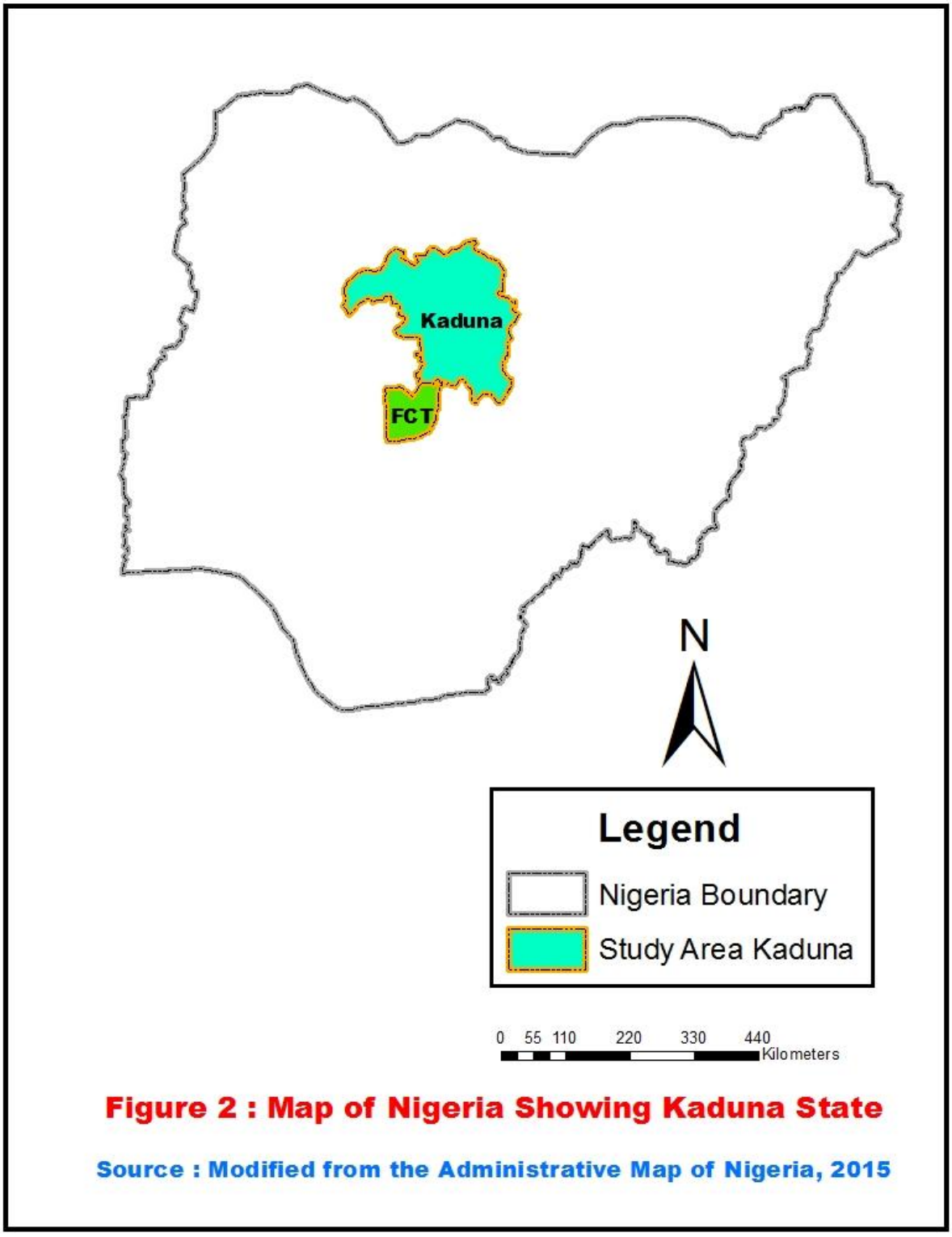


Figure 2 : Map of Nigeria Showing Kaduna State

Source : Modified from the Administrative Map of Nigeria, 2015

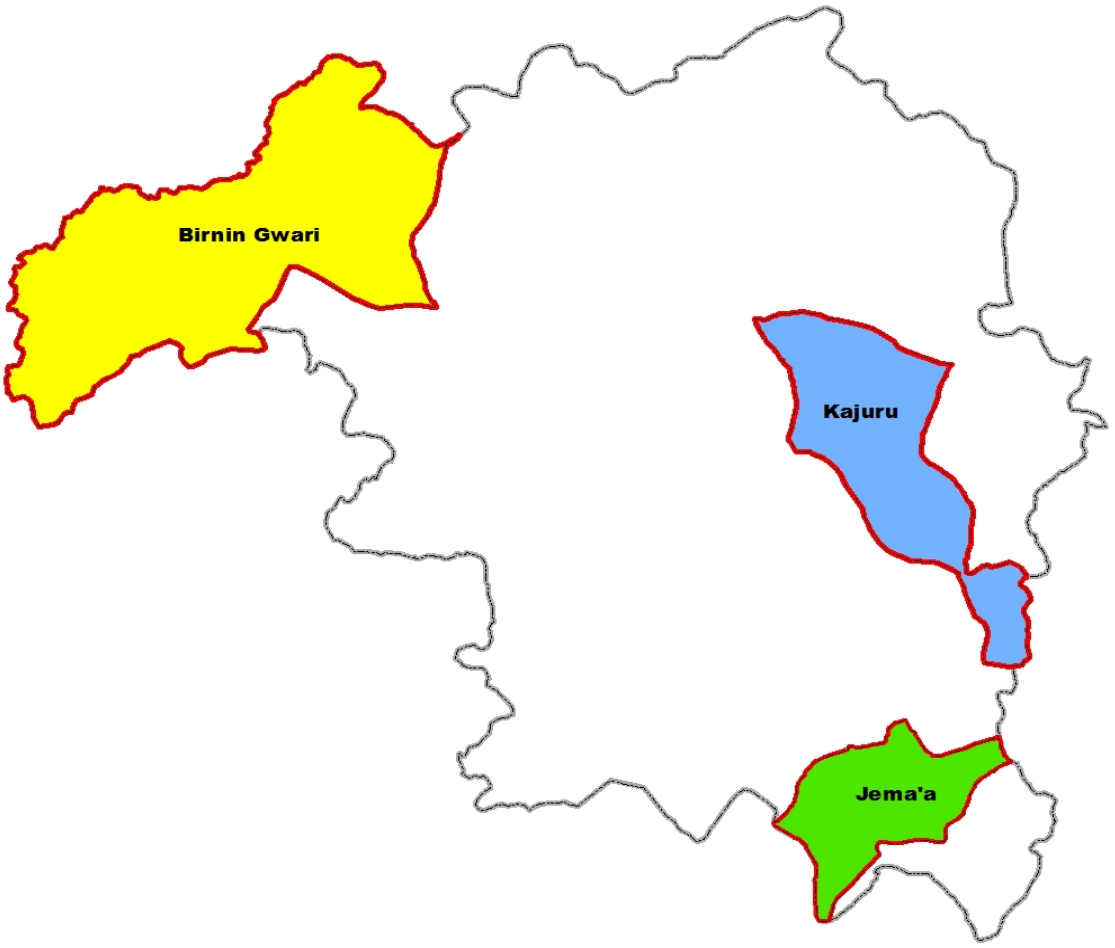


Figure 3 : Map of Kaduna State Showing Birnin Gwari, Jema'a and Kajuru LGAs

Source: Modified from the Administrative Map of Nigeria, 2015

4.2 Sampling Procedure and Sample Size

The target population for this study was male and female participating and non-participating farmers in ASM who reside in the mining communities during the survey. The rationale was that most of the rural dwellers combine small-scale mining, farming and other occupations. Kaduna State was chosen for data collection due to same situation in every State with abundance mineral resources deposit in the federation.

For the purpose of this study, a multi-stage sampling technique was used. In the first stage, Birnin-Gwari and Kajuru Local Government Areas were purposively selected from the Central Senatorial District while Jema'a LGA was purposively selected from the Southern Senatorial District of Kaduna State. The rationale for the selection of these LGAs from two Senatorial Districts was that most of the farmers participated in mining activities.

The second stage included purposively identifying three villages in each of the Local Government Areas where mining activities take place. That is, in Birnin-Gwari LGA, Yankan Dutse, Kakini and Janruwa ("Abuja") mining communities were purposively selected. In Jema'a LGA, Antang, Godo Godo and Nisama were also purposively selected. While, in Kajuru LGA, Maraban Kajuru, Kasuwan Magani and the ancient Kajuru town were also purposively selected. What informed the choice of these areas was that many farmers were actively participating in ASM to improve their output, income and standard of living in Kaduna State.

In the third stage, purposive sampling technique was employed in the selection of some major streets in each mining community.

In the fourth stage, systematic sampling technique was used to enumerate some houses for easy administration of questionnaire.

In the fifth stage, households enumerated in each street during the community survey were used to select the required number of respondents for each community as it is shown in Table 4.1. It means that the respondents were randomly selected in each household. The selection procedures are as follows:

A total of 381 respondents were sampled as the sample size from a sample frame of 1270 households. The procedure for the selection of the sample size of farmers was 30% for each mining community; however the number of respondents was disproportionately selected as shown in Table 4.1. The reason was that the population projected for each LGA and/or density of population as at 2015 was not the same.

Birnin Gwari LGA had 252,363 populations during the 2006 national census while the population projected stood at 335,076 in 2015. In Yankan Dutse mining community, out of a sample frame of 250 respondents, 30% was used to select 75 respondents as the sample size. In Janruwa ("Abuja") mining community, out of a sample frame of 150 respondents, 30% was equally used to select 45 respondents while in Kakini mining community, 30 respondents were randomly selected from a sample frame of 100 respondents.

According to NPC (2006) Jema'a LGA had a population of 278,735, while the population projected as at 2015 was 370,091. The same procedure was repeated for the selection of respondents in this LGA. That is, in Antang mining community, out of a sample frame of 195 respondents, 30% was used to select 59 respondents. In Godo Godo mining community, out of a sample frame of 300 respondents, 90 respondents were randomly selected while in Nisama mining community, 36 respondents out of a sample frame of 125 were equally randomly selected.

Kajuru LGA in 2006 stood at110, 868 with a population projected of 147,205 in 2015. In Maraban Kajuru mining community, out of a sample frame of 45, 30% was used to select 14 respondents. In Kasuwan Magani mining community, out of 30 respondents, 30% was used to select 9 respondents while in Kajuru mining community, 23 respondents were randomly selected from a sample frame of 75 respondents. During the rural appraisal in the mining communities, what the researcher had observed were also documented and used in analyzing the data.

As regards to the in-depth interview, the informants were purposively selected and the participants during the focus group discussion were also purposively selected in the study area. In each of the three LGAs: Birnin Gwari, Jema'a and Kajuru, the informants comprised of 2 community leaders, 2 participating farmers and 2 ex-miners. These informants were considered knowledgeable about the phenomenon of the study due to their experiences in the mining communities. It was a detailed one-on-one interview to collect additional relevant qualitative data from them (i.e. 6 informants x 3 LGAs = 18

informants) were interviewed on the problem of study. The 18 informants were not part of the 381 respondents sampled for questionnaire administration. Also, the in-depth interview guide was used to streamline the questions, which were directly deduced from the research objectives.

Three FGDs were conducted separately with group of farmers. The participants were purposively selected due to their experiences in the communities. That is, one FGD was conducted in each LGA. Birnin Gwari LGA had twelve (12), Jema'a had nine (9) and Kajuru eight had (8) participants. Each of the FGD session comprised of discussants with the same characteristics. This was done to enable the participants to freely express themselves and give valid information on the phenomenon of the study. The researcher moderated all the discussions while a research assistant took notes during all the interview sessions.

Table 4.1: Sample size of farmers selected in the mining communities of Kaduna State

S/No	LGA	Communities Selected	Sample Frame	Sample Size of Farmers (30%)
1.	Birnin Gwari	Yankan Dutse	250	75
		Janruwa ("Abuja")	150	45
		Kakini	100	30
2.	Jema'a	Antang	195	59
		Godo Godo	300	90
		Nisama	125	36
3.	Kajuru	Maraban Kajuru	45	14
		Kasuwan Magani	30	9
		Kajuru	75	23
	Total		**1270**	**381**

Source: Reconnaissance survey, 2015

4.3 Methods of Data Collection

4.3.1 Quantitative method

Primary data were collected directly from the respondents using structured questionnaire. The survey questionnaire was prepared and divided into thematic sections which covered the research objectives. First and foremost, a reconnaissance survey was carried out by the researcher to familiarize and conduct a pre-test on the population of the study in the mining communities. More importantly, each questionnaire was administered under a close-supervision of the researcher and three enumerators who were trained to assist the respondents in clarifying some questions that might be difficult to understand and they were guided on how to fill the questionnaire properly. The fieldwork lasted for about four weeks. The data generated from the respondents were validated and reliable.

Secondary information on participation in ASM and its effect on the output, income and standard of living of farmers were sourced from relevant literature such as local and foreign published and unpublished materials. Some of them were journals, books and internet sources as well as periodicals related to the phenomenon of study.

4.3.2 Qualitative method

In-depth interview was conducted with informants while focus group discussion was conducted with participants in each of the mining communities. This was personally done by the researcher. The responses generated from the IDI and FGD strengthened the quantitative data.

During the observation, camera was also used to snap some mining sites where the participating farmers were actively working and the methods and tools they used in processing mineral resources. Some abandoned mining pits as well as the damage they have caused to farmlands and its effect on the output, income and standard of living of farmers. Other areas of interest to the study included the type of house/hut the miners live, the place they wash the minerals, the type of water the rural dwellers drink and some infrastructural facilities were observed and snapped.

Participatory Rural Appraisal (PRA) was used since different people and groups within the mining communities have different perceptions and points of view. During the appraisal, it was important that a full-range of perspectives being considered as data were gathered. Thus, data were collected from the respondents who were older and younger, participating and non-participating farmers in ASM. The respondents were drawn from different socio-economic backgrounds, ethnic groups, educational backgrounds or professions who had experienced in ASM as insiders or outsiders.

4.4 Analytical Techniques

Descriptive and inferential statistical analyses were used. The qualitative data were transcribed from cellphone/midget and further contextualized in prose. The convergent and divergent views of the participating farmers were presented to strengthen the quantitative data. For the testing of hypotheses, correlation analysis was used. In addition, where necessary, relationships between one variable and the others were graphically presented.

4.4.1 Descriptive statistics

The study used bar charts, mean, pie-charts and standard deviation. They were used in analyzing objective (i) which described the socio-economic characteristics and institutional variables of farmers. It was used to achieve objective (iv) which described the strengths, weaknesses, opportunities and threats (SWOT) of ASM and objective (v) which also examined the strategies adopted by farmers to cope with the challenges of ASM in the mining communities. This is because descriptive statistics show a clear picture of these characteristics of the respondents.

4.4.2 Tobit regression model

This model was used to achieve objective (iii) of the study. The objective determined the effect of participation in ASM on the output, income and standard of living of farmers. The Tobit regression, a hybrid of the discrete and continuous dependent variables was used to determine the effect of the explanatory variables on the probability of participation in ASM. The empirical model is specified as follows:

$Y_i = 0$ if $Y^*_i < 0$

$Y_i = Y^*_i$ if $Y^*_i >= 0$

$$Y^*_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + e$$

$i = 1, 2\ldots\ldots\ldots\ldots 10$

Where:

Y_i = participation in artisanal and small-scale mining by farmers (This was measured by the quantity of assets possessed by farmers in the mining communities).

Y_i^*= unobserved participation in ASM by farmers ([$(Z\text{-}Ii)/Z$])

Z = level of adoption

e_i = truncated error term

β_0 = intercept term

$\beta_1 \ldots \beta_{11}$ = slope coefficients

x_{1i} = sex (male or female)

x_{2i} = age (years)

x_{3i} = level of education (years)

x_{4i} = marital status (married, single, divorced, widowed, separated)

x_{5i} = household size (number of people)

x_{6i} = ownership of land (owned, not owned)

x_{7i} = farming experience (years)

x_{8i} = access to credit (accessible, not accessible)

x_{9i} = membership of cooperatives (members, non-members)

x_{10i} = extension contacts (number of visits per annum)

4.4.3 Z-test statistic: The Z-test statistic was used to achieve hypotheses (i), (ii) and (iii) of the study. The Z-test was used to test the hypotheses because it is recommended that when a sample size is large and the Z distribution is closed to normal distribution, therefore the sample size will increase beyond 30 (i.e. n>30). The a priori level of significance for the null hypotheses (H_O) was 0.10%. The Z-test is statistically represented as:

$$Z = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\frac{S_1}{n_1} + \frac{S_2}{n_2}}}$$

Where z = calculated z value

$\overline{X}_1$ = mean value of the output, income and standard of living of participating farmers in ASM.

$\overline{X}_2$ = mean value of non-participants' in ASM.

S_1 = standard deviation of participants' output, income and standard of living.

S_2 = standard deviation of non-participants' in ASM.

n_1 = sample size of the output, income and standard of living of participating farmers in ASM.

n_2 = sample size of non-participants' in ASM.

4.4.4 Likert scale

Likert scale was used with categories such as very effective = 5, effective = 4, less effective = 3, not effective = 2; undecided = 1. It was used to achieve objective (ii) of the study which examined the perception of farmers on government policies on ASM.

Perception Index = $\frac{\Sigma\ (n)}{N}$ ……………………………………..….……. (3)

Where: n = perception score

N = total number of perception statement

4.5 Definitions and Measurements of Variables

4.5.1 Independent variables

Sex (X_1): This is a variable which specifies whether a person is a male or a female in the society. Sex is biological rather than social. The sex of a farmer is a determinant for his or her participation in ASM in the mining communities. It was measured using male = 2, female = 1.

Age (X_2): This is the length of years a respondent had lived on earth. Thus, it is expected that the members of a community who had attained the age of 18 - 45 years on the average is economically active and thus, contribute to rural development. Age was measured in years as reported by the respondents during the survey.

Level of education (X_3): The level of educational attainment of a respondent was measured by the total number of years of schooling. Education is a learning process from the day one is born to the day he or she dies. Education affects the level of participation of respondents in ASM in the study area. That is, the more educated a farmer is, the less his or her level of participation in mining activities and the less educated a farmer is, the more likely he or she would participate in ASM as a livelihood strategy. Education was sought to find out the level of literacy of the farmers in the mining communities using tertiary = 3, secondary = 2, primary = 1, no schooling = 0.

Marital status (X_4): This refers to the recognition of an individual after he or she has gotten married in the society. The more the duration of stay in the mining communities by farmers, the likelihood that their participation, social relationships and nature of occupation would make them to marry amongst themselves. This variable was measured as whether or not a respondent has ever gotten married as a result of his or her participation in ASM using married = 5, single = 4, divorced = 3, widowed = 2, separated = 1.

