FACTORS INFLUENCING PARTICIPATION OF FARMERS IN BROWN SUGAR PROCESSING IN SELECTED LOCAL GOVERNMENT AREAS OF KADUNA STATE, NIGERIA

BY

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

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NIGERIA

JANUARY, 2016

DECLARATION

I hereby declare that this dissertation titled "**Factors Influencing Participation of Farmers in Brown Sugar Processing in Selected Areas of Kaduna State, Nigeria"** has been written by me and it is a record of my research work. No part of this work has been presented in any previous application for another degree or diploma in this or any institution. All borrowed information have been duly acknowledged in the text and a list of references provided.

_____ _____

Jummai Sunday LYOCKS **Date**
Student

CERTIFICATION

This dissertation titled '**Factors Influencing Participation of Farmers in Brown Sugar Processing in Selected Areas of Kaduna State, Nigeria,'** by Jummai Sunday **LYOCKS** meets the regulations governing the award of the degree of Master of Science in Agricultural Extension and Rural Sociology of the Ahmadu Bello University, Zaria and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This work is dedicated to God Almighty the giver of life and wisdom who saw me through the turbulent and hectic M.Sc. programme successfully and to my loving and darling husband, Dr. Lyocks S.W.J. and my children Ghifenhas and Ghitonmen Lyocks for their patience and financial support.

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ABSTRACT

The study was conducted to assess farmer's participation in brown sugar processing in Makarfi, Soba and Kubau LGAs. A multistage sampling method was used. Data were collected from a total of 138 respondents using structured questionnaire and interview schedule. Data analysis was carried out using descriptive statistics, logit regression, one sample t-test and t-test independent. The result showed that the age of the majority of the respondents fell between 31 and 50 years. Majority (75%) of the respondents were married. About (97%) of the respondents had one form of education of another. Logit Regression analysis showed that activity perform (1.01) and total income (0.00) were significantly related / influence to full- time participation at 1% level of significance while household size (1.20) and extension contact (0.06) were significantly related/ influence to full- time participation at 5% level of significance with a log likelihood of -30.76368, Pseudo R^2 of 0.6498 and LR statistic of 114.15 which shows that the model has a good fit, Sex, age, marital status, level of education, primary occupation, access to credit, processing experience and cooperative association have positive coefficient, though not significant. One sample t- test reveals that differences existed between the mean income of brown sugar, molasses, bagasse and their total income. The mean income of brown sugar (₦ 39,615.66) was higher than that of bagasse (₦12, 311.70) and molasses (₦31, 303.42). Some of the constraints facing respondents in the study areas were insufficient capital to expand their businesses, lack of improve processing equipment, Lack of good roads network and Lack of marketing links were the major problems. It was recommended that government should make fund available to farmers inform of agricultural soft loan, make available improve processing machine at subsidize rate, farmers should form co-operative group (processors group) and more extension agents should be employed.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Nigeria is an agrarian society with about 70% of her over 170 million population engaging in agricultural production (NBS, 2014). Agriculture is therefore the most assured engine of development and a reliable key to industrialization. Since the discovery of petroleum in commercial quantities in Nigeria, oil importance to the Nigerian economy has been increasing. But, in spite of the huge but ephemeral revenue derived from petroleum, agriculture remains the cornerstone of the Nigerian economy (Salami, 2006). The contribution of Agriculture to the GDP in 2014 is 40% (NBS, 2014).

Sugar from sugar cane is extracted today much the same as it was 40 years ago. Sugarcane has been grown all over the world in several types, and reached a popularity peak in the 1700s with the rise of Atlantic sugar plantations (Hoyum, 2014). Sugar cane was first introduced into the country along the western and eastern coast of Nigeria in the fifteenth century (Colonial Era) by European sailors (Busari, 2004). However, only few farmers planted it then as a backyard garden crop because it was not possible to process it into a meal but was only fit for chewing. Following the development of the technique of making honey from sugar cane around the beginning of the 18^{th} century, further interest in the crop was generated and it rapidly spread from the coast to the other parts of the country, even to the drier northern areas, (Busari, 2004). By the end of the first world war, the technology for the production of crude sugar cakes, (Brown sugar) Jaggery

(India) or *Mazarkwaila*(Hausa) had been developed. Today, *Mazarkwaila* is still a common sugar product in the northern part of Nigeria where it is used as a traditional sweetener. Sugar has been the most widely used sweetener for commercial purposes by man. Sugar is consumed by households and particularly the industries where it serves as raw materials for companies in the foods and beverages industry i.e. confectioneries, soft drink and brewery and pharmaceuticals alike account for 41% of the total sugar consumption in Nigeria (NSDC, 2006). Brown sugar historically was used to sweeten drinks, bake breads and pastries, and make candies sauces. It is now used to add the rich flavor of molasses to baked goods and other recipes, and light brown sugar can still be used as a substitute for white sugar in almost every case.