Household size (X_5): This is an important source of family labour most especially in farming communities. That is, the size of a household is a determinant of labour mobilization and thus their participation in ASM. For example, this variable was measured by the number of people in a household whether they were participants or non-participants of ASM. It comprised of parents, children, grandparents, grandchildren and dependants' in the household of respondents. This agrees with the definitions of Bekele and Mekonnen (2010) and that of Akinola and Owombo (2012). According to these researchers household size is the number of persons that live under the same roof. A large household size working on the farm reduces the farms' external labour requirements. Norman (1972) also held similar view when he refers to a household size as the number of people eating from the same pot. This implies that the consumption unit is also the production unit in the rural areas.

Ownership of land (X_6): This refers to the hectare of land a respondent had as a result of participation in ASM during the survey. Ownership of land was also measured in hectares (ha). That is, it was measured using owned = 1, not owned = 0.

Farming experience (X_7): This refers to the number of years a farmer had spent participating in ASM in the mining communities. This variable was measured in years. According to Godoy, Kirby and Wikkie (2001) and Clay, Kelly, Mpyisi and Reardon (2002) farming experience is measured in number of years, that is, the year a respondent started farming on his or her own. Experience of the farmer is likely to have a range of influences on adoption. Experience will improve the skills of farmers in production operations. Farmers with higher experience appear to have full information and better knowledge and are able to evaluate the advantage of a technology.

Access to credit (X_8): This means whether or not the respondents could access credit or not from formal or informal sources in the mining communities. This was measured using accessible = 1, not accessible = 0.

Membership of cooperatives (X_9): This refers to the social group a respondent belonged to in the mining community. This variable was measured by the number of years a respondent had spent as a member of a cooperative group.

Extension contacts (X_{10}): This is the contacts the farmers had with extension agents as they participate in ASM. This is also to ascertain the actual number of visits to the mining communities by extension agents. It was measured using the number of

visits/contacts. Several studies (Kidane, 2001; Owombo, Akinola, Ayodele and Koledoye, 2011) indicated that extension visits refer to the number of contacts farmers had with extension agents to take advice in last cropping season. Therefore, extension contact is expected to have a positive influence on the farmers' investment decision on soil conservation technologies. It is believed that frequent contacts enhance the exposure of farmers to improved production package.

4.5.2 Dependent variable

Participation in ASM: In this study, participation referred to the extent of involvement in ASM by the respondents. That is, it is the process through which all or most members are involved in and have influence on decisions related to developmental activities that affect them in the mining communities. This variable was measured using sixteen activities = 4, twelve activities = 3, eight activities = 2, four activities = 1. That is, the minimum level of participation by a respondent in ASM was 4 while 16 was the maximum. The intensity of participation in ASM showed that it was the primary occupation of the respondents whereas, the non-participants engaged in other occupations like farming, hunting, trading, and tailoring among others. Tobit regression model was used to determine the relationship between the dependent variable (participation) and effect analyzed. According to Owombo *et al*. (2011) the measurement of wealth comprising value of livestock, off-farm income and credit access that could be used either in the production process or exchanged for cash or other productive assets.

4.5.3 Observable effects

Crop yield: This is the total crop output in kilogrammes produced by the farmers at the end of the growing season divided in kilogrammes by the total hectares of land under production. This variable was measured using 100 kilogramme of bags divided by the total hectares of land in the last rainy season.

Damage to farmland/crops: This is the damage caused by mining activities on the crops and farmlands of farmers. This was measured using damaged = 1 (i.e. if farmland/crops was damaged) or not damaged = 0 (i.e. if not affected).

Crop output: It is referred to the total quantity of crops that farmers produced in the last season such as maize, sorghum, groundnut, wheat and cassava among others. It was determined by whether or not the crops of the respondents had increased or decreased in a year. This variable was measured in kilogramme. That is, a bag produced by a farmer in the previous year (i.e. 2014) was calculated as 100 kilogrammes.

Level of income: This was computed as the amount of money realized from agricultural activities in the mining communities by farmers. This variable was measured in naira (₦) and kobo (K).

Standard of living: This refers to the relative quality of life of a household in the mining communities. It was assumed that participation in ASM enhances better life chances and standard of living of the participating farmers. Measuring a household standard of living with precision is very difficult as people's perceptions differ in the society. However, the

material possessions (assets) of the participants as well as their general expenditure were used as indicators to measure the standard of living in the study area. It means that any farmer whose value of assets included both landed and movable properties like houses, farmlands, plots of land, livestock, poultry, television set, radio, car, motorcycle, bicycle, among others or the value of asset equivalent to an average (and above) was scored high. However, a farmer whose total value of assets was less than an average was scored low.

Loss of lives: This refers to the death of participating farmers or animals or unlucky persons as a result of participation in ASM. This was measured in terms of whether or not a respondent had ever lost a family member, friend or co-worker. It was measured using loss = 1, not loss = 0.

Deforestation: This is the cutting down of trees as a result of ASM activities by the participating farmers. This variable was measured using affected = 1, not affected = 0. This agrees with the World Bank (2015) report which stated that in Nigeria, 3.67% accounted for annual deforestation between 2000 and 2010.

Land conflict: This refers to the misunderstanding that usually occurs between farmers and miners or among either the participating and non-participating farmers mainly due to ownership of land or land tenure system in the mining communities. It will was measured using conflict = 1, no conflict = 0. This is in tandem with Baba's (1987) observation. According to him, farmers are regarded as those who own the land and therefore they determine how it is used in the society.

Environmental pollution: This is the extent to which pollution had affected the rural dwellers where ASM take place. Pollution here can take the form of air, land, noise and water in the study area. This variable was measured using pollution = 1 if respondents experienced noise, air or water pollution from participation in ASM and no pollution = 0 if not affected by the pollution of mining activities.

CHAPTER FIVE

RESULTS AND DISCUSSION

5.1 Description of Socio-economic Characteristics of Farmers

5.1.1 Sex

The sex distribution as presented in Figure 4 showed that 68% were male while 32% were female respondents in the study area. This shows that majority of the respondents who participated in this research were males. The sex implication, as the study clearly revealed, the male respondents were still the dominant figures than their female counter-parts in mining activities. The field observation revealed that few women participated actively in mining but some of them were liberated to do so because they were widows, divorcees or separated from their husbands. Those women whose husbands were alive because of religious factor particularly in Birnin Gwari LGA and ancient town of Kajuru mining communities were in "purdah" (seclusion i.e. the condition being cut-off from others or from other places). This attitude is not unconnected with the culture of patriarchal practice in Nigerian society. This study agrees with the findings of Yunana and Banta (2014) who found that 81.44% of the respondents were men as opposed to 18.56% female respondents in Antang District of Kaduna State, Nigeria. This study further supported that of Mwaipopo *et al.* (2004) study in Mabuki, Mgusu and Nyarugusu communities in Tanzania. According to these researchers, men were more involved in Artisanal and Small-Scale Mining (ASM) than their female counter-parts who also find employment in mining-related activities.

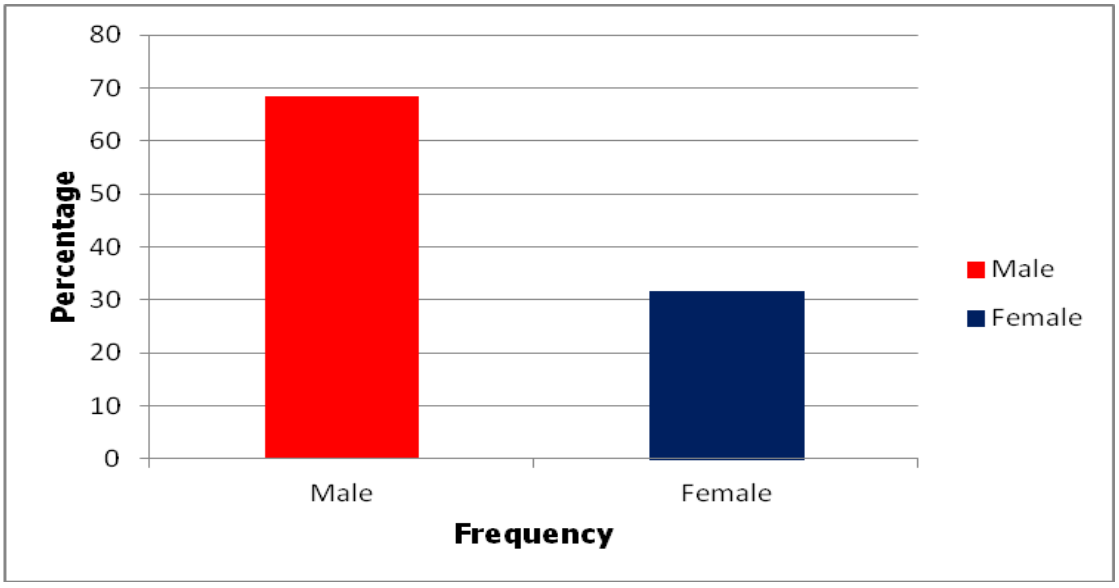


Figure 4: Distribution of respondents based on sex

The results as presented in Figure 5 showed that 32% of the respondents were in the age bracket of 20 and 25 years while 9% were aged between 51 and 60 years. This shows that the mean age of the respondents was 30 years and their age revealed that the respondents between 20 and 25 years were agile and in their reproductive age; hence the active participation in both farming and ASM as primary occupations. This implies that farming was carried out by energetic rural dwellers to safeguard their farmlands from being destroyed by miners. The findings of this study is in agreement with a study of artisanal and small-scale mining conducted in Totororo Southern Zimbabwe by Mabena (2012) who found that most of the artisan miners were aged between 17 and 35years. However, this study also disagrees with that of Ezeaku (2011) who stated that the average age of farmers who participated in mining in selected areas of Nasarawa State was 35 years. The study further disagrees with a study conducted by Yunana and Banta (2014) in Jema'a LGA of Kaduna State, Nigeria that adults between the ages of 55 - 65

years participated in ASM while the least age group according to these researchers stood at 15 - 25years.

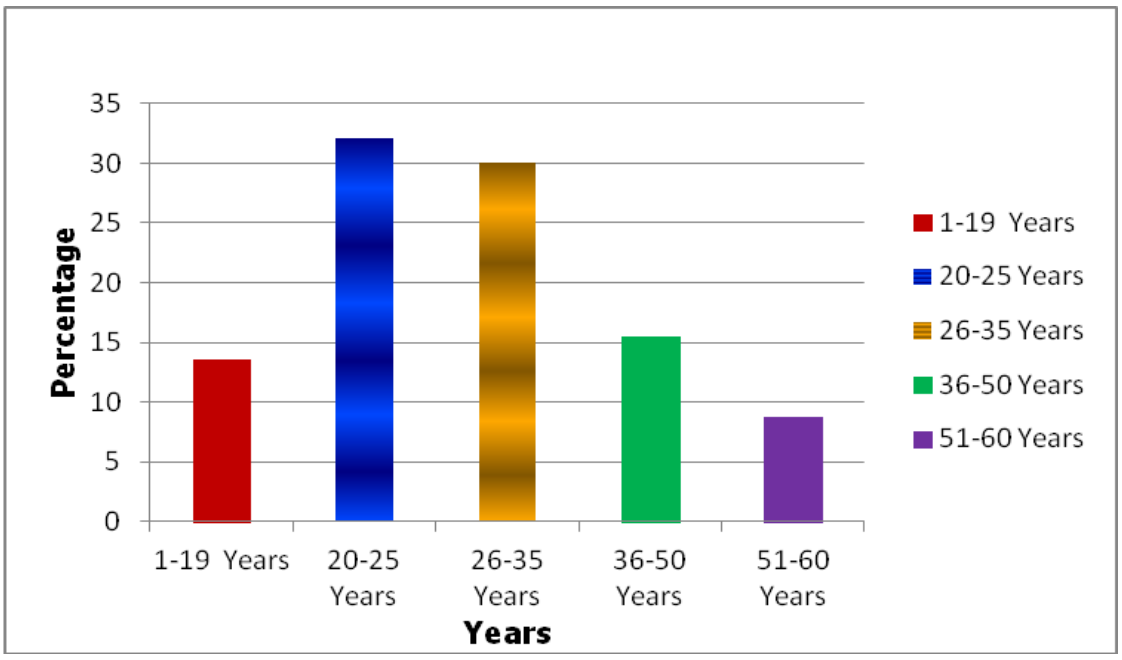


Figure 5: Distribution of respondents based on age

The results as presented in Table 5.1 revealed that 35% of the respondents had acquired secondary education, while 13% were holders of tertiary certificates. This means that majority of the respondents were holders of secondary school certificates and that the respondents had low level of educational backgrounds. This agrees with Hilson (2002b) who described the educational attainment of respondents in developing countries as low. The finding of this study was also in line with the result of Yunana and Banta (2014) who maintained that the literacy level among respondents in Antang's district was low and that of Mwaipopo *et al*. (2004) in a survey in Tanzania. According to these researchers, about 14.6% members of household they studied across three villages

(Mabuki, Mgusu and Nyarugusu) revealed that the respondents had low educational backgrounds.

An IDI with the *Dagacin* (Ward Head) of Nisama confirmed this when he noted that ASM has negatively affected his education in the past when he was young but he was overwhelmed that his children were in schools at the time of the survey. But observation showed that majority of the child miners in Kakini and Yankan Dutse communities hardly attend any formal school due to their active participation in mining.

The survey of Mwaipopo *et al.* (2004) in Mgusu Primary School of Tanzania contradicted the view of the *Dagacin* (Ward Head) of Nisama. This was because the Head teacher stated that his pupils' participation in mining had no negative effects on their performance in school.

Table 5.1: Level of education of the respondents

Level of Education	**Frequency**	**Percentage**
Non-formal education	110	31
Primary education	77	21.7
Secondary education	123	34.6
Tertiary education	45	12.7
Total	**355**	**100**

The results as presented in Figure 6 showed that significant proportions (75%) of the respondents were married while 23% were single. This signifies that majority of the respondents were married in the mining communities. The scenario in some mining

communities showed that majority of the respondents irrespective of their religious affiliations practiced polygamous type of marriage (i.e. a man married to more than one wife). It appears that the longer the duration of stay in mining communities, the more likelihood the respondents would marry more wives. An observation further revealed that the standard of living of farmers had improved tremendously because an overwhelming proportion combined both farming and mining to complement their level of income. The result of this study is in tandem with what Yunana and Banta (2014) obtained in a study in Antang District of Jema'a LGA, where they found that 88.7% of the respondents were married. A farmer in Godo Godo village expressed his ordeal and maintained that some successful men among them who combined farming and mining had developed the attitude of snatching other men's wives who were unsuccessful. According to him, the women should also be blamed for abandoning their husbands due to greediness and the desire to live in luxury in rural area.

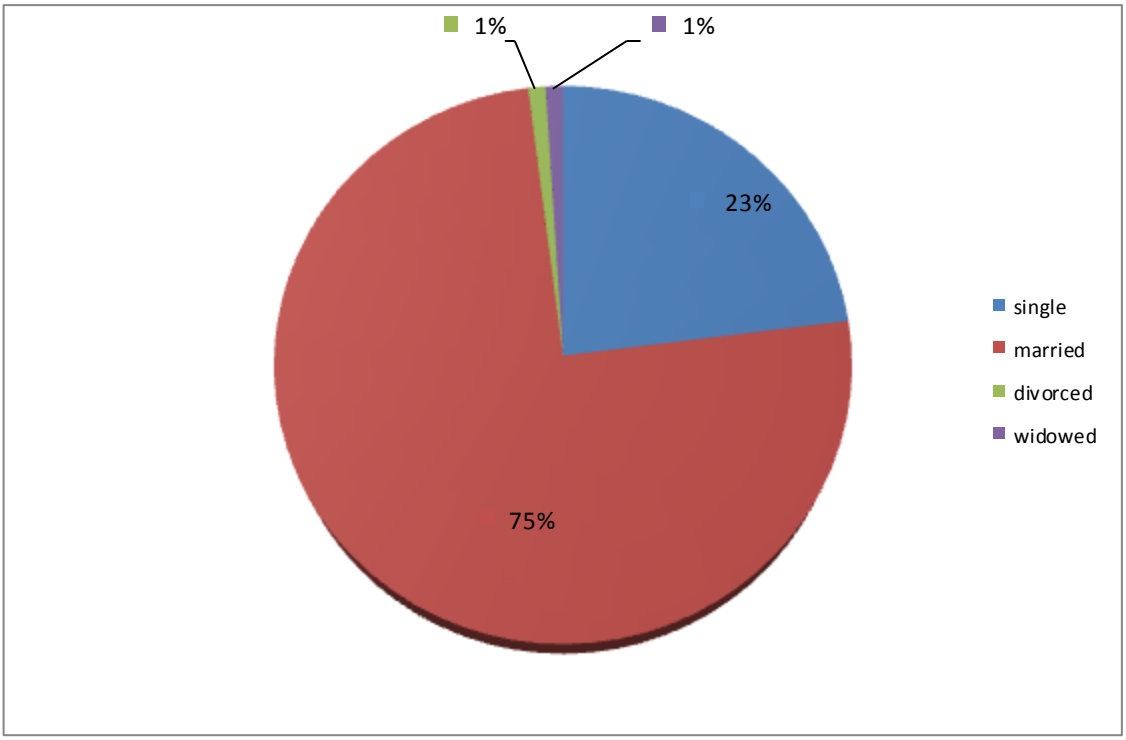


Figure 6: Distribution of respondents based on marital status

The results as presented in Table 5.2 indicated that many (51%) of the respondents had between 1 and 5 members in their households while 9% had between 11 and 15 household size. This shows that majority of the respondents had a fairly large size of family with a mean of 6 members in the study area. This disagrees with the findings of Ezeaku (2011) who reported that the average number of household was 8. This implies that the higher the family size, the greater the chances of participation in ASM by farmers.

Table 5.2: Distribution of household size of the respondents

Household Size	Frequency	Percentage
1-5	182	51.3
6-10	143	40.2
11-15	30	8.5
Total	**355**	**100**
Min	**1**	
Max	**15**	
Mean	**6**	
S.E.	**0.17**	

As regards to ownership of land, the results of this study as presented in Figure 7 showed that 75% of the respondents answered in affirmative that they owned land while 25% answered in the negative. This shows that majority of the respondents owned land in the mining communities. Thus, land conflicts were settled through negotiations between the parties involved. An in-depth interview with a farmer in Antang village revealed that:

> *Mine sites are acquired from farm owners whenever the participating farmers find prospects of solid minerals such as tin (kuza) or sapphire (kwaranda) underneath our farmlands. Sometimes, the miners would completely buy from the owners at the rate of ₦2, 000.00 or ₦3, 000.00 for every narrow hole dug, while the big ones attracted extra charges of about ₦5, 000.00 or ₦6, 000.00 or pay according to the utilization of the farmland. Sometimes, certain portion of the minerals is given as compensation to us. We don't usually quarrel among ourselves because we understand ourselves (sic). Nobody takes another person's farmland without his or her consent in this community.*

A similar scenario was expressed by the *Dagacin* (Ward Head) of Nisama village - a participating farmer and one time a miner. He pointed out that:

Dispute over land is not too common because Nisama village has arable land for farming in the whole of Godo Godo chiefdom. The only problem we are facing is that some successful artisans are snatching the unsuccessful husband's wives because they have made it in life. Poverty is ejecting those women from their husbands' homes because of long throats.

This result is in accordance with the study of Woods (2009). Woods' holds that traditionally, the class structure of rural society was based on property relations. That is, the ownership of land brought not just status, but also power relations in a rural economy based on the exploitation of land, through agriculture, forestry, mining and quarrying.

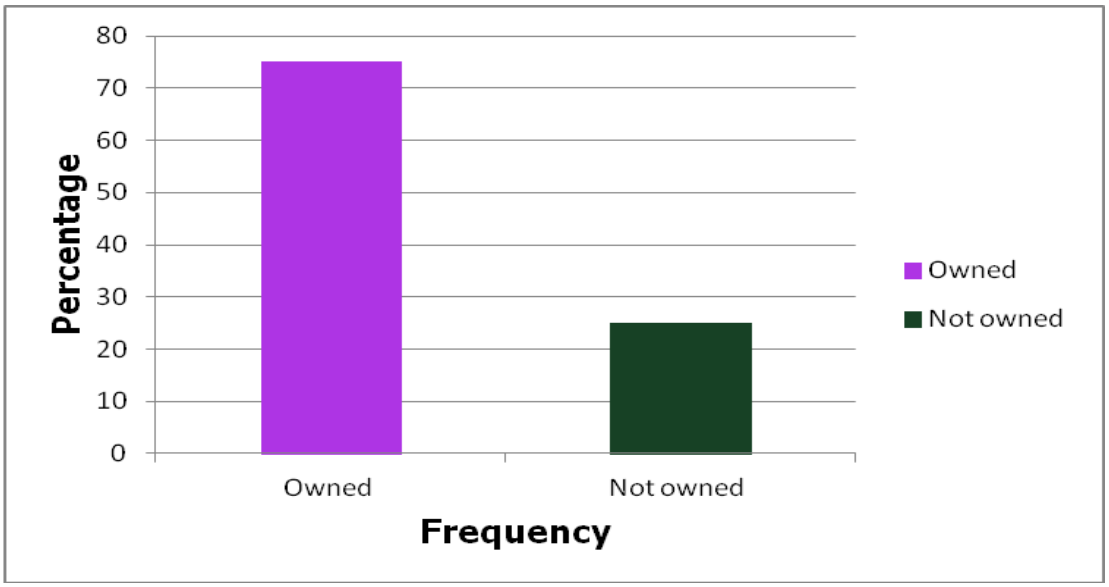


Figure 7: Distribution of respondents according to ownership of land

The results as presented in Figure 8 showed that 20% each of the respondents had farming experience of about 11 - 15years, 16 - 20 years and 21 - 25 years respectively while 7% of the respondents had farming experience of about 6 - 10 years. This indicated that majority of the respondents had 17 years mean farming experience in spite of the fact that some of them were engaged in mining activities. The findings of this study agrees with that of Yunana and Banta (2014) who stated that 67% of the respondents in a

study conducted had over 20 years' experience in farming in Antang District of Jema'a LGA of Kaduna State.

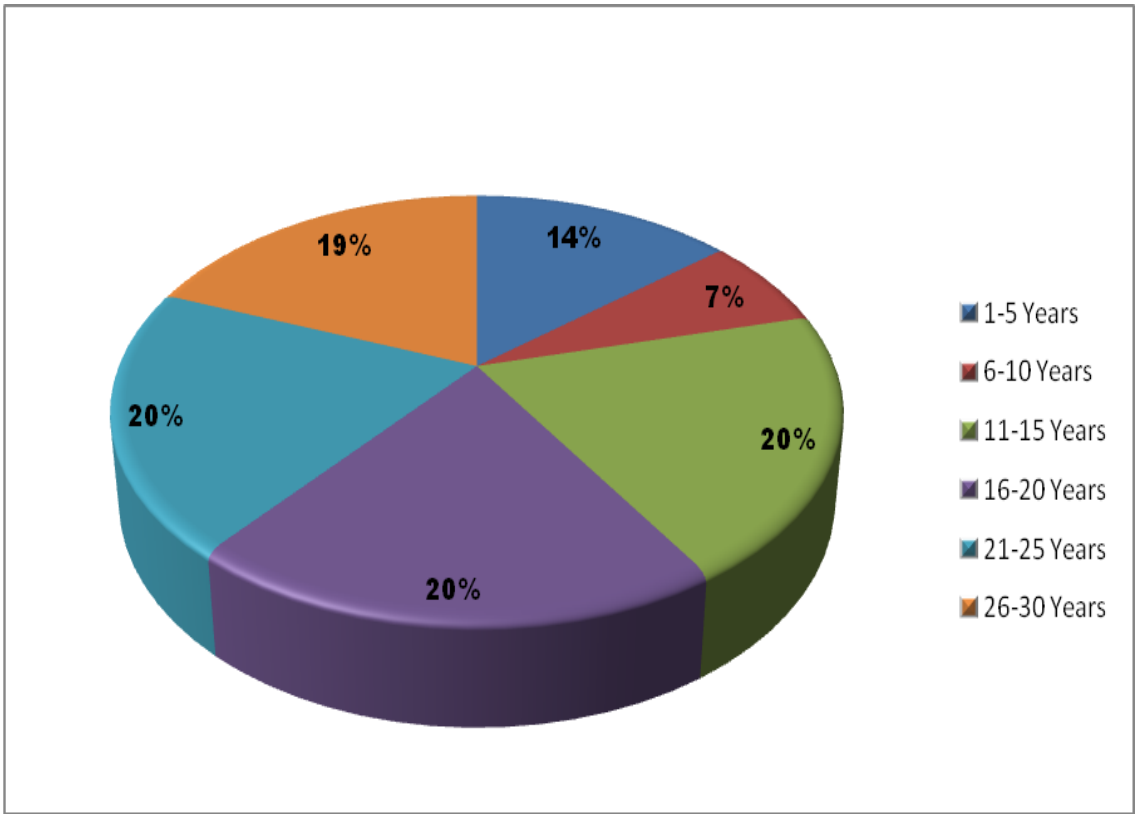


Figure 8: Distribution of farming experience of the respondents

The results as indicated in Figure 9 showed the distribution of respondents' based on access to credit. The findings showed that many (67%) of the respondents did not have access to credit while 34% said that they had access. One can infer that a significant number of the respondents did not have access to credit in the study area. Although Ekong (2010) stressed the importance of credit facility to farmers and maintained that it is a strong factor for efficiency of an enterprise in the society.

This finding is in tandem with the views expressed by discussants during an FGD in Godo Godo and Antang communities. According to the participants, the government and non-governmental organizations did not assist them with loans to boost their productivity in the informal sector.

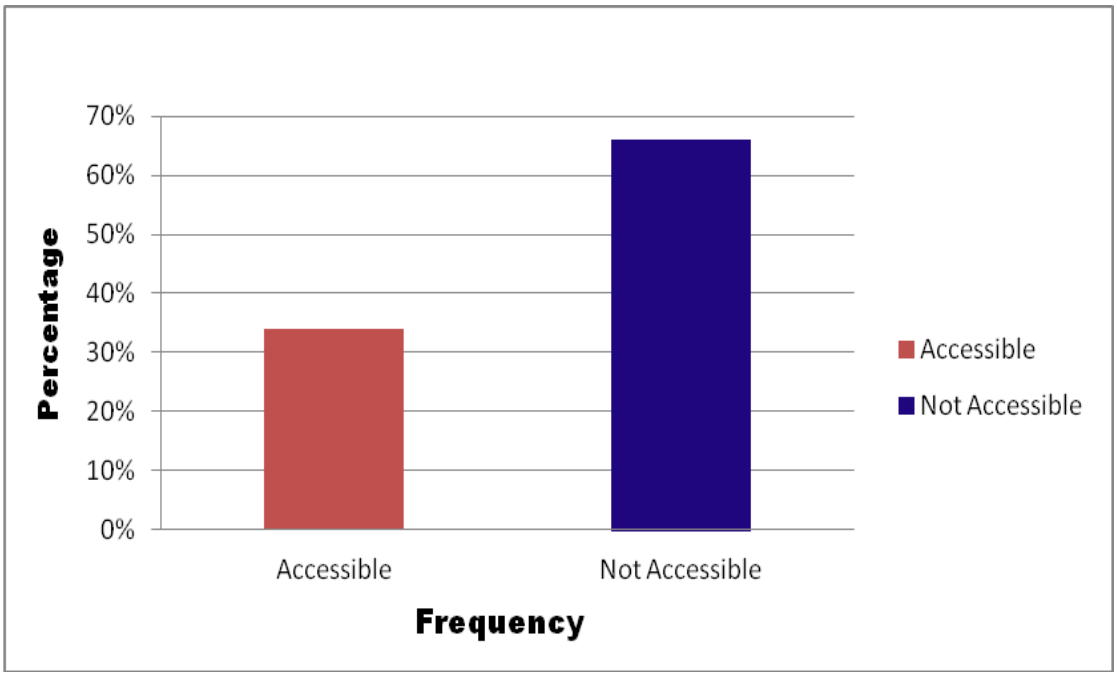


Figure 9: Distribution of respondents based on access to credit

The study went further to find out the membership of cooperatives that the respondents' belonged to. The results presented in Figure 10 revealed that majority (79%) of the respondents answered in negative while 21% answered in the affirmative. This shows that the average years the respondents had spent as members of cooperatives was 3 years although significant proportions were not members of cooperatives. The implication is that respondents were ignorant about the benefits they can derive from participating in association as a social group. It appears that when farmers work as a team they tend to benefits more in rural communities.

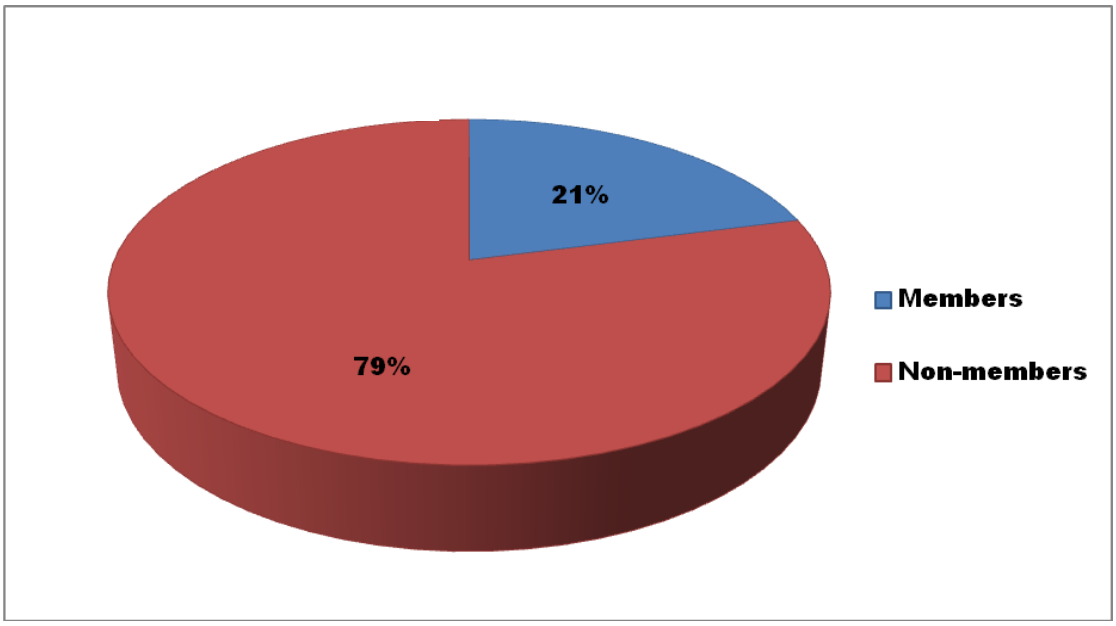


Figure 10: Distribution of respondents based on membership of cooperatives

The results as presented in Table 5.3 indicated the distribution of access to extension contacts by respondents. The findings showed that majority (64%) had access to extension contacts of about 6 - 10 times while 0.3% of the respondents had extension visits of more than ten times. This is an indication that a significant proportion of the respondents had a mean of 6 times access to extension contacts. This shows that majority of the rural dwellers were aware of the roles of village extension workers and they were fortunate to have access to them.

Table 5.3: Distribution of extension contacts by the respondents

Extention Contacts	**Frequency**	**Percentage**
1 - 5 times	127	35.8
6 - 10 times	227	63.9
> 10 times	1	0.3
Total	**355**	**100**

5.2 Perception of Farmers on Government Policies on Artisanal and Small-Scale Mining (ASM)

This section examines the perception of government policies on artisanal and small-scale mining by respondents. The results as presented in Table 5.4 showed that overwhelming proportions (93%) of the respondents were aware of the policies on ASM while 7% were not. This shows that the respondents were aware of government policies on ASM in Kaduna State. The implication of this result is that these mining laws were not executed in the mining communities.

The study further probed for more information about the participation of respondents in the formulation of policies on ASM. The results in Table 5.4 showed that 58% were not involved in policies formulation while 42% of the respondents said that they were involved. These results showed that majority of the respondents were not involved in the formulation of policies on ASM. The implication is that affected farmers were not involved in policies formulation hence their own decisions were not taken into consideration. Development is supposed to be people-centred and the rural dwellers felt-needs are expected to be heard whenever decisions that affected their lives are taken. This would enhance the development of the mining communities in Kaduna State.

As regard to whether or not the policies on ASM were properly enforced, a reasonable proportion (80%) of the respondents answered in the negative while 20% answered in affirmative. This implies that majority of the respondents did not agree that policies on ASM were properly enforced. The implication is that if the mining regulations were properly enforced the miners would not have been operating without license and by

extension there would also be land rehabilitation and reclamation in the mining communities because of its adverse effect on agricultural activities.

Table 5.4: Awareness, involvement and enforcement of government policies on ASM by the respondents

Option	Frequency	Percentage
Awareness of policies on ASM		
Aware	329	92.7
Not aware	26	7.3
n = 355		
Involvement in policy formulation		
Involved	150	42.3
Not involved	205	57.7
n = 355		
Policy enforcement		
Enforced	71	20.0
Not enforced	284	80.0
Total	**355**	**100**

The effectiveness of government policies on ASM was sought from the respondents. The results as presented in Table 5.5 showed that many (59%) of the respondents said that it was not effective while 4% indicated that it was effective. From these results, one can infer that majority of respondents perceived the policies of the government on mining activities as not effective because of its non-existence in Kaduna State. The finding of this study agrees with that of Onoja (2013) who noted that the Nigerian government and international agencies often see the mining sector as only a threat and ineffective,

although it could be a source of sustainable livelihoods for millions of marginalized people.

Table 5.5: Views of respondents on the effectiveness of policies on ASM (n=355)

Effectiveness of Policy	Frequency	Percentage
Very effective	17	4.8
Effective	13	3.7
Not effective	211	59.4
Less effective	85	23.9
Undecided	29	8.2
Total	**355**	**100**

5.3 Effect of Participation in ASM on the Output, Income and Standard of Living of Farmers

5.3.1 Effect of participation in ASM on the output of farmers

The Tobit regression model was used to estimate the parameters of effect of participation in artisanal and small-scale mining on the output of farmers. From the maximum likelihood estimates of the Tobit regression, the results showed that the model fits the data reasonably. For example, the (maximum likelihood) estimates maximize the log likelihood functions. This implies that among all the possible regression lines, the coefficients of this regression line maximizes the joint probability (likelihood) of observing the *n* sample values of the effect of participating in ASM on the farmers' output. This indicates that variation in output is explained by the (maximum likelihood) estimates of the selected explanatory variables, suggesting that the model as specified has explained that there is a significant non-zero variation on the effect of participation in artisanal and small-scale

mining among the respondents. Furthermore, the Pseudo R-square (coefficient of determination) is 0.65, suggesting that the model has a good fit to the data. This shows that 65% variation in effect of participation in ASM on the farmers' output is explained by variations in the specified explanatory variables. This suggests that the model has a good explanatory power on the changes in output among the respondents with 95% level of confidence.

The results as presented in Table 5.6 showed the parameters used in measuring the goodness of fit of estimated Tobit regression model. Nine variables sex, age, education, household size, land ownership, farming experience, access to credit, membership of cooperatives and extension contacts were analyzed and four of these variables namely; sex, household size, farming experience and membership of cooperatives were found to be significant at ($P \leq 0.01$) while age as the fifth variable was significant at ($P \leq 0.10$) as indicated with asterisk signs in Table 5.6. However, the education, land ownership, access to credit and extension contacts of the respondents was insignificant.

The estimated coefficient of sex (-30.873) showed an inverse effect with participation in artisanal and small-scale mining on the output of farmers and it was significant at ($P \leq 0.01$) level of probability. Due to many socio-cultural values and norms, the male respondents' had freedom of mobility and participation in different extension programmes and consequently had greater access to agricultural information. This invariably led to better output. However, Doss and Morris (2001) in a study on factors influencing improved maize technology adoption in Ghana indicated that there was insignificant effect of gender on adoption.

The estimated coefficient of age (-0.826) was negative and significant with participation in artisanal and small-scale mining on the farmers' output at ($P \leq 0.10$) level of probability. The negative effect of age could be expected as a result of the fact that when farmers grow old, there is tendency that their level of participation in ASM will reduce as their ability to cope with various farm operations diminishing. This is in tandem with Schellekens (2013) who reported that China old-age dependency ratio is expected to double in the next two decades, as obtainable in Norway and the Netherlands by 2030.

Household size revealed a positive and significant effect with participation in artisanal and small-scale mining on the output of farmers in the study area. The value was significant at 5% level of probability. This implies that when a unit increases in household size, there is also an increase in the output of participating farmers in ASM activities. Household size has been recognized (Bamire, Fabiyi and Manyong, 2002) to play a vital role in the participation and adoption of any particular technology or farm practice. On the one hand, family provides the human labour and management inputs for both farming and mining activities. On the other hand, household size has an effect at encouraging farmers to improve their earning capacity because some family members would tolerate certain levels of unfavourable conditions created by channeling family resources into investment to improved technologies. This therefore put such families in a financially advantageous position to have more resources for investment in order to improve farm practices (Agbamu, 2006).

The study revealed that there was a significant effect on farming experience and the output of participating farmers in ASM. With increased in farming experience, farmers are

generally better, able to have reasonable output. This often comes from their interactions with their neighbouring farmers and the outside world. It can also be argued that the experience of farmers can generate or erode confidence. In other words, with more experience, farmers can become more or less risk-averse to new technology and consequently, farming experience had a positive effect on their output.

Membership of social organization also had a positive and significant coefficient (20.136). This implies that 1% increase in cooperative membership will increase the output of participating farmers in artisanal and small-scale mining. This also means that farmers, who are members of social organizations, participated more in ASM than non-members. This is logical because membership of social organization provides farmers with access to information on potential benefits of improved agricultural technologies and mining activities. This is in agreement with Deji (2005) who observed that membership of cooperative societies positively and significantly affected the farmers' participation and adoption of agricultural innovation.