Sugar extracted from sugar cane is processed to become raw sugar at sugar mills and then further purified to refined white sugar in a sugar refinery, using energy intensive processes (Chou *et al.*, 2002). Development of sugar processing technology at intermediate or rural levels with indigenous technology had reached a tertiary stage in several other third-world countries like India, Cuba, Brazil and Puerto-Rico (Raphael, 2004). In these countries, enormous socio-economic benefits have been reaped, such as generating employment, increasing incomes of the citizenry and raising the living standard of the rural dwellers, thus justifying their existence and improvement (Baron, 1975; Garg, 2007). Brown sugar is made from sugarcane, cane stalks are cut and squeezed for their juice, which is then boiled until it thickens to form molasses. The process of making brown sugar traditionally is by using horse-driven crushers, diesel crushers or manual juice

extraction which is not so common. In Nigeria, males and females are engage in agricultural activities, but the major involvement of a particular gender varies with the culture and religion. Umechukwu (2004) explained that processing of Gari and groundnut are mainly in the hands of women while brown sugar and palm oil are mainly processed by men. The level of farmers participation in traditional brown sugar processing in the study area varies between the male and the female, most of the work done is dominated by the male farmers because it is labour intensive, men who processed it use either horse or diesel-powered crushers while the women who processed brown sugar do it manually (Yusuf and Ogodo, 2013). Farmers' participation in development programs had in recent years become increasingly popular especially those that are geared towards poverty reduction. In the words of Parfitt, (2004) "it is clear that participation has become one of the central influences in mainstream development thinking".

Sugarcane is the raw material used for manufacturing sugar in Nigeria which accounts for about 61% of the total world sugar production (Wayagari *et al*., 2003). Two types of sugarcane are grown in Nigeria – industrial and soft (chewing) cane. The industrial cane is the hard or tough type generally processed into sugar by the sugar estates. The soft cane is mainly chewed raw for its sweet juice. Some of it is also processed into different crude sugar products. Local farmers grow soft cane all over Nigeria. Soft cane production accounts for about 60% of total sugarcane production in many years in Nigeria (Wayagari *et al*., 1999;Nmadu *et al.,* 2010).The exact total land area currently under cane cultivation and the total production in Nigeria is not known, but it is estimated at

between 25,000-35,000 hectares, out of which soft cane covers 18,000 hectares. Average yield of soft cane on farmers' plots varies between 45-75tonnes per hectare depending on management, varieties and inputs used(Nmadu*et al.*, 2010). Globally the major use of the crop is in the manufacture of sugar. Sugar is used universally as a sweetener, blender and as a preservative. Major industrial users of the product include the pharmaceutical industries, the food and beverages industries, bakeries, soft drinks bottling plants as well as biscuit and other confectionery manufacturers. Domestically, it is used in large amounts as a table sweetener. Although a number of other by-products, e.g. bagasse, molasses, etc. are produced when sugarcane is processed, its major product and the one for which it is commercially cultivated is sugar. Nevertheless, cane production for chewing purpose is also of major commercial interest in Nigeria (Wayagari *et al.*, 1999; Nmadu *et al.*, 2010). According to FAOSTAT (2011), Nigeria's accumulated import of sugar and sugar products in the last 50 years is valued at $8.18B (N1267.6B) showing that much of the sugar needs have been met through importation.

In spite of its large areas of cultivatable land suitable for the growing of sugar cane and some recent investments in the sub-sector, Nigeria still imports 90% of its sugar (Flexible sugar industry (FSI), 2008). Sugar, is one of the product gotten from the processing of sugar cane, is one such consumer goods that is consumed by virtually everyone because it has little or no substitute. Although there are variants of sweeteners– honey, saccharine, and others, these are seldom used by the industrial consumers of sugar. Another product that can be produced from

sugar cane, ethanol, is a very useful biodiesel(Foraminifera magazine (FM), 2012). Brown sugar has a long history, being the earliest recorded sugar used.