Table 5.6: Effect of participation in ASM on the output of farmers

Variables	Coefficient	Standard error	t-value
Constant	284.154	33.696	8.433***
Sex	-30.873	9.817	-3.145***
Age	-0.826	0.437	-1.897*
Education	2.136	4.132	0.517
Household size	1.414	0.316	4.475***
Land ownership	7.197	11.105	0.648
Farming experience	0.576	0.070	8.228***
Access to credit	-0.004	0.017	-0.222
Membership of cooperatives	20.136	3.017	6.675***
Extension contacts	0.319	1.834	0.174

Number of observations	355
Log likelihood function	-293.1285
Number of parameters	9
Info. Criterion: HQIC =	2.04421
Pseudo R-square	0.653
Threshold values for the model:	
Lower= .0000 Upper=+infinity	
LM test [df] for tobit=	.000[12]
Normality Test, LM =	257.801[2]
ANOVA based fit measure =	.069149
DECOMP based fit measure =	.069149

*** P≤0.01 ** P≤0.05 * P ≤0.10

5.3.1.1 Test of Hypothesis I

Ho_1 There is no significant effect on the output of participating and non-participating farmers in artisanal and small-scale mining.

The null hypothesis (H_o) which stated that there is no significant effect on the output of participating and non-participating farmers in ASM in the study area was tested using the results of a z-test as presented in Table 5.7. From the results, an average output of participants was 12290.63 while that of non-participants was 9891.67. The calculated z-

value was 3.14 and exceeds the critical value (z-critical two-tail) of 1.97; therefore, the null hypothesis (H_o) was rejected at $P \leq 0.05$ level of significance. The result of the analysis indicated that there is significant effect of artisanal and small-scale mining on the output of participating farmers in the study area.

Table 5.7: Z - statistic showing the significant effect on the output of participating and non-participating farmers' in ASM

	Output of farmers participating in ASM	**Output of farmers not participating in ASM**
Mean	12290.63	9891.67
Variance	2239750.66	7003827.68
Observations	48	145
Hypothesized mean difference	0	
Df	70	
z Stat	3.1413	
P(Z<=z) one-tail	0.0012	
z Critical one-tail	1.6669	
P(Z<=z) two-tail	0.0024	
z Critical two-tail	1.97*	

*** $P \leq 0.01$

5.3.2 Effect of participation in ASM on the income of farmers

The Tobit regression model was used to estimate the parameters of the effect of participation in artisanal and small-scale mining on the farmers' income. From the maximum likelihood estimates of the Tobit regression, the results showed that the model fits the data reasonably. For instance, the (maximum likelihood) estimates maximize the log likelihood functions. This implies that among all the possible regression lines, the coefficients of this regression line maximizes the joint probability (likelihood) of observing the *n* sample values of the effect of participation in ASM on the farmers' income. This indicated that variation in income was explained by the (maximum

likelihood) estimates of the selected explanatory variables. This suggests that the model as specified has explained that there was significant non-zero variation on the effect of participation in artisanal and small-scale mining among the respondents. Furthermore, the Pseudo R-square (coefficient of determination) is 0.50, suggesting that the model has a good fit to the data. This shows that 50% variation affected participation in ASM on the farmers' income as explained by variations in the specified explanatory variables. This suggests that the model has a good explanatory power on the changes in income among the respondents with 95% level of confidence.

The results as presented in Table 5.8 showed that nine variables sex, age, education, household size, farming experience, membership of cooperatives, access to credit, extension contacts and land ownership were analyzed. Five variables education, household size, access to credit, extension contacts and ownership of land significantly affected the income of the respondents and these variables had negative coefficients. While, education, land ownership, access to credit and extension contacts were not found to be significant.

The estimated coefficient of education (0.3431) indicated the level of education of the respondents was a very important variable ($P \leq 0.01$) that affected the level of income of participating farmers in artisanal and small-scale mining in the study area. This further implies that a unit increase in educational level of the farmers led to an increase on the farmers' income. This study agrees with earlier studies (Awe, 1999) that literacy level positively affected the income of farmers in south-western Nigeria.

Household size showed a negative and significant effect on participation in ASM on the farmers' income in the study area. The value was significant at (P≤0.01) level of probability. This implies that a unit increase in household size decreases the income of the participating farmers in mining activities. Household size was associated with increased household consumption expenditure which reduces the money that could be used for production purposes. Okoruwa and Ogundele (2006) noted that a large family size does not necessarily translates to higher use of family labour because some of the young able-bodied family members might prefer other jobs than farming in rural areas.

The estimated coefficient of credit (0.0038) had positive and significantly affected the income of the participating farmers in artisanal and small-scale mining in the study area at (P≤ 0.01) level. Farm households who had access to credit for mining activities planted more area under artisanal and small-scale mining compared to farming households who had no access to credit. Part of the reasons for this was that mining activities are costly. Cash is needed to purchase equipment as well as complementary inputs where necessary. This explains why access to credit is often observed as an important determinant of participating farmers in the study area (James and Smith, 2006). It is also evident from this study that majority of the farmers had no access to credit.

The estimated coefficient of access to extension contacts (0.6012) had positive coefficient and significantly affected participating farmers' income in ASM in the study area at (P≤ 0.05) level of probability. Extension contact determines the information that farmers could obtain on production and mining activities and the application of innovations through counseling and demonstrations by extension agents consequently enhanced the farmers'

income. The effect of exposure to extension programmes is enormous. This could be attributed to increase in farmers' interaction with extension personnel in the form of multiple visits. Technical support to farmers greatly increases their knowledge of available technologies and their potential benefits, hence acting as a trigger mechanism for income generation.

The estimated coefficient of land ownership (-0.2079) had a negative relationship with the income of farmers and significant at ($P \leq 0.05$) level of probability as a result of their participation in ASM. This implies that an increase in the number of land by farmers, the less income they would realize. This indicated that less land ownership is better-off than to own land in the study area.

Table 5.8: Effect of participation in ASM on the income of farmers

Variables	Coefficients	Std. error	T-value
Constant	-0.2974	0.9729	-0.3057
Sex	28.231	27.981	1.009
Age	0.0362	0.0308	1.1748
Education	0.3431	0.2038	1.6849*
Household size	-0.1543	0.0538	-2.8704***
Farming experience	0.0404	0.0319	1.2666
Membership of cooperatives	0.0458	0.0768	0.5969
Access to credit	0.0038	0.0012	3.1667***
Extension contacts	0.6012	0.2962	2.0297**
Land ownership	-0.2079	0.0918	2.2647**

Number of observations	355
Log likelihood function	-438.145
Number of parameters	9
Info. Criterion: HQIC =	3.0487
Pseudo R-square	0.523
Threshold values for the model:	
Lower= .0000 Upper=+infinity	
LM test [df] for tobit=	.000[12]
Normality Test, LM =	153.801[2]
ANOVA based fit measure =	.50149
DECOMP based fit measure =	.509149

*** P≤0.01 ** P≤0.05 * P≤0.10

5.3.2.1 Test of Hypothesis II

Ho_2 There is no significant effect on the income of participating and non-participating farmers in artisanal and small-scale mining.

The null hypothesis (H_o) which stated that there is no significant effect on the standard of living of participating and non-participating farmers in ASM in the study area was tested using the results of a z-test as presented in Table 5.9. From the results, an average income

of participants was ₦309414.08 while that of non-participants was ₦34227.21. The calculated z-value was 6.18 and exceeds the critical value (z-critical two tails) of 1.97; therefore, the null hypothesis (H_o) was rejected at $P \leq 0.05$ level of significance. The result of the analysis indicated that there is significant effect of artisanal and small-scale mining on the income of participating farmers in the study area. This finding is in tandem with that of Ezeaku (2011) who found that 80% of the participating respondents in ASM earned higher income than what they get from the sales of agricultural produce in Obi communities of Nasarawa State.

Table 5.9: Z - statistic showing the effect of farmers' participation or non-participation in ASM on their income

	Income of farmers participating in ASM	**Income of farmers not participating in ASM**
Mean	309414.0845	34227.21127
Variance	6.89276E+11	6912597817
Observations	205	355
Pearson correlation	-0.058618157	
Hypothesized mean difference	0	
Df	354	
Z Stat	6.178298115	
P(Z<=z) one-tail	8.90546E-10	
z Critical one-tail	1.649169415	
P(Z<=z) two-tail	1.78109E-09	
Z Critical two-tail	1.97**	

**$P \leq 0.05$

5.3.3 Effect of participation in ASM on the standard of living of farmers

The Tobit regression model was used to estimate the parameters of effect of participation in artisanal and small-scale mining on the farmers' standard of living. From the maximum likelihood estimates of the Tobit regression, the results showed that the model fits the data

reasonably. For example, the (maximum likelihood) estimates maximize the log likelihood functions. This implies that among all the possible regression lines, the coefficients of this regression line maximizes the joint probability (likelihood) of observing the *n* sample values of the effect of participation in artisanal and small-scale mining on the standard of living of farmers. This shows that variation in income is explained by the (maximum likelihood) estimates of the selected explanatory variables. This suggests that the model as specified has explained significant non-zero variations on the effect of participation in ASM among the respondents. Furthermore, the Pseudo R-square (coefficient of determination) is 0.54, suggesting that the model has a good fit to the data. This indicated that 54% variation on the effect of participation in artisanal and small-scale mining on the farmers' standard of living was explained by variations in the specified explanatory variables, suggesting that the model has a good explanatory power on the changes in standard of living among the respondents with 95% level of confidence.

The results as presented in Table 5.10 revealed that seven variables age, education, household size, farming experience, membership of cooperatives, access to credit and extension contacts were significant at different levels of probability and had effect on the standard of living of the respondents. The sex of the farmers was not significant.

Household size revealed a negative and significant effect with participation in artisanal and small-scale mining on the standard living of farmers in the study area. The value was significant at ($P \leq 0.05$) level of probability. This implies that a unit increase in household size decreases the standard of living of the participating farmers in ASM. Household size

was associated with an increase in household consumption expenditure which reduces the money that could be used for production purposes. Okoruwa and Ogundele (2006) observed that a large family size does not necessarily mean a higher use of family labour. This shows that some of the young able-bodied family members might prefer other jobs than farming in rural communities.

The study revealed a significant relationship on farming experience and the standard of living of participating farmers in ASM. This suggests that an increase in farming experience generally makes farmers better, able to have reasonable standard of living. This often comes from their interactions with their neighbouring farmers and other communities of the world. It can also be argued that the experience of farmers can generate or erode confidence. In other words, with more experience, farmers could become more or less risk-averse to new technology and thus this invariably had a positive effect on the standard of living of farmers in mining communities.

Membership of social organization also had a positive coefficient (0.306) and significant at ($P \leq 0.05$) level of probability. This implies that 1% increase in cooperative membership increases the standard of living of the participating farmers in artisanal and small-scale mining. This also means that the farmers who are members of social organizations participated more in ASM than non-members. This is logical because membership of social organization provides the farmers with access to information on potential benefits to improved agricultural technologies and mining activities. The finding of this study is in agreement with Deji (2005) who observed that membership of cooperative societies

positively and significantly affected participation and adoption of agricultural innovation among farmers in rural communities.

The estimated coefficient of credit (0.392) had positive and significant affected the standard of living of participating farmers in artisanal and small-scale mining at ($P \leq 0.05$) level of probability. This implies that a unit increase in access to credit increases the standard of living of farmers in the study area.

The estimated coefficient of access to extension contacts (0.650) had positive coefficient and significant effect on the participating farmers' standard of living in ASM at ($P \leq 0.05$) level. Extension contact provides the information that farmers could obtain on production and mining activities and the application of innovations through counseling and demonstrations by extension agents consequently enhanced the farmers' income in the study area.

Table 5.10: Effect of participation in ASM on the standard of living of farmers

Variables	Coefficients	Standard error	T-value
Constant	23.935	25.600	0.933
Sex	-26.335	25.640	-1.027
Age	2.196	1.159	1.895*
Education	-0.474	0.274	-1.729*
Household size	1.105	0.452	2.445***
Farming experience	-0.417	0.182	-2.291**
Membership of cooperatives	0.306	0.149	2.064**
Access to credit	0.392	0.195	2.010**
Extension contacts	0.650	0.286	2.273**

Number of observations	355
Log likelihood function	-198.121
Number of parameters	9
Info. Criterion: HQIC =	4.02417
Pseudo R-square	0.523
Threshold values for the model:	
Lower= .0000 Upper=+infinity	
LM test [df] for tobit =	.000[12]
Normality Test, LM =	153.801[2]
ANOVA based fit measure =	.56149
DECOMP based fit measure =	.568149

*** P≤0.01 ** P≤0.05 * P≤0.10

5.3.3.1 Test of Hypothesis III

Ho_3 There is no significant effect on the standard of living of participating and non-participating farmers in artisanal and small-scale mining.

The null hypothesis (H_o) which stated that there is no significant effect on the standard of living of participating and non-participating farmers in ASM in the study area was tested using the results of a z-test as presented in Table 5.11. From the results, an average standard

of living of participants was 38381.37 while an average standard of living of non-participants was 28690.91. The calculated z-value was 6.33 and exceeds the critical value (z-critical two tails) of 1.97; therefore, the null hypothesis (H_o) was rejected at $P \leq 0.05$ level of significance. The result of the analysis indicated that there was significant effect of participation in artisanal and small-scale mining on the standard of living of participating farmers in the study area. One can infer that the greater the level of participation in ASM by farmers, the higher their standard of living.

Table 5.11: Z - statistic showing the effect of farmers' participation or non-participation in ASM on their assets (standard of living)

	Assets of farmers participating in ASM	**Assets of farmers not participating in ASM**
Mean	38381.37	28690.91
Variance	102497768.4	117544054.3
Observations	205	145
Hypothesized mean difference	0	
Df	180	
z Stat	6.33	
P(Z<=z) one-tail	9.27635E-10	
z Critical one-tail	1.65	
P(Z<=z) two-tail	1.85527E-09	
z Critical two-tail	1.97*****	

* $P \leq 0.05$

5.4 Strengths, Weaknesses, Opportunities and Threats (SWOT) Analysis of Artisanal and Small-Scale Mining

This section presents the SWOT analysis of artisanal and small-scale mining in Table 5.12. On the strengths of ASM, the results showed that 51% of the respondents indicated that it has improved their standard of living while 12% said that there was always ready market for solid minerals to be sold to dealers. This showed that ASM had improved the

standard of living of the respondents in the mining communities. For instance, a farmer in Godo Godo village whose farm was affected by mining activities opined that:

> *We enjoy working during the dry season than the rainy season because the mining pits are usually flooded with water coupled with the one coming out from the ground. More so, some of the miners left Godo Godo village to their countries or States of origin particularly our neighbours from Plateau States to farm during the rainy season. Majority of these migrants are landless.*

IDI conducted with the *Madaki* (a traditional title holder) of Antang, a farmer who also happened to be one of the ex-miners in this village buttressed the view expressed by a farmer in Godo Godo community. The *Madaki* observed that due to the prospects in artisanal and small-scale mining in this locality, some people come from Senegal, Gambia and other parts of African countries mostly to buy sapphire (*kwaranda*) as dealers during gold boom. He added that even white men sometimes come from Australia to buy precious stones as dealers and some of these dealers also participate in ASM. This is in line with the submission of Udo (2012) who noted that all development is targeted at people. He added that cultured human beings are the major beneficiaries of the products obtained from the exploitation of the environment in which they live. The finding of this study also agrees with Akwarandu (2013). According to him, a reasonable proportion of the Nigerian families earn their livelihood from environmental resources through small-scale mining. Likewise, Hopkins cited in Falola and Paddock (2010) stressed the significance of environment to human beings. He maintained that people particularly those in the rural areas use the environment to achieve their economic goals.

Concerning the weaknesses of ASM as presented in Table 5.12, 33% of the respondents revealed that they lack modern equipment, 24% said that lack of organization while 16%

of the respondents identified exploitation by buying agents (dealers), inadequate land and water for mining activities. One can draw inference from these results that lack of modern equipment is one of the major threats the respondents faced in the mining communities. But a different weakness of ASM was observed by the *Maigari* (Village Head) of Kakini. According to this traditional ruler who is also a farmer:

> *Nowadays, mining has grossly affected our tarred road due to the fact that some quantities of gold were discovered underneath by artisan miners. They dug and caused havoc to our only tarred road. Forgetting that, this is one of the rural access mobility roads that need rehabilitation by the Kaduna State government because majority of the farmers always use it. The road as you can see is as old as this community. This attitude was developed recently by these miners and it is difficult for vehicles to move with goods from this village to other communities.*

The *Dagacin* (Ward Head) of Nisama during an IDI interview maintained that:

> *Farmers and artisan miners are involved in conflict in this area because the miners used to trespass our farms. They also enter our farms and destroy the crops without our permission particularly in the night. The miners' work 24hours in a day and some of them derived pleasure working in the night with torch lights. It is when the affected farmers confronted the miners before negotiation will take place after they might have damaged their farmlands.*

FGD with farmers and miners groups in Janruwa ("Abuja"), a village in Birnin Gwari LGA of Kaduna State revealed that:

> *The major threat we are facing every blessed day in this place is insecurity. Armed robbers always threatening our lives and the little money we make from sales of gold and even the gold itself are collected by them. They have evacuated all our domestic animals. The only technique that we developed now is that whenever they come in the day time or night, as it has been the usual practice, we run into the pits we had dug for safety. Day and night we keep vigil and always in possession with our torchlights which we use to enter the pits due to darkness. We can't communicate in this village for help. Our roads are bad. No electricity, good drinking water, clinic and other things that make human life meaningful.*

The opportunities derived from ASM were also sought from the respondents as presented in Table 5.12. The results showed that the informal sector has created employment to majority (59%) of the rural dwellers. Ten per cent of the respondents said that they enjoyed good wages from participation in ASM. This indicated that majority of the respondents enjoyed good wages as a result of participation in ASM. This is in line with the finding of Walsh (2003) in Madagascar who maintained that what a miner earned in a day was what a farmer earned in a month in the same community. Additionally, the result of this study concurred with the HDR (2010) that human development is about sustaining positive outcomes steadily overtime and combating processes that impoverished people and underpinned oppression and structural injustice. It showed that human development is the expansion of people's freedom to live long, healthy and creative lives. People, particularly in the rural areas are both the beneficiaries and the drivers of sustainable human development as individuals and groups.

It was observed that most of the fine/decent modern houses in Godo Godo and Antang communities were built by *kuza* (tin) and *kwaranda* (sapphire) dealers. Some of them had about three houses, cars and motorcycles. The dealers had more than one wife irrespective of their religious affiliations. Due to the dealers' status, they were respected by members of the mining communities. The finding of this study agrees with that of Ezeaku (2011) who discovered the negative environmental externalities of ASM on agricultural resource uses. Interestingly, he found that 60% of the respondents agreed that ASM has created job opportunity to most rural dwellers in Obi communities of Nasarawa State.

The threats of ASM as indicated in Table 5.12 revealed that a significant proportion (83%) of the respondents said that ASM has destroyed their farmlands while loss of animals was represented by 1%. This shows that mining activities have caused land degradation on the farmlands of the farmers in the study area. This result supported the findings of Yunana and Banta (2014). According to these researchers, small-scale mining has affected farmlands in Antang District of Kaduna State. Their study further showed that ASM has affected crop yield, and many people including animals lost their lives as a result of mining activities. For example, 67% of the respondents said that for a decade, they were getting fewer yields from their farmlands due to participation in ASM.