1.2 Problem Statement

Sugar is an essential commodity used by consumers in Nigeria. The processing of the conventional sugar cannot meet up with the demand of the people, which is estimated at about 1.4 million tonnes while local production only has the capacity of less than 10% of the national requirement (Usman, 2012). At present, high priority is accorded to brown sugar production in Nigeria, as 98% of brown sugar demand is met through importation (Daily Trust Newspaper, 2012; Uba, 2013). Nigeria had been losing N568bn yearly to the importation of brown sugar (The Punch, 2014). With growing population, demand for sugar for human consumption is on the increase in Nigeria. Trends in industrial activities suggest that the demand for sugar will continue to rise. The demand for sugar in Nigeria today is put at between 2.5 and 3 million tonnes (Foraminifera magazine, 2012).

Various attempts have been made in the past to increase sugar production in Nigeria. The establishment of large scale sugar processing factories in four strategic locations (viz: Bacita, Numan, Sunti and Lafiagi) is an example of such efforts (Tiamiyu *et al.*, 2013). However, both (Bacita and Numan) of which are now undergoing transformation from public to private ownership, are out of production. Several of these mini plants will be required to produce raw sugar that will feed the larger factories. In line with government policy, a mini brown sugar plant that has the capacity to process 10 tonnes of cane per day was developed by the National Cereals Research Institute Badeggi (NCRI), the development and

farmers participation using the mini brown sugar have received so much criticism that the policy was not benefiting the farmers (Ucha and Chimobi, 2010).

One of the major problems with Nigeria sugar industry is the low level of technology involved. Rural farmers in area where sugar cane are grown are participating in traditional brown sugar processing using either horse-driven crushers, diesel crushers or human labour (Olaito*et al.*, 2013). Hedayat and Ma'rof, (2009), stated that constraint to farmer's participation is related to lack of appropriate institutional framework for farmer's participation coupled with advanced and inappropriate technology involved. Little or no government encouragement is given to sugar processing at the village level. Indeed, processing at village level is almost impossible without meaningful research on processing. Thus there is an insignificant contribution to overall national sugar production from this sector. The drudgery associated with traditional processing is enormous and the products from traditional processing methods are often contaminated with undesirable extraneous matter. Some of the products are therefore not hygienic and so are of poor market value. Better processing methods can improve the life-styles and health of rural people through higher processing efficiency, labor saving and reduced drudgery, all of which improve the quality of products.

Production of sugarcane in Kaduna State is common in most parts of the state such that almost in every community, sugarcane is grown but there are very few communities that process the cane into brown sugar. Rather, white sugar which is expensive is more commonly used than the brown sugar and people prefer to take the sugarcane as raw stalk than the processed brown sugar.

There is need to increase farmers participation in the cultivation and processing of sugar cane into sugar locally in order to conserve the country‘s foreign exchange.

Despite the importance of participation of farmer’s in brown sugar processing, scanty information is available on the factors influencing participation of farmers in brown sugar processing in Kaduna state. Thus, this study would provide the valuable bench mark information to the partially existing knowledge about participation of farmers in brown sugar processing in the study area.

In view of the foregoing, this research seeks to address the following questions:

i. What are the socio-economic characteristics of brown sugar processors in the study area?

ii. What is the level of participation of farmers and type of processing technologies available in brown sugar processing in the study area?

iii. What are the socio-economic and institutional factors influencing the level of participation of farmers in brown sugar processing in the study area?

iv. What is the effect of participation of farmers in brown sugar processing on their income generation?

v. What are the constraints militating against farmers participation in brown sugar processing in the study area?

1.3 Objectives of the Study

The broad objective of the study was to assess the factors influencing participation of farmers in brown sugar processing in Soba, Kubau and Makarfi Local Government Area of Kaduna State.

The specific objectives of the study were to;

i. describe the socio-economic characteristics of the brown sugar processors in the study area;

ii. describe the level of participation of farmers and type of processing technologies available in brown sugar processing in the study areas;

iii. determine the socio-economic and institutional factors influencing the level of participation of farmers in brown sugar processing in the study area;

iv. determine the effect of participation of farmers in brown sugar processing on their income generation;

v. describe the constraints militating against farmers participation in brown sugar processing in the study area;

1.4 Justification of the Study

The Nigerian sugar industry is largely under - developed due to its untapped resources and potentials. This study will bring to fore factors that have hindered

sugar industry development in Nigeria and proffer possible solutions for improvement to bring about desired changes in the industry. Therefore, this study is significant because increase in the development of brown sugar production/ processing will ultimately benefit sugarcane farmers in terms of enhanced income earning if suggested improvement measures are followed, it will benefit traders through employment generation (Perera, 2002), reduce rural- urban migration by the youth, benefit the Government and people of Nigeria in teams of foreign exchange conservation. Findings will be available as guide for Nigerian government to amend sugar policy that would reduce sugar importation and also play a role for the realization of Vision 20: 2020.