In addition, the result of this study agrees with that of Akwarandu (2013). He estimated that there were more than 1000 active open pits of different sizes, ranging between 10 - 70ft deep and 20 - 120ft wide, littering the quarries and mine sites, leading to loss and degradation of farm lands/landscapes in Ikpeshi community of Akoko Edo Local Government Area of Edo State, Nigeria.

An in-depth interview with the *Madaki* (a traditional title holder) of Antang, who happened to be an ex-miner revealed that:

> *People complained of the death of their domestic animals and human beings due to the mining activities in Antang community. Other members who are unfortunate usually fall into the illegal mining pits and sustain injuries. The problem is that only few farmers used to close the mining pits dug by miners and continue with their farming activities. And the government is not concern about land rehabilitation in this community. Although we are happy that the government is aware that many of the rural dwellers like us participate in small-scale mining as livelihood option.*

Maigari (Village Head) of Janruwa ("Abuja") - a farmer also during an in-depth interview opined that:

> *Majority of the farmers in this community mine gold without bothering to close the pits they dug which have affected both human beings and animals. The scenario here is unique because our mine site is located in the bush and it hardly affects other neighbouring communities. The only problem we are facing in this place is that whenever the pastoralists are grazing their cattle and sheep, some of these animals used to mistakenly fall inside the mining pits as victims of our actions. The nomads who understood that ASM is our source of livelihood would cooperate with us and beg for assistance to remove the affected animals; however we used to have conflict with the aggressive pastoralists who refused to cooperate.*

Another similar view which affected human beings was narrated during an IDI with a miner in Godo Godo village. According to him:

> *The major challenge we are facing in this community has to do with some miners who come to mine sites to pick the remnants of sapphire (kwaranda) or the left over from the pits we dug. This is what is called roro or kale-kale in Hausa. These miners usually die in existing mining pits we took our energy to dig. There are some pillars we used to leave while digging solid mineral. The pillars like that of a house help us to hold the upper soil from collapse but ignorantly, the roro miners are fond of removing these pillars, which will eventually collapse and kill them in the pit. The sign that make some us to know that death has occurred in a mine pit is when we see many flies around a pit. Another indicator is that when we notice that some of our members are nowhere to be found in the mining locality or when we are actively digging a pit and we heard an unusual sound. We go there for rescue mission. The survivors are rescued while the unlucky ones are removed and buried; however those that could not be rescued are left in the affected pit. We cover the pit and continue with our business as usual.*

Aged man during an IDI in Antang village re-called his experience on the income of participating farmers of nowadays and the ones they had made in the past when he was an active miner. He said that mining yields more income these days than in the past. An elderly informant further posited that *we could had built beautiful houses for our family*

roofed with zinc in those days but unlucky for people like us, we ended up building mud-thatched huts because of our level of income.

The *Dagacin* (Ward Head) of Nisama in an exclusive in-depth interview equally stressed that:

> *I can say as a farmer some of the miners in my community have bought motorcycles, cars, pick-ups and bicycles from the proceeds of mining. Some of the miners built their personal houses and about two or three other houses for tenants to rent.*

A middle-age man who was an ex-miner but at the time of this survey, a farmer in Kajuru ancient town hinted that:

> *Mining has affected majority of us both positively and negatively in this area. Negatively, because it has affected our farmlands, crops, environment and so forth. We are faced with the problem of land degradation as a result of iron ore mining in this locality, which my people called "bakin dutse" (i.e. black stone) due to its colour. Zircon is also found in abundance in this village in the past than nowadays. The government used the law enforcement agents to drive the illegal miners.*

Table 5.12: SWOT analysis of ASM in the mining communities of Kaduna State

SWOT Analysis	Frequency	Percentage
Strengths		
Improve standard of living	182	51.3
Availability of solid minerals	129	36.3
Ready market	44	12.4
Weaknesses		
Lack of modern equipment	119	33.5
Fall in price	47	13.2
Lack of organization	86	24.2
Exploitation by buying agents	25	7.0
Lack of capital/loan	47	13.2
Inadequate land for mining	31	8.7
Opportunities		
Job creation	211	59.4
Keeping large family size	108	30.4
Primary occupation	36	10.1
Threats		
Destruction of farmland	294	82.8
Decrease in crop output	33	9.3
Reduction in income	21	5.9
Loss of human lives	3	0.8
Loss of animals	4	1.1
Total	**355**	**100**

5.5 Strategic Measures adopted by Farmers to cope with the Challenges of Small-Scale Mining

The results as presented in Table 5.13 indicated the strategic measures used by farmers to manage the challenges posed by participation in small-scale mining in communities. The Table showed that 34% of the respondents said that they cope with the negative effects of ASM by using the farm lands not used for ASM, while 0.7% of the respondents sold

their livestock and their products as a coping strategy. This result shows that majority of the respondents utilized lands not meant for ASM. The finding of this study corroborates that of Egbe (2014) who noted that development is geared towards transforming citizens from poverty, ignorance and disease into contented human beings, able to earn an income capable of sustaining a reasonable standard of living in rural areas.

During an FGD, the participating farmers were asked how they cope with the challenges they faced from mining activities at Godo Godo and they maintained that:

> *Really, our farmlands are frequently destroyed by mining activities. But whenever the artisan miners discovered tin on such farms, they used to seek for our consents. The owners of the affected farmlands and the artisan miners usually enter into agreement. After the negotiation, the farmers will be given their own share of the proceeds gotten from their farmlands. It is based on the farmers' discretion which is left for them to either sale the tin back to the miners or directly to dealers in the mining communities. We also have some farmers who did not negotiate with filling in the open pits after mining. These farmers take up the pain to do so and they used same land for farming.*

Observation in Maraban Kajuru indicated that those farmlands destroyed by mining activities over the years were used by the farmers to farm their crops without covering them. Participants (a group of farmers), in Antang village during an FGD said that:

> *We cope with the challenges of ASM during the rainy season by fully participating in farming due to the effect of rain. Let me tell you that the water that comes out inside a mining pit is enough reason to make us change occupation to farming. Coupled with this scenario, the rain too was a contributing factor. As a survival strategy, the miners who have water generators usually dredge or drain the water out while those of us who did not have alternatives took solace in farming until the dry season, and then, we join them. In addition, the energetic young and vibrant ones among us also combined farming, mining and* "going" or *"express" business. That is, "okada", "kabu-kabu", "achaba" with their motorcycles.*

Table 5.13: Strategies adopted to cope with the effect of participation in ASM by the farmers

Coping Strategies	**Frequency**	**Percentage**
Utilizing of lands not used for ASM	119	33.5
Engaging in paid manual labour	47	13.2
Participating in small-scale businesses (e.g. tailoring, trading, fishing, sale of fire woods, commercial motorcycling, etc)	86	24.2
Sale of livestock and their products	25	7.0
Sale of solid minerals obtained from ASM	78	22.1
Total	**355**	**100**

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 Summary

The study was carried out to investigate the effect of participation in artisanal and small-scale mining on the output, income and standard of living of farmers in Kaduna State, Nigeria. It was on the basis of this that the study described the socio-economic characteristics and institutional variables of farmers, examined the perceptions of farmers on government policies on mining activities, determined the effect of participation in artisanal and small-scale mining on the output, income and standard of living of farmers, described the strengths, weaknesses, opportunities and threats (SWOT) of ASM and examined the strategies adopted by farmers in the mining communities to cope with the challenges of ASM.

A total of 381 respondents were randomly selected from 1,270 sample frame of population using one of the probability sampling techniques - a multi-stage. However, only 355 copies of survey questionnaire were retrieved, validated and analyzed. Eighteen (18) informants and three (3) Focus Group Discussions (FGDs) comprised of twenty nine (29) participants were purposively selected from Birnin Gwari, Jema'a and Kajuru LGAs of Kaduna State. The data collected were analyzed using descriptive and inferential statistics such as Tobit regression model and Z-test statistic.

The results of the study showed that majority (68%) were male while 32% were female respondents and their ages revealed that many (61%) were in the age category of 20 and

35 years and their highest education was secondary. Seventy five per cent of the respondents were married and had sizeable members in their households. Significant proportion of the farmers owned land and 20% each of the respondents had about 11 - 15 years, 16 - 20 years and 21 - 25 years of experience in farming. The study revealed that the respondents had no access to credit and they were not members of cooperatives but had about 6 - 10 times access to extension contacts in the mining communities.

The results of the study indicated that 93% of the respondents were aware of government policies on ASM while 58% were deprived participation in its formulation and thus, the policies were not properly enforced. The study further confirmed that a significant proportion of the respondents' perceived these policies as not effective in the study area.

The findings of this study showed that sex (-30.873), household size (1.414), farming experience (0.576) and membership of cooperatives (20.136) were highly significant at ($P \leq 0.01$) levels of probability while age (-0.826) was also significant at ($P \leq 0.10$) level. Variables such as education, land ownership, access to credit and extension contacts of the respondents were insignificant. In addition, the mean output of the participating farmers was 12290.63 while that of non-participants was 9891.67. The calculated z-value was 3.14 and it was greater than the critical value (z-critical two-tail) of 1.97; therefore, the null hypothesis (H_o) was rejected at $P \leq 0.05$ level of significance. This showed that there was significant effect of artisanal and small-scale mining on the output of participating farmers in the study area.

The results further indicated that education (-0.3431) was significant at (P≤0.10) level of probability, household size (-0.1543) and access to credit (-0.0038) were significant at (P≤0.01) levels, extension contacts (-0.6012) and ownership of land (-0.2079) were significant at (P≤0.05) levels of probability. An average income of participants was ₦309414.08 while that of non-participants was ₦34227.21. The calculated z-value was 6.18 and it was greater than the critical value (z-critical two tail) of 1.97; therefore, the null hypothesis (H_o) was rejected at P≤0.05 level of significance. Thus, there was significant effect of ASM on the income of participating farmers in the study area.

The findings of the study revealed that age (-26.335) and education (-0.474) were significant at (P≤0.10) levels of probability, household size (1.105) was highly significant at (P≤0.01) level, farming experience (-0.417), membership of cooperatives (0.306), access to credit (0.392) and extension contacts (0.650) were significant at (P≤0.05) levels of probability and had effected the standard of living of the respondents. The sex (-26.335) of the farmers was not significant. The mean standard of living of participants was 38381.37 while an average standard of living of non-participants was 28690.91. The calculated z-value was 6.33 and greater than the critical value (z-critical two tail) of 1.97; therefore, the null hypothesis (H_o) was rejected at P≤0.05 level of significance. This showed that there was significant effect of participation in ASM on the standard of living of participating farmers in the study area.

The results of SWOT analysis on the strengths of ASM showed that it had improved the standard of living of the respondents in the mining communities while the weaknesses of

ASM indicated that 33% of the respondents lacked modern equipment for mining activities. The results on the opportunities of ASM showed that the informal sector had created employment to the farmers and they earned good wages as a result of their participation in ASM while the threats of ASM revealed that a significant proportion (83%) of the respondents' farm lands were destroyed.

The results of the study on strategic measures used by farmers to cope with the challenges posed by participation of farmers in small-scale mining showed that 34% of the respondents cope with the negative effects of ASM by using the farm lands not used for ASM, while 0.7% sold their livestock and their products to cope with the effect of mining activities.

6.2 Conclusion

The results of the study showed that the output, income and standard of living of farmers were significant and had affected their participation in ASM. It was also discovered that ASM had affected the farmers' farmlands in the mining communities. In spite of the negative effects of ASM on the output, income and standard of living of farmers, it serves as an employer of labour to most of the people in the rural areas. The study found that farming and mining were considered as springboards to rural economy diversification in the study area. Thus, the participation of both farmers and miners in ASM had improved their livelihoods. The findings of the study indicated that the farmers also negotiated with some deviant miners who acquired their farmlands without their consents to avoid conflict in the mining communities. Consequently, the farmers had

devised some coping strategies on how to cope with the challenges they faced from participation in ASM.

6.3 Recommendations

Based on the results of this study, the following recommendations were proffered:

i. The findings of the study showed that 83% of the respondents said that participation in small-scale mining had grossly affected the farmlands of majority of the farmers and consequently, human beings and animals also died in the uncovered mining pits. To this end, the study recommends that for the environment to be sustainable there is a need for the participating farmers to carry out their mining activities at virgin lands that were far away from residential areas and farms.

ii. The results of this study indicated that ASM is a revenue generated activity and by implication it had provided employment to a significant proportion of the respondents in the study area. The study therefore recommends that the income realized from participation in ASM by farmers should be used for family sustenance like educating their children and boosting farming.

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iii. The findings of the study revealed that majority of the migrants/foreigners were landless and most of them come to the mining communities during the dry season to participate in ASM. It is recommended that the movement of these migrants/foreigners should be controlled at the borders entry into Kaduna State by the government.

iv. It was found from the study that the solid minerals dealers were fond of exploiting the farmers in the mining communities. It is therefore recommended that participating farmers should be discouraged not to sale their solid minerals directly to dealers but rather deal with the companies themselves.

v. The study also showed that majority of the farmers involved in conflict with participating farmers in ASM due to trespassed of farmlands. The study recommends that the participating farmers in ASM should be encouraged to either hire or utilize farmlands that the consents of the owners were sought.

6.4 Contributions to Knowledge

i. The study showed that ASM had significant effect on the income (₦309414.08) per annum of participating farmers.

ii. The study revealed that participation in ASM by the farmers had affected their sex (-30.873), age (-0.826), household size (1.414), farming experience (0.576) and membership of cooperatives (20.136).

iii. The study also discovered that many (51%) of the ASM participating farmers standard of living had been improved in the mining communities.

iv. Artisanal and small-scale mining had provided employment to majority (59%) of the rural dwellers in the study area.

v. The study also found that majority (83%) of the farmlands was destroyed as a result of farmers' participation in ASM; however, human lives and some animals were lost.

vi. The findings of this study showed that 80% of the participating farmers in ASM agreed that the mining policies were not properly enforced and regulated by the government and thus, it had negatively affected the sustainability of the environment in the study area.

REFERENCES

Abbass, I. M. (2014). *The Political Economy of Rural Development in Nigeria*. Kaduna: Ahmadu Bello University, Zaria Press.

Abutu, A. (2015). In Zamfara, all that Glitters may Lead to Poisoning. *Weekly Trust Newspaper.* Saturday, June 6, 18(49): 14 - 15.

Adama, D. S. (2015). Local Miners go for Gold in Kaduna's Birnin Gwari. *Weekly Trust Newspaper.* Saturday, June, 13.

Adebayo, A. (2015). Developing Artisanal Small-Scale Mining in Nigeria. *Weekly Trust Newspaper.* Saturday, August 15.

Adekoya, J. A. (2003). Environmental Effect of Solid Minerals Mining. *Journal of Physical Science Kenya.* pp. 625 - 640.

Afonja, S. and Pearce, T. O. (1986). Social Change in Nigeria: A Theoretical Exploration of the Path and the Goal. In: Afonja, S. and Pearce, T.O. (Eds.) *Social Change in Nigeria*. Ibadan: Intec Printers Limited.

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

Agbesinyale, P. K. (2003). Ghana's Gold Rush and Regional Development. The Case of Wassa West District. SPRING Centre, University of Dortmund.

Aigbedion, I. and Iyayi, S. E. (2007). Environment Effect of Mineral Exploitation in Nigeria. *International Journal of Physical Sciences.* 2(2): 33 - 38.

Akinola, A. and Owombo, P. (2012). Economic Analysis of Adoption of Mulching Technology in Yam Production in Osun State, Nigeria. *International Journal of Agriculture and Forestry. 2*(1): 1 - 6 http://dx.doi.org/10.5923/j.ijaf.20120201.01.

Akwarandu, N. E. (2013). Perception of Environmental Effects of Small-Scale Mining in Nigeria: The Case of Ikpeshi Community. *Journal of Applied Technology in Environmental Sanitation.* 3(1): 33 - 41.

Alexander, J. and McGregor, J. (2013). Introduction: Politics, Patronage and Violence in Zimbabwe. *Journal of Southern African Studies.* Routledge: Taylor and Francis Group. 39(4): 749 - 763.

Alhassan, A. and Umar, S. (2013). Zamfara Lead Poisoning: Hope after Fund Release for Remediation. *Weekly Trust Newspaper*. Saturday, February 2, 16(27): 10.

Aslam, M. (1981). Rural Development in India. *Journal of Bangladesh Academy for Rural Development,* Comilla, X(1/2).

Awe, D.A. (1999). Soil Fertility Management Using Organic Fertilizers and Low-External - Input Techniques in Southwestern Nigeria. Paper presented at a National Workshop on Soil Conservation and Soil Management for Sustainable Rural Development in Nigeria, Ibadan 5th-7th November.

Baba, J. M. (1987). Reconciling Agricultural and Pastoral Land Use System in Nigeria. *Perspective on Land Administration and Development in Nigeria*. Bayero University Kano/Ford Foundation.

Bamire, A. S., Fabiyi, Y. L and Manyong V. M, (2002). Adoption Pattern of Fertilizer Technology among Farmers in the Ecological Zones of South-Western Nigeria: A Tobit Analysis.

Barry, M. (Ed.) (1996). Regularizing Informal Mining - A Summary of the Proceedings of the International Roundtable on Artisanal Mining. *Industry and Energy Department Occasional Paper*. IEN No. 6, April, World Bank. Retrieved October 5, 2013 from http://wwwwds5_3980429111204/rendered/pdf/multi_page.pdf.

Bass, S. Dalal-Clayton, B. and Pretty, J. (1995). *Participation in Strategies for Sustainable Development*. London: Environmental Planning Issues.

Bekele, G. and Mekonnen, A. (2010). Investment in Land Conservation in Ethiopia Highlands: A Household Plot-Level Analysis of the Roles of Poverty, Tenure Security, and Market Incentives. *Environment for Development Discussion Paper Series*, 10 - 09.

Bleasdale, M. (2011). A Heavy Price: Lead Poisoning and Gold Mining in Nigeria's Zamfara State. *Human Rights Watch.*

Brooks, D. B. (1974). Conservation of Mineral and the Environment. *Office of Energy Conservation.* Ottawa: Canadian Department of Energy, Mines and Resources, pp. 80 - 91.

Bugnosen, E. (1995). *Approaches to Providing Appropriate Technology to Small-Scale miners*. The World Bank International Roundtable on Artisanal Mining, May 19, Washington DC.

Buttel, F. (2000). Classical Theory and Contemporary Environmental Sociology: Some Reflections on the Antecedents and Prospects for Reflexive Modernization Theories in the Study of Environment and Society. In: Spaargaren, G., Mol, A. P. J. and Buttel, F. H. (Eds.) (2000). *Environment and Global Modernity*. London: Sage Publications.

Carley, M. (1994). *Policy Management Systems and Methods of Analysis for Sustainable Agriculture and Rural Development*. International Institute for Environment and Development (IIED), London and United Nations Food and Agriculture Organization (FAO), Rome.

Carney, D. (Ed.) (1998). Sustainable Rural Livelihoods. What Contribution Can we Make? *Department of International Development.* Nottingham: Russell Press Ltd.

Castells, M. and Portes, A. (1989). The Origins, Dynamics, and Effects of the Informal Economy. In: Portes, A., Castells, M. and Benton, L. (Eds.). *The Informal Economy: Studies in Advanced and Less Developed Countries.* Baltimore: John Hopkins University Press.

Chambers, R. and Conway, G. (1992). Sustainable Rural Livelihoods: Practical Concept for the 21st century. *Institute of Development Studies (IDS) Discussion Paper 296*. Brighton UK: IDS.

Charkravorty, S. L. (2001). Artisanal and Small-Scale Mining in India. *Mining, Minerals and Sustainable Development (MMSD) Project*.

Clay, D. C., Kelly, V., Mpyisi, E. and Reardon, T. (2002). Input Use and Conservation Investments among Farm Households in Rwanda: Patterns and Determinants. In Barret, C. B., Place, F. and Solid, A. A. A. (Eds.), *National Resources Management in Africa Agriculture: Understanding and Improving Current Practices.* Willingford, Oxfordshires, UK: (AB). http://dx.doi.org/10.1079/9780851995847.0103.

Cohen, P. S. (1968). *Modern Social Theory*. London: Heinemann.

Colom, S. G. (2006). Solid Minerals Development in Plateau State: The Journey So Far. Paper Presented at the Raw Materials Research and Development Council in collaboration with the Plateau Minerals and Development Company Seminar on *Exploitation and Utilization of Mineral Raw Material Endowment of Plateau State Cottage Level Development* held at the Tudun Wada Government Lodge, Jos August 17.

Dasgupta, P. (1995). Population, Poverty and Local Environment. *Scientific American.* 272(2): 26 - 31.

Dasgupta, P. and Maler, K. G. (1994). Poverty, Institutions and the Environment - Resource Base. *World Bank Environment Paper No. 9.* World Bank: Washington, DC.

Deji, O. (2005). Membership of Co-operative Societies and Adoption Behaviour of Women Farmers: Implication for Rural Development. *Journal of Social Science.* 10 (2): 145 - 147.

Doss, C. R. and Morris, M. (2001). How Does Gender Affect the Adoption of Agricultural Innovations? The Case of Improved Maize Technplogy in Ghana. Agricultural Economics. 25(1): 27-39, June.

Dreschler, B. (2001). Small-Scale Mining and Sustainable Development within the SADC region: Mining, Minerals and Sustainable Development (MMSD). No. 84 England: SANTREN/ ITDG.

D'Souza, K. (2002). *Artisanal and Small-Scale Mining in Africa: A Reality Check.* Keynote Presentation at the Seminar on Artisanal and Small-Scale Mining in Africa, Yaoundé, Cameroon. Retrieved April 15, 2013 from http://www.un.org/esa/sustdev/tech_coop/documents/seminar_Yaounde /Session1 Souza.pdf.

ECA/UNDESA (2002). A Compendium Presented for Validation in the Joint Seminar on A*rtisanal and Small-Scale Mining in Africa: Identifying Best Practices and Building the Sustainable Livelihoods of Communities* held in Yaoundé, Cameroon, 19 - 22 November.

Egbe, E. J. (2014). Rural and community development in Nigeria: An Assessment. *Arabian Journal of Business and Management Review Nigerian Chapter.* 2(2).

Ekbom, A. and Bogo, J. (1999). Poverty and Environment: Evidence of Links and Integration into the Country Assistance Strategy Process. *Discussion Paper No. 4.* The World Bank. London: Washington DC.

Ekong, E. E. (2010). *Rural Sociology* (Third Edition). Uyo, Nigeria: Dove Educational Publishers.

Ezeaku, P. I. and Anikwe, M. A. N. (2005). A Model for Description of Water and Solute Movement in Soil-Water Restrictive Horizons Across Two Llandscapes in South East Nigeria. *Journal of Research Agriculture*. 2(2): 47 - 53.

Ezeaku, P. I. (2011). Evaluating the Influence of Open Cast Mining of Solid Minerals on Soil, Land Use and Livelihood Systems in Selected Areas of Nasarawa State, North-Central Nigeria. *Journal of Ecology and the Natural Environment.* 4(3):62-70, February 12. Retrieved October 14, 2014 from http://www.academicjournals.org/JENE, DOI: 10.5897/JENE11.32

Falola, T. and Paddock, A. (Ed.) (2010). *Environment and Economic in Nigeria*. Routledge African Studies.

Fatubarin, A. (2014). Nigerian Nation, the Challenges of its Natural Environment and the Imperative of a Prompt Action on them. *European Journal of Botany Plant Sciences and Phytology.* 1(2): 1 - 12, June.

Federal Environmental Protection Agency (FEPA) (1992). Biological Diversity in Nigeria - a Country Study, 1991 - 1992, pp. 57.

Fisher, E., Mwaipopo, R., Mutagwaba, W., Nyange, D. and Yaron, G. (2009). The Ladder that Sends us to Wealth: Artisanal Mining and Poverty Reduction in Tanzania. *Resources Policy*. 34(1): 32 - 38.

Freund, W. M. (1981). Labour Migration to the Northern Nigerian Tin Mines, 1903-1945. *Journal of African History*. Cambridge: Cambridge University Press. 22(1): 73 - 84.

Fwatshak, S. U. (2010). Environment Impact of Post-Colonial Mining Activities on the Jos Plateau. In: Falola, T. and Paddock, A. (Ed.) (2010). *Environment and Economic in Nigeria*. London: Routledge African Studies.

Gana, J. (1996). A Strategy for Integrated Rural Development in Nigeria. Being a Paper Presented at a National Seminar Organized by the Directorate of Foods, Roads and Rural Infrastructures (DIFRRI), Lagos.

Githinji, M. and Perrings, C. (1992). *Environmental Economics and Sustainable Development*. The World Bank: The International Bank for Reconstruction and Development.

Godoy, R. (1988). Small-Scale Mining and Agriculture among the Jukumani Indians, Northern Potosi and Bolivia. *Journal of Development Studies.* 24(2): 177 - 196.

Godoy, R., Kirby, K. and Wikkie, D. (2001). Tenure Security, Private time Preference, and Use of Natural Resources among Lowland Bolivian Ameridians. *Ecological Economics, 38,* 105l - 118. http://dx.doi.org/10.1016/S0921-8009(01)00144 - 6.

Gono, G. (2007). Promoting Indigenous Economic Empowerment. Address to the Extraordinary Session of ZANU (PF) Congress in Harare, December 14.

Gonyok, C. K. (1986). A History of Labour in the Tin Mining Industry on the Jos Plateau. Unpublished PhD Thesis Department of History, Faculty of Arts and Social Sciences, Ahmadu Bello University, Zaria, Kaduna State-Nigeria.

Gunson, A. J. and Yue, J. (2001). Artisanal Mining in the People's Republic of China. MMSD Project, No.74.

Gutti, B., Aji, M. M. and Magaji, G. (2012). Environmental Impact of Natural Resources Exploration in Nigeria and the way Forward. *Journal of Applied Technology in Environmental Sanitation.* 2(2): 95 - 102.

Harrison, P. (1993). *The Third Revolution: Population, Environment and a Sustainable World*. Harmonsworth: Penguin Books.

Heemskerk, M. (2000). Gender and Gold Mining: The Case of the Maroons of Suriname: *Working Paper*.

Heemskerk, M. (2002). Livelihood Decision Making and Environmental Degradation: Small-Scale Gold Mining in the Suriname Amazon. *Society and Natural Resources*. Retrieved October 15, 2013 from http//www.ddiglobal.org/pages/artisanal-diamond.php.

Heemskerk, M. (2005). Profiling Artisanal and Small-Scale Mining - A Toolkit for Baseline Studies in Africa.

Hentschel, T., Hruschka, F. and Priester, M. (2003). *Artisanal and Small-Scale Mining: Challenges and Opportunities*. London: International Institute for Environment and Development and World Business Council for Sustainable Development, pp. 7.

Hilson, G. (2001). A Contextual Review of the Ghanaian Small-Scale Mining Industry, IIED and WBCSD.

Hilson, G. (2002a). Land Use Competition in Developing Countries: Profiling the Struggles of Ghana's Galamsey miners. *Minerals and Energy.* 17(3): 2 -14.

Hilson, G. (2002b). Small-Scale Mining and its Socio-economic Impact in Developing Countries. *Natural Resources Forum.* 26:3 - 13.

Hilson, G. and Banchirigah, S. M. (2009). Are Alternative Livelihoods Projects Alleviating Poverty in Mining Communities? Experiences from Ghana. *Journal of Development Studies.* 4(2):172 - 196.

Hilson, G. and Potter, C. (2003). Why is Illegal Gold Mining Activity so Ubiquitous throughout Rural Ghana? *African Development Review.* 15(2): 237 - 270.

Huber, J. (2004). *New Technologies and Environmental Innovation.* Cheltenham, UK: Edward Elgar.

Hughes, N. and Furamera, D. (1999). Socio-economic Issues Relevant to the Uptake of New Technology in Small-Scale Gold Mining: Studies in Guyana and Zimbabwe, BGS, MERN and DFID.

Human Development Report (2010). The Real Wealth of Nations: Pathways to Human Development (20th Anniversary Edition). United Nations Development Programme (UNDP). New York: Palgrave Macmillan.

Humphrey, A. (2005). SWOT Analysis for Management Consulting. *SRI Alumni Newsletter:* SRI International.

ILO (1999). Social and Labour Issues in Small-Scale Mines: Report for Discussion at the Tripartite Meeting on Social and Labour Issues in Small-Scale Mines, Sectoral Activities Programme. Geneva: International Labour Organization.

Invest in Kaduna State Nigeria (2014). *A Guide to Business and Investment*. A Publication of the Ministry of Commerce, Industry, Cooperatives and Tourism, Kaduna State, Nigeria.

Ishaya, S. and Abaje, I. B. (2008). Indigenous People's Perception on Climate Change and Adaptation Strategies in Jema'a Local Government Area of Kaduna State, Nigeria. *Journal of Geography and Regional Planning.* 1(8): 138 -143.

Ivbijaro, M. F. A. (2012a). Sustainable Development in Nigeria. In: Ivbijaro, M. F. A. and Akintola, F. (Ed.) *Sustainable Environmental Management in Nigeria*. (Second Edition). Ibadan: Oluben Printers, pp. 9 - 36.

Ivbijaro, M. F. A. (2012b). Managing Ecological Problems. In: Ivbijaro, M. F. A. and Akintola, F. (Ed.) *Sustainable Environmental Management in Nigeria*. (Second Edition). Ibadan: Oluben Printers, pp. 233 - 251.

James, L. and Smith, P. (2006). Overdraft Loans: Survey Finds Growing Problems for Consumers, CRL Issue Paper No. 13, Durham, NC: Centre for Responsible Lending.

Jennings, N. S. (2001). Small-Scale Mining in Developing Countries: Addressing Labour and Social Issue. Guidelines for the Development of Small/Medium-Scale Mining.

Jibowo, O. (2000). *Essentials of Rural Sociology*. Abeokuta: Gbemi Sodipo Press Ltd, pp. 196 - 197.

Kaduna State Government of Nigeria. Retrieved June, 21, 2013 from http://www.kadunasatate.gov.ng.

Kamuku Park Report (2010). Kamuku National Park (KNP), Birnin Gwari Local Government Area Report of Kaduna State, Nigeria.

Kanyenze, G. (2004). The Zimbabwean Economy 1980 - 2003: A ZCTU Perspective. Harold – Barry, D. (Ed.), *Zimbabwe: The Past is the Future*. Harare: Weaver Press.

Kareem, I. A. and Owao, S. (2000). The Effects of Mining Activities on the Environment of Sanga Forest Reserved, Kaduna State. Retrieved April 24, 2015 from http://www.dspace.unijos.edu.ng/handley.10485/496.

Kidane, G. (2001). Factors Influencing the Adoption of New Wheat and Maize Varieties in Tigray, Ethiopia: The Case of Hawzien Woreda. M.Sc. Thesis Presented to School of Graduate Studies of Alemaya University, Ethiopia. 140p.

Kogbe, C. A. (1989). Statistics of Mineral Production in Nigeria (1968 - 1986) and the Contribution of the Mineral Industry to the Nigerian Economy. In: Kogbe, C. A. (Ed.) *Geology of Nigeria*. Second Revised Edition. Jos: Rock View Limited.

.

Labonne, B. and Gilman, J. (1999). Towards Building Sustainable Livelihoods in the Artisanal Mining Communities. Paper Presented at the Tripartite Meeting in Social and Labour Issues in Small-Scale Mines. ILO: Geneva, 17-21 May.

Mabogunje, A. L. (1970). A Typology of Population Pressure on Resources in West Africa. In: Zelinsley, W., Kosinski, L. A. and Prothero, R. M. (Eds.). *Geography in a Crowding World*. London: Oxford University Press.

Mabogunje, A. L. (1981). *The Development Process: A Spatial Perspective*. London: Hutchinson Publishers.

Madulu, N. F. (1998). Changing Lifestyles in Farming Societies of Sukumaland: Kwimba District, Tanzania. *ASC Working Paper 27*. Afrika-Studiecentrum, Leiden.

Magalela, W. (1999). Towards Development of Sustainable Mining and Processing Technologies for the Small and Artisanal Gold Miners in Zimbabwe. Unpublished Research Report for UNIDO.

Maler, K. G. (1990). Economics Theory and Environmental Degradation: A Survey of Some Problems. *Revista de Analysis Economics.*5 (2):7-17, November.

Mallo, S. J. (2012). The Socio-economic Impact of Artisanal Mining in Kuru, Plateau State, North Central Nigeria. *Continental Journal of Engineering Sciences*. 7(3): 27 - 32.

Manson, A. (2013). Mining and Traditional Communities' in South Africa's 'Platinum Belt': Contestations over Land, Leadership and Assets in North - West province c.1996-2012. *Journal of South African Studies.* North West University, Mafikeng, 39(2): 409 - 423. DOI: 10.1080/03057070.2013.796738.

Maponga, O. (1995). Small-Scale Mining and the Environment in Zimbabwe: The Case of Alluvial Gold Panning. IMR, University of Zimbabwe, October.

Mawowa, S. (2013). The Political Economy of Artisanal and Small-Scale Gold Mining in Central Zimbabwe. *Journal of Southern African Studies*. Routledge: Taylor and Francis Group, 39(4): 921 - 936.

McMahon, G., Elly, R. S., Jean, A., Aziz, B., Giovanna, D. and Ramanie, K. (2000). Mining and the Environment in Indonesia: Long-term Trends and Repercussions of the Asian Economic Crisis. *Discussion Paper Series.* World Bank Environment and Social Development Unit, East Asia and South Pacific Region (EASES), Washington DC.

MEM (2002). Arusha Gemstone Carving Centre: Mode of Operation of the Arusha Gemstone Carving Centre. *Information leaflet*. Ministry of Energy and Minerals (MEM), Dar-es-Salaam, Tanzania.

Mink, S. (1993). Poverty, Population and Environment. *Discussion Paper No.189.* The World Bank. London: Washington DC.

Mkapa, B. W. (2001). Extracts of the Speech by the President of the United Republic of Tanzania at the Inauguration of Bulyanhulu gold mine, Kahama, 18 July.

MMSD (2002). Breaking New Ground. Mining, Minerals and Sustainable Development. The Report of Mining, Minerals and Sustainable Development Project. London: Earth Scan.

Mol, A. P .J. (1995). *The Refinement of Production. Ecological Modernization Theory and the Chemical Industry*. Utrech: Jan Van Arkel/International Book.

Mol, A. P .J. (2001). *Globalization and Environmental Reform: The Ecological Modernization of the Global Economy*. Cambridge: Ma, MIT Press.

Mol, A. P. J. and Sonnenfeld, D. A. (Eds.) (2000). *Ecological Modernization around the World: Perspectives and Critical Debates.* London: OR, Frank Cass/Routledge.

Moore, D. and Mawowa, S. (2010). Mbimbos, Zvipamuzis and 'Primitive Accumulation' in Zimbabwe's Violent Mineral Economy: Crisis, Chaos and the State. Padayachee, V. (Ed.) *The Political Economy of Africa*. London: Routlledge.

Mukhtar, A. B. (2013). Gold Miners Demand Compensation from FG. *Daily Trust Newspaper.* Tuesday July 9, pp. 22.

Munasinghe, M. (1992). *Water Supply and Environmental Management.*West View Press, Boulder, Co.

Mutagwaba, W. K. (2000). Removal of Barriers to the Introduction of Cleaner Artisanal Gold Mining and Extraction Technologies: A Case for Tanzania, Sudan and Zimbabwe. Unpublished Research Report, UNIDO.

Mwaipopo, R., Matagwaba, W., Nyange, D. and Fisher, E. (2004). Increasing the Contributions of Artisanal and Small-Scale Mining to Poverty Reduction in Tanzania. Based on an Analysis of Mining Livelihoods in Misungwi and Geita District, Mwanza Region. A Report Prepared for the Department for International Development, United Kingdom.

Nigerian Minerals and Mining Act (2007). Federal Republic of Nigeria.

Norman, D. W. (1972). An Economic Survey of Three Villages in Zaria Province: Input and Output Study. *Samaru Miscellaneous Paper*, 37(1).

NPC (2006). Population Census of the Federal Republic of Nigeria. Official Gazette of the National Bureau of Statistics, Abuja - Nigeria.

Nwosu, I. E. (2009). Agricultural Development in Nigeria: A Conceptual Overview. *Journal of Food and Fibre Production.* Faculty of Agriculture, Abia State University, Uturu. 2(1): 429 - 436.

Oakley, P. (1995). *People's Participation in Development Projects. A Critical Review of Current Theory and Practice*, INTRAC, July.

Ofei-Aboagye, E. O. (1995). Women's Participation in Artisanal Mining in Ghana. Paper Prepared for the World Bank International Round Table on Artisanal Mining, Washington DC, May.

Offiong, A. V. (2012). Ebonyi Community where Minors Mine Lead. *Weekly Trust Newspaper.* Saturday, September 15.

Okoruwa, V. O. and Ogundele, O. O. (2006). Technical Efficiency Differentials in Rice Production Technologies in Nigeria. A Research Paper Presented at a Workshop Organized by the Nigerian Institute of Social and Economic Research (NISER) Ibadan, Nigeria.

Olisa, M. S. O. and Obiukwu, J. I. (1992). *Rural Development in Nigeria: Dynamics and Strategies.* Awka: Mekslink Publishers (Nigeria).

Olsthoorn, X. and Wieczorek, A. (Eds.) (2006). *Understanding Industrial Transformation. Views from Different Disciplines.* Dordrecht: Springer.

Onoja, N. (2013). Nigeria: Beaming the Light on Small-Scale Mining. *Vanguards Newspaper*. March 4.

Owombo, P. T., Akinola, A. A., Ayodele, O. O. and Koledoye, G. F. (2011). Economic Impact of Agricultural Mechanization Adoption: Evidence from Maize Farmers in Ondo State, Nigeria. *Journal of Agriculture and Biodiversity Research.* 1(2): 25 - 32.

Oyedokun, O. M. and Igonor, E. E. (2013). Solid Minerals Development in parts of Southwest Nigeria - in the Light of Recent Reforms. *British Journal of Applied Science and Technology*. 3(4): 1391 - 1404.

Padayachee, V. (Ed.) (2010). *The Political Economic of Africa.* London: Routledge.

Pearce, D. W. and Turner, R. K. (1990). *Economics of National Resources and the Environment*. Harvester wheat Sheaf.

Phiri, S. (2012). Effects of Artisanal Small-Scale Gold Mining in Umzingwane District (Zimbabwe): A Potential for Ecological Disaster. A Thesis in Partial Fulfillment of the Requirements for the Award of Masters' Degree in Disaster Management Submitted to Disaster Management Training and Education Centre for Africa at the University of Free State, Bloemfontein, South Africa.

Quiroga, E. R. (2002). The Case of Artisanal Mining in Bolivia: Local Participatory Development and Mining Investment Opportunities, *Natural Resources Forum.* 26: 127 - 139.

Rodney, W. (1972). *How Europe Underdeveloped Africa.* Darres Salam: Ethipe Press.

Saunders, R. (2008). Painful Paradoxes: Mining, Crisis and Regional Capital in Zimbabwe. Retrieved May 29, 2014 from http://www.africafiles.org/printableversion.

Schellekens, P. (2013). A Changing China: Implications for Developing Countries. *Economic Premise*. The World Bank: Poverty Reduction and Economic Management Network (PREM), No.118, May.

Schumacher, E. F. (1983). *Project with People: The Practical of Participation in Rural Development*. New York: Longman.

Seers, D. (1969). "Meaning of Development", A Paper Presented at the 11th World Conference of the Society for International Development, New Delhi, India.

Shelley, T. (2007). *Exploited: Labour in the New Global Economy*. New York: Zed Books Limited.

Siegel, S. and Veiga, M. M. (2009). Artisanal and Small-Scale Mining as an extra-legal Economy: De Soto and the Redefinition of 'Formalization'. *Resources Policy.* 34(1-2): 51 - 56.

Sinding, K. (2005). The Dynamics of Artisanal and Small-Scale Mining Reform. *Natural Resources Forum.* 29(3): 243 - 252.

Spiegel, S. and Hoeung, S. (2011). *Artisanal and Small-Scale Mining (ASM): Policy Options for Cambodians*. Cambodia: UNDP.

Svotwa, R. S. and Bugnosen, E. M. (1993). Shamva Mining Centre Demonstration Project - An Example of International and Local NGO Collaboration Progress and Problems to Date. *United Nations Seminar on Guidelines for the Development of Small and Medium - Scale Mining*, 11 - 19 February, Harare, Zimbabwe.

Svotwa, R. S. (2000). Situational Analysis in Strengthening Small-Scale and Artisanal Mining Sector in Zimbabwe. Study done for UNIDO.

Tan Discovery (2003). Situational Analysis Report of the Tanzania Mining Sector. Tan Discovery/UNDP: Unpublished.

Todaro, M. P. (1977). *Economics for a Developing World.* London: Longman Group Limited.

Trochim, W. M. K. (2006). The Conceptual Framework, College of Education. Alabama State University.

Udo, R. K. (2012). Population Pressure and the Nigerian environment. In: Ivbijaro, M. F. A. and Akinlola, F. (Eds.) *Sustainable Environmental Management in Nigeria* (Second Edition). Ibadan: Oluben Printers. pp. 73 - 103.

Uka, C. (2011). Formalization and Legalization of Artisanal and Small-Scale Mining in Nigeria. Paper Presented by Artisanal and Small-Scale Mining Department, Ministry of Mines and Steel Development. At Regional Multi-Stakeholders' Workshop: Anglophone West Africa sub-Regional Action Planning on Mercury Use in Artisanal and Small Scale Gold Mining. Organized by the United Nations Environment Programme, June 8 - 10.

Umebali, E. E. and Akubuilo, C. J. C. (2006). Principles of Rural Development. *Readings in Cooperative Economics and Management*. Lagos: Computer Edge Publishers.

UNEF, IUCN and WWF (1991).*Caring for the Earth*. London: Macmillan Press.

United Nations (1976). *The Significance of Rural Housing in Integrated Rural Development*. New York: UN.

Veiga, M. and Hinton, J. (2002). Abandoned Artisanal Gold Mines in the Brazilian Amazon: A Legacy of Mercury Pollution, *Natural Resources Forum.* 26: 15 - 26.

Walsh, A. (2003). "Hot money" and Daring Consumption in a Northern Malagasy Sapphire - Mining Town. *American Ethnologist.* 30(2): 290 - 305.

WCED (1987). Report of the World Commission on Environment and Development: our Common Future. Development and International Cooperation: Environment. UN Development.

Woods, M. (2009). *Rural Geography*. London: Sage Publications Limited.

World Bank (1990). Towards the Development of an Environmental Action Plan for Nigeria. In Transition to Sustainable Development in Nigeria.

World Bank (1992). *World Development Report. Development and the Environment*. New York: Oxford University Press.

World Bank (1995). *Staff Appraisal Report, Republic of Ghana, Mining Sector Development and Environmental Project*. World Bank Report No. 13881 - GH, Industry and Energy Operations, West Central Africa Department, Africa Region, World Bank, Africa.

World Bank (1997). *Poverty and Welfare in Nigeria*. Federal Office of Statistics, National Planning Commission. The Federal Republic of Nigeria, Abuja.

World Bank (2013). *Artisanal and Small-Scale Mining: Brief*. The World Bank Group. Retrieved May 29, 2015 from http://www.worldbank.org/en/topic/extractiveindustries/brief/artisanaand small-scale-mining.

World Bank (2015). *World Development Report*. Washington D.C.: The World Bank Group.

Yunana, M. A. and Banta, A. L. (2014). Socio-economic Effects of Illegal Mining Activities in Antang District of Jema'a Local Government Area, Kaduna State. *Journal of Environmental Sciences and Resources Management.* 6(2): 12 - 21.

Zimmermann, E. W. (1951). *World Resources and Industries*. New York: Harper and Row.

APPENDIX I

QUESTIONNAIRE TEMPLATE

Dear Respondent,

I am a Postgraduate Student in the Department of Agricultural Economics and Rural Sociology, Faculty of Agriculture, Ahmadu Bello University, Zaria, Kaduna State undergoing a Doctor in Philosophy (PhD) Degree in Agricultural Extension and Rural Sociology. I am currently carrying out a research on the **Effect of Participation in Artisanal and Small-Scale Mining on the Output, Income and Standard of Living of Farmers in Kaduna State, Nigeria**. You have been chosen to participate in this research by providing your views on the topic. Your sincere responses will help in the completion of this study. The information you provide will only be used strictly for academic purposes. Participation in this research is voluntary and your confidentiality will be protected as neither your names nor the information about you will be published.

Yours faithfully,

Ishaku Usman GADZAMA
PhD /AGRIC/ 14039/ 2011 - 12

Instruction: Circle or tick the options applicable to you and write in the space provided where necessary.

Section 'A': Socio-economic Characteristics of Farmers

1. Sex
a. Male [ ]
b. Female [ ]

2. Age
a. 1 - 19 years [ ]
b.20 - 25years [ ]
c. 26 - 35years [ ]
d.36 - 50years [ ]
e. 51 - 60years [ ]

3. Level of education
a. Non-formal [ ]
b. Primary [ ]
c. Secondary [ ]
d. Tertiary [ ]
e. Other (please specify)…….……..……..……..…

4. Marital status
a. Single [ ]
b. Married [ ]
c. Divorced [ ]
d. Widowed [ ]
e. Separated [ ]

5. Household size
a. 1 - 5 people [ ]
b. 6 - 10 people [ ]
c. 11 - 15 people [ ]

6. Do you owned a land?
a. Owned [ ]
b. Not owned [ ]

7. What is your faming experience?
a. 1 - 5years [ ]
b. 6 - 10 years [ ]
c. 11 - 15years [ ]

d. 16 - 20years [ ]
e. 21 - 25years [ ]
f. 26 - 30years [ ]

8. Do you have access to credit in this area?
a. Accessible [ ]
b. Not accessible [ ]

9. Are you a member of cooperative societies?
a. Member [ ]
b. Non - member [ ]

10. How many times do you have contact with extension agents?
a. 1-5 times [ ]
b. 6-10 times [ ]
c. >10 times [ ]

Section 'B': Perceptions of Farmers on Government Policies on ASM

11. Are you aware of policies governing Artisanal and Small-Scale Mining (ASM)?
a. Aware [ ]
b. Not aware [ ]

12. If you are aware, were you involved in the formulation of these policies?
a. Involved [ ]
b. Not involved [ ]

13. Are these policies properly enforced?
a. Enforced [ ]
b. Not enforced [ ]

14. How effective are the ASM policies in Kaduna State?
a. Very effective [ ]
b. Effective [ ]
c. Not effective [ ]
d. Less effective [ ]
e. Undecided [ ]

15. Are artisanal miners licensed in this community?
a. Yes [ ]
b. No [ ]

16. Do farmers pay tax to the government for their involvement in mining?
a. Yes [ ]
b. No [ ]

Section "C": Participation in Artisanal and Small-Scale Mining (ASM)

17. Are you a participant of ASM?
a. Participant [ ]
b. Non-participants [ ]

18. If you are a participant, what prompted you to participate in mining activities?
a. Unemployment [ ]
b. More Income [ ]
c. Lack of fertilizer for farming [ ]
d. Severe droughts/flood [ ]
e. Large size of family [ ]
f. Poverty [ ]
g. All of the above [ ]
h. Other (please specify)……...…….....……..…..

19. How often do farmers participate in ASM?
a. Full-time [ ]
b. Part-time [ ]
c. Occasionally [ ]
d. Seasonally [ ]

20. Who usually assist you in mining?
a. Some children in the community [ ]
b. Men [ ]
c. My own children [ ]
d. Women [ ]
e. All of them [ ]

21. How does your present output of crops compare to the past as a result of ASM?
a. Better [ ]
b. Worse [ ]
c. Same [ ]

22. If it is better, what makes it so?

…….……..……

…….……..……

…….…….....……

23. If the output is worse, give your reason(s):

……..……..……

.……..……

……..…….

24. Which of the following do you think are responsible for the increase in the profits you make in this area? (Tick as many as are applicable to you):

a. More experience	[ ]
b. Good price	[ ]
c. Help from family/hired labourer	[ ]
d. Discovering of new land	[ ]
e. Fall in price	[ ]
f. Government suspension/no sales	[ ]
g. Impoverishment of site	[ ]
h. Mishaps	[ ]
i. Lack of materials	[ ]
j. Fetish/sacrifice	[ ]
k. New materials bought	[ ]
l. Overexploitation	[ ]
m. Arrival of migrants	[ ]
n. All of them	[ ]

25. As a farmer, would you say that participation in ASM has improved your standard of living?

a. Yes	[ ]
b. No	[ ]

26. In what ways has ASM affected you in this community?

Positively:

a…….

…….……..

.……..

……...

b...…….……

....…….……..…

…….……....

……..…….

Negatively:

a…….……

……...

b…….

……..…….….……..…..

.……..…..……...

27. Which of the following health conditions are you currently facing?

a. Constant headache	[ ]
b. Backache	[ ]
c. Arthritis	[ ]
d. Waist or lower abdominal pain	[ ]
e. Stomach ache	[ ]
f. Eye problem	[ ]
g. Constant fatigue	[ ]
h. High blood pressure	[ ]
i. Diabetes	[ ]
j. Fever	[ ]
k. Ulcer	[ ]
l. Sore (wound)	[ ]

m. Other {specify) ……..……..…….....

28. Which other health challenge do members of this community mostly suffer from as a result of mining activities?

a. Constant headache	[ ]
b. Backache	[ ]
c. Arthritis	[ ]
d. Waist or lower abdominal pain	[ ]
e. Stomach ache	[ ]
f. Eye problem	[ ]
g. Constant fatigue	[ ]
h. High blood pressure	[ ]
i. Diabetes	[ ]
j. Fever	[ ]
k. Ulcer	[ ]
l. Sore (wound)	[ ]

m. Other {specify) ……...…….....

29. To what extent do you agree that the income from sales of agricultural produce has helped you to achieve any of the following?(Tick as many options as applicable to you):

S/No	Items	Agree	Disagree	Neutral
30.	Payment of children's school fees			
31.	Settle medical expenses			
32.	Payment of house rent			
33.	Buy food stuffs/clothes			
34.	Engage in other business apart from mining/farming			
35.	Build house (s)			
36.	Buy a car/cars			
37.	Buy a motorcycle			
38.	Buy a bicycle			
39.	Assist co-miners and co-farmers with Loans			

Section "E": Strengths, Weaknesses, Opportunities and Threats of ASM

Strengths:

40. What season do you mostly farm?

a. Dry season [ ]
b. Rainy season [ ]
c. Both season [ ]

41. Give reason(s) for your response:

……

……

……

……

……

42. Would you say that your standard of living over the years has improved?
a. Better off [ ]
b. Averagely improved [ ]
c. Poorer [ ]
d. Same situation [ ]

43. Has your crop yield improved in this community?
a. Yes [ ]
b. No [ ]

44. Do you have a particular market where you sale your solid minerals?
a. Ready market [ ]
b. No ready market [ ]

45. As a participating farmer in ASM, how would describe your relationship with the non-participants?
a. Cordial and friendly [ ]
b. Conflictual [ ]
c. No idea [ ]

Weaknesses:

46. What are your estimate hectares of land destroyed by mining activities?
a. Only one hectare [ ]
b. 2 - 5 hectares [ ]
c. 6 - 10 hectares [ ]
d Above 10 hectares [ ]
e. None [ ]

47. Does it have effect on the output of your farm crops?
a. Yes [ ]
b. No [ ]

48. How much do you realized from the sales of your farm produce per annum **after** you have been affected by ASM?
a. < ₦50, 000.00 [ ]
b. ₦50,000.00 - ₦300, 000. 00 [ ]
c. ₦301, 000.00 - ₦500, 000.00 [ ]
d. > ₦500, 000. 00 [ ]

49. As a farmer, how much income do you realized from the sales of your farm produce in a year **before** you were affected by ASM?

a.< ₦100, 000.00 [ ]
b. ₦100, 000.00 - ₦500, 000. 00 [ ]
c. ₦501, 000.00 - ₦1milion [ ]
d. Above ₦1 million [ ]

50. Are you aware of the death of people or domestic animals as a result of mining activities in this area?

a. Yes [ ]
b. No [ ]

51. In the past two years, have you lost any relative/friend/co-worker in the mining pits dug uncovered?

a. Yes [ ]
b. No [ ]

52. If yes, how many?

a. 1 - 5people [ ]
b. 6 - 10people [ ]
c. More than 10 people [ ]
d. None [ ]

53. What other major challenges you are faced with in this mining community? (Tick as many as are applicable to you):

a. Lack of modern equipment [ ]
b. Fall in price [ ]
c. Lack of organization [ ]
d. Exploitation by buying agents [ ]
e. Lack of capital/loan [ ]
f. Lack of exposure to appropriate technology [ ]
g. Insecurity [ ]
h. Inadequate land for ASM [ ]
i. All of the above [ ]

54. As a farmer, which of the following major problem do you mostly face as a result of your participation in ASM?

a. Bush burning [ ]
b. Pollution [ ]
c. Contamination of drinking water [ ]
d. Deforestation [ ]
e. Land degradation [ ]
f. Land conflicts [ ]
h. All [ ]

Opportunities:

55. Are there people who come from other places to participate in ASM in this community?

a. Yes [ ]
b. No [ ]

56. What do you think made them to participate in ASM?

a. Poverty [ ]
b. Illiteracy [ ]
c. Lack of job opportunity [ ]
d. Keeping large family size [ ]

57. Is mining your primary occupation?

a. Primary occupation [ ]
b. Not primary occupation [ ]

58. What category of people?

a. Men only [ ]
b. Women only [ ]
c. Children [ ]
d. Men and Women [ ]
e. All of them [ ]

59. Do you have children attending schools?

a. Yes [ ]
b. No [ ]
c. No response [ ]

60. If yes, what type of school?

a. Private not faith-based [ ]
b. Government/Public [ ]
c. Private faith-based [ ]

61.If no, please explain:

……..…….…..…

……..……..…

...…….……..……..…

……..……...

62. Where do you go for help when you have misunderstanding?

a. Police [ ]
b. Village head [ ]
c. Vigilante [ ]
d. Nowhere [ ]
e. Leave the community [ ]
f. Head of the family [ ]
g. Association/cooperative leader [ ]
h. Others (specify)…..……..

Threats:

63. In your own opinion, what are the major problems you face in farming?

a. Low production [ ]
b. Lack of fertilizer [ ]
c. Lack of loan [ ]
d. Fall in prices of goods [ ]
e. Lack of organization [ ]
f. Insecurity [ ]
g. Reduction in capital [ ]
h. Destruction of farmland [ ]
i. Loss of human lives [ ]
j. Loss of animals [ ]
k. All of them [ ]

64. To what extent has ASM affected you?

a. Positively affected [ ]
b. Moderately affected [ ]
c. Negatively affected [ ]

65. What is the current security situation in this community?

a. Highly effective [ ]
b. Effective [ ]
c. Ineffective [ ]
d. No idea [ ]

66. In what ways have mining activities affected the following?

S/No	Items	Negatively	No change	Positively
a.	Farmland			
b.	Quality of water			
c.	Men			
d.	Women			
e.	Children			
f.	Animals			
g.	Crop output			

Section 'F': Strategic Measures adopted by Farmers cope with the Challenges of ASM

67. Can the government do something to enhance effective ASM operations in this area?

a. Yes [ ]
b. No [ ]

68. If yes, what are the strategic measures against the negative effects of ASM?

……...……

……...……

69. What are you as an individual farmer doing about the problems you are experiencing in this locality?

……..……

……...……

70. Are there land rehabilitation activities in place in this community?

a. Yes [ ]
b. No [ ]

71. If yes, please specify:

……...……

……..…….

72. How do you think the problems you are facing can be tackled? (Tick as many as are applicable to you):

a. Utilizing of lands not used for ASM [ ]
b. Engage in paid manual labour [ ]
c. Participating in small-scale businesses [ ]
d. Sale of livestock and their products [ ]
e. Sale of solid minerals obtained from ASM [ ]

73. Would you recommend that all the participating farmers in ASM should acquire license?

a. Recommended [ ]
b. Not recommended [ ]
c. Strongly recommended [ ]
d. No response [ ]

APPENDIX II

IN-DEPTH INTERVIEW/FOCUS GROUP DISCUSSION GUIDE

Dear Participant,

I am a Postgraduate Student in the Department of Agricultural Economics and Rural Sociology, Faculty of Agriculture, Ahmadu Bello University, Zaria, Kaduna State undergoing a Doctor in Philosophy (PhD) Degree in Agricultural Extension and Rural Sociology. I am currently carrying out a research on the **Effect of Participation in Artisanal and Small-Scale Mining on the Output, Income and Standard of Living of Farmers in Kaduna State, Nigeria**. You have been chosen to participate in this research by providing your views on the topic. Your sincere responses will help in the completion of this study. The information you provide will only be used strictly for academic purposes. Participation in this research is voluntary and your confidentiality will be protected as neither your names nor the information about you will be published.

Yours faithfully,

Ishaku Usman GADZAMA
PhD /AGRIC/ 14039/ 2011 - 12

Section 'A': General Characteristics of Participants

1. Sex: .....……

2. Age: …..……

3. Marital status: ……...…… ……...

4. Level of education: ……...

Section 'B': Perceptions of Farmers on Government Policies on ASM

5. What is the effect of government policies on ASM on farming activities?

Probe for:

- Nature of awareness
- Involvement in its formulation
- Effectiveness of the policies
- Rehabilitation of damaged land by the government

Section 'C': Effect of Participation in ASM

6. How does ASM affect the mining communities?

Probe for:

- Crop output
- Level of income
- Standard of living
- Education of children
- Human/Animal lives

7. How do you organize yourselves in associations or cooperatives as farmers?

8. In what ways are the following people participating in ASM?

Probe for:

- Young men and women
- Aged men and women
- Child miners

9. How does participation in ASM affect you as a farmer in this community?

Section 'D': Strength, Weaknesses, Opportunities and Threats of ASM

10. What are the negative effects of ASM on the following?

Probe for:
- Farming in general (e.g. farmland, etc)
- Individual farmers (e.g. health challenge, etc)
- Child/adult miners
- The community (e.g. insecurity, increase in population, conflict, etc)
- Neighbouring communities
- Pollution (air, water, etc)

Section 'E': Strategic Measures adopted by Farmers in the Communities to Cope with the Challenges of ASM

11. What are the measures put in place to encourage ASM operations?

Probe for:
- By the community members (e.g. farmers, etc)
- By the government (Federal, State or LGA)
- Other stakeholders

12. What other information would you like to share with the researcher?

APPENDIX III

OBSERVATION GUIDE

During the course of this study, the researcher observed the following:

1. The sites where the participating farmers were actively working or abandoned.
2. The methods and tools used by participating farmers in processing solid minerals.
3. The damages mining activities have caused to farmlands/crops.
4. Sites and the type of houses/huts where miners lived during the colonial era.
5. The patterns of settlements in the rural areas.
6. Source (s) of drinking water in the mining communities.
7. Infrastructural facilities available in the communities (e.g. hospitals, schools, pipe-borne water, recreational centres, post office, telecommunication, feeder-roads, etc).

APPENDIX IV
PHOTOGRAPHS OF MINING ACTIVITIES IN KADUNA STATE



Plate i: Researcher at Birnin Gwari LGA



Plate ii: Letter of introduction received by Maigari of Janruwa ("Abuja")



Plate iii: Some sands of gold



Plate iv: Local washing of gold



Plate v: Inspecting land destroyed by mining activities



Plate vi: Farmland damaged by ASM

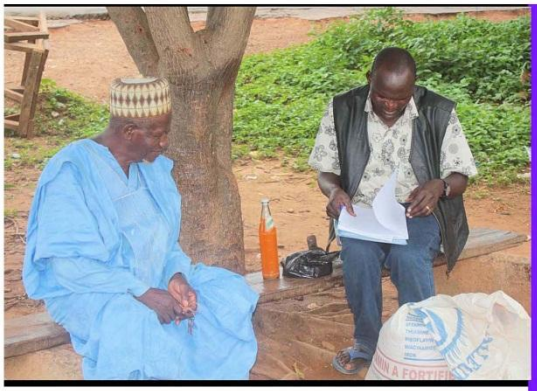


Plate vii: IDI with the Maigari of Janruwa (“Abuja”)



Plate viii: FGD with some women miners in Janruwa (“Abuja”)



Plate ix: FGD with some men miners in Janruwa (“Abuja”)



Plate x: FGD with some men miners in Yankan Dutse



Plate xi: Gold grinding machines in Yankan Dutse

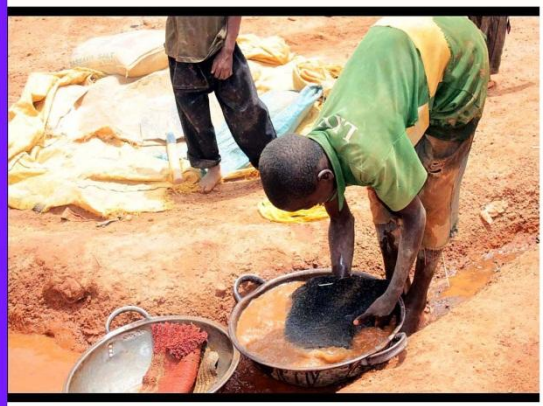


Plate xii: A child miner washing sands to extract gold



Plate xiii The researcher with some child miners at a mining site in Yankan Dutse



Plate xiv: Some child miners digging gold

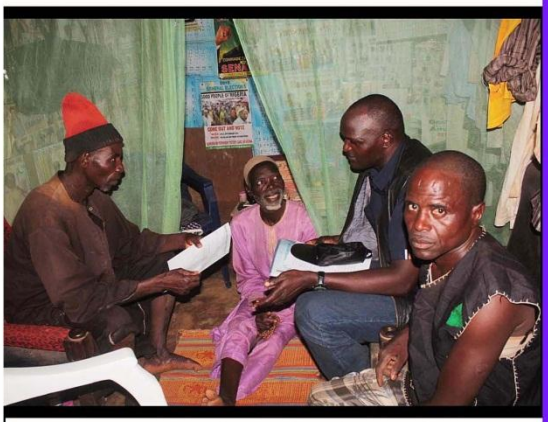


Plate xv: IDI with Maigari of Kakini



Plate xvi: A tarred road destroyed by miners at Kakini Village



Plate xvii: Farmland damaged by miners in Kakini village

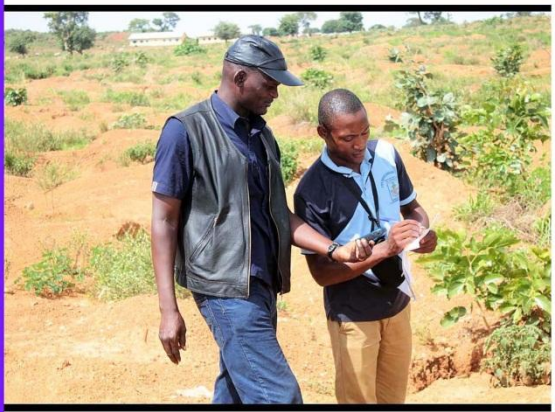


Plate xviii: The researcher with one of the field-assistants in Kakini

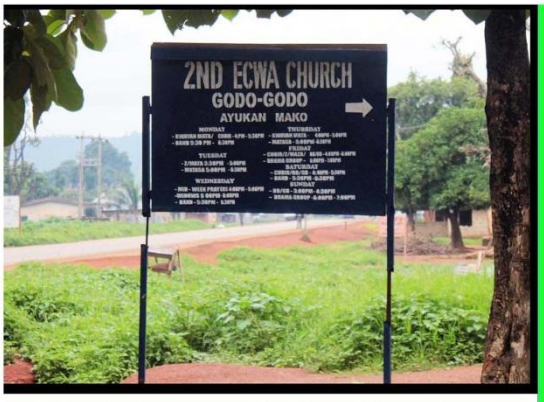


Plate xix: A sign-post in Godo Godo village



Plate xx: Presenting a letter of introduction to the Secretary and Dagacin of Godo Godo

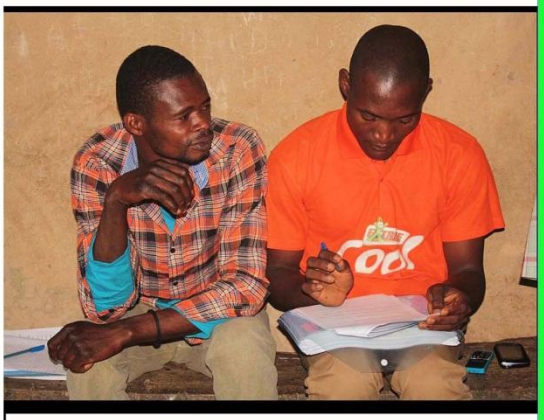


Plate xxi One of the field-assistants with a respondent in Godo Godo

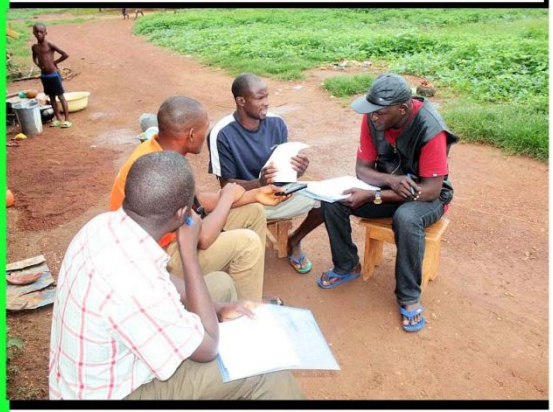


Plate xxii: IDI with one of the ex-miners in Godo Godo

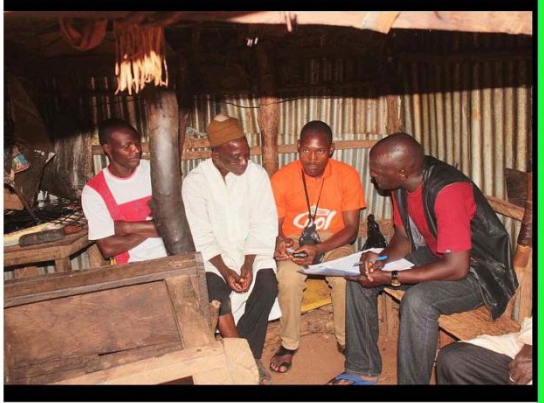


Plate xxiii: IDI with the Dagacin of Godo Godo



Plate xxiv: The researcher with the field-assistants at a farm in Godo Godo



Plate xxv: The researcher looking at a mining pit in Godo Godo

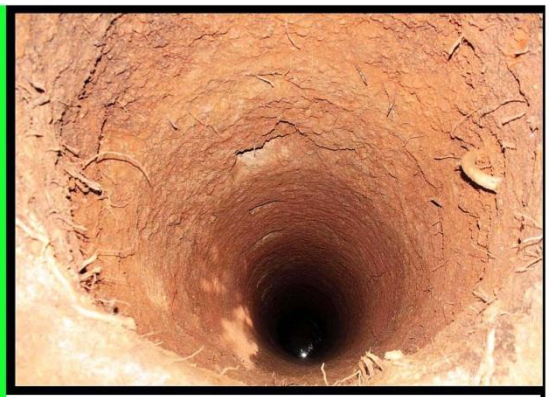


Plate xxvi: One of the pits dug by miners in Godo Godo



Plate xxvii: Artisan miners collecting sands from a pit in Godo Godo



Plate xxviii: A miner coming out from a mining oit in Godo Godo



Plate xxix: A miner demonstrating how tin (kuza) are washed in Godo Godo



Plate xxx: The researcher in action in Godo Godo



Plate xxxi: Participating farmers washing tin (kuza) in Godo Godo

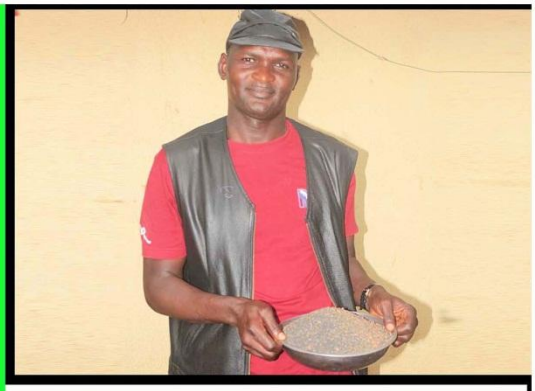


Plate xxxii: The researcher with some quantity of tin in Godo Godo



Plate xxxiii: One of the small scale miners housee in Godo Godo



Plate xxxiv: The researcher in Antang District



Plate xxxv: The researcher with the Madaki of Antang District



Plate xxxvi: A farmer showing his palm affected by ASM



Plate xxxvii: Artisan miners filling some copies of questionaire in Antang



Plate xxxviii: Some miners giving additional information to the researdcher in antang

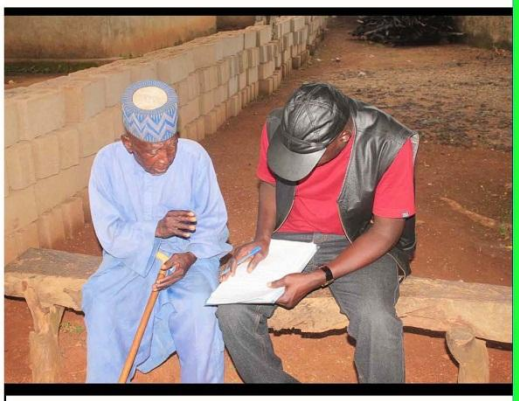


Plate xxxix: An aged ex-miner filling a questionaire

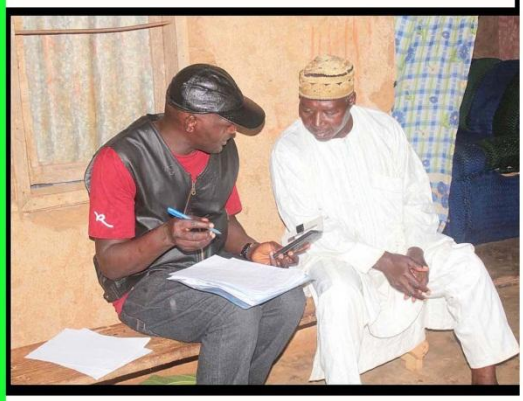


Plate XL: IDI with the Madaki of Antang District



Plate XLi: The researcher, research assistants and the Chief of Godo Godo

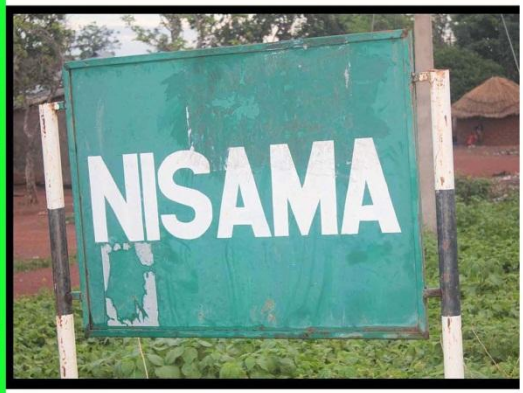


Plate XLii: Nisama village



Plate XLiii: The Dagacin of Nisama welcoming the researcher

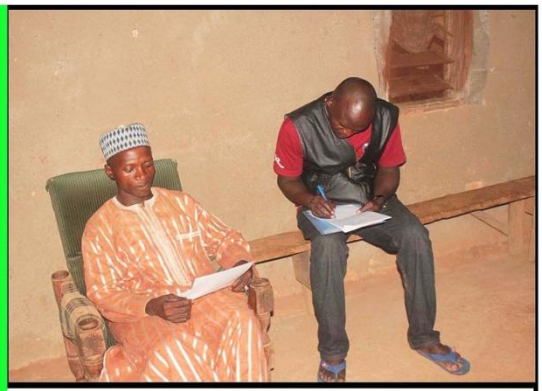


Plate XLiV: IDI with the Dagacin of Nisama

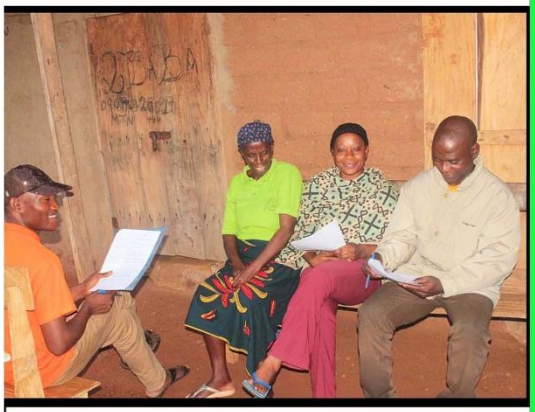


Plate XLV: Some respomdents participating in filling questionnaire in Nisama

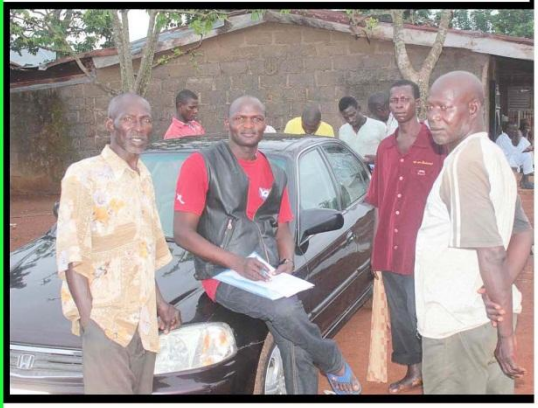


Plate XLVi: Respondents' filling copies of questionnaire in Nisama



Plate XLVii: Researcher observing land destroyed by mining in Nisama



Plate XLViii: An abandoned pit surrounded by grasses in Nisama



Plate XLiX: A sign-post in Maraban Kajuru



Plate L: IDI with a dealer/ex-miner in Maraban Kajuru

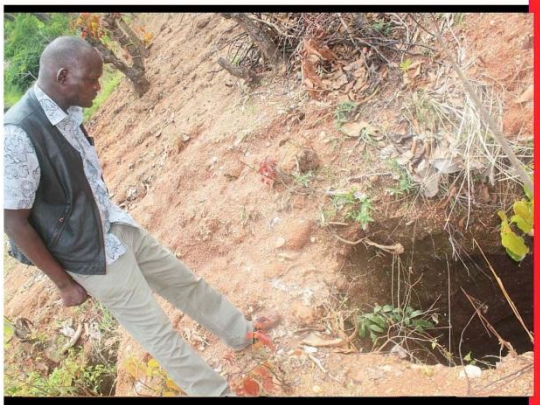


Plate Li: An abandoned mining pit in Maraban Kajuru



Plate Lii: Land damaged by mining activities in Maraban Kajuru



Plate Liii: Entrance to Ancient Kajuru village



Plate LiV: The researcher with the Galadima of Kajuru and some elders



Plate LV: Land degredation by miners in Ancient village



Plate Lvi: The researcher with the Galadima and Dan-Galadima of Kajuru picking some samples of iron-ore



Plate LVii: A blacksmith workshop in Ancient Kajuru village



Plate LViii: A sign-post in Kasuwan Magani



Plate LiX: IDI with an ex-miner in Kasuwan Magani

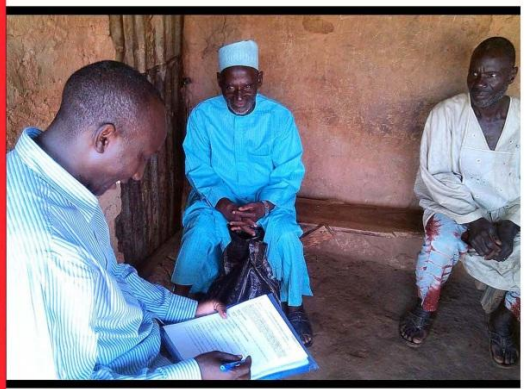


Plate LX: A research assistant administering questionnaire in Kasuwan Magini