Traditional brown sugar processing is not a very popular method to many people, despite its significance in the processing industry. Since there are inadequate studies conducted to examine the factors influencing participation of farmers in brown sugar processing, it is believed that the findings of the study would add to the existing knowledge in the area of brown sugar processing enterprise in Nigeria and contribute and provide valuable information that would guide researchers who might be interested in carrying out further works on brown sugar processing and to raise public awareness of the factors influencing participation of farmers in brown sugar processing in the study areas. Then, the policy makers will use the information to draw plans and programs to enhance brown sugar production.

1.5Hypotheses of the Study

In course of the research, the following hypotheses were tested:

i. There is no significant relationship between socio-economic and institutional characteristics of the respondents and their participation in brown sugar processing.

ii. The type of participation of farmers in brown sugar processing has no significant impact or influence on their income.

CHAPTER TWO

LITERATURE REVIEW

2.1.1 History of Brown Sugar

Brown sugar has a long history, being the earliest recorded sugar used. Sugar cane has been grown all over the world, and it reached a popularity peak in the 1700s with the rise of Atlantic sugar plantations. It comes in several types, and while it originally was an unfinished form of refined sugar, now it is more often created by adding molasses to white sugar (for better consistency). It has almost identical food properties to white sugar, but adds a molasses-like flavor to foods. Brown sugar is made from sugar cane or sugar beets. Cane stalks or beets are cut and squeezed for their juice, which is boiled until it thickens to molasses. Sugar crystals settle out of this mixture, and are stripped of the molasses through centrifuging and drying. If the process is taken to its conclusion, white, refined sugar is the result. Brown sugar is made by leaving some of the molasses on the sugar crystals (Hoyum, 2014).

Brown sugar cane into popular use with the rise of European sugar plantations in the Caribbean in the 1700s. It was widely used as a sweetener in England and its American colonies, because it was much cheaper than white sugar. The use and export of brown sugar from the islands rose in conjunction with the infamous "triangle trade." The Triangle trade refers to a three-legged trade route that saw much intercontinental shipping trade in the 1600s and 1700s(Hoyum, 2014). Manufactured goods were traded from Europe to Africa, where men, women and

children were enslaved and taken to the Caribbean islands, where they were sold as slaves to Southern colonies or island plantations, the second leg of the triangle, or the "Middle Passage." The third leg was to trade slave for produced goods like sugar, tea, cotton, tobacco and coffee to the colonies and back to Europe (Hoyum, 2014).

2.2 Description of Brown Sugar Production

Brown sugar can be defined as a granulated sugar having golden color with 0.1-0.2mm crystal size depending on the process condition and cane maturity in the field. It has brix value of 80-85^{0}and dissolves easily in water. It also has a characteristic chocolate flavor (SSC, 1998). Molasses is the liquid fraction left after separating brown sugar from the massecuite through centrifugation. The molasses of the sugar plant has 70-75^{0}brix. As a result, it is still useful for human consumption in addition to other various uses such as production of cough syrup and children drugs in the pharmaceutical industries, alcohols and soft drinks in the brewery industries, biscuits, breads in the confectionery industries and production of animal feeds among others. The only difference with white crystal sugar is the use of chemical treatment (lime and Sulphur dioxide gas), this permits the removal of colour matters and allows it to be white (SSC, 1998).

Brown sugar processing begins form the moment the sugar cane is harvested. Harvest commences when the leaves turn yellow, green, purplish, reddish or when cane punches show that there is a sufficiently high content of sucrose and this occurs between 10 and 14th or 4-8 and 12thmonths after planting (African farming,

1986; Anno, 2013). Depending on the availability of moisture in the soil, the cane should reach the height of 6-9 feet tall Abbott (2009), stated that the most suitable moment for harvesting sugar cane for processing is when it is able to produce an economic optimum of recoverable sugar per area per time. He further stated that the ultimate correct economic formula must determine when or at what age a sugar cane stands will supply the largest quantity of recoverable market sugar per surface unit and per time unit.

The main product of sugar cane is sucrose which is later processed into brown sugar. The sucrose accumulates in the stalk internodes. The cane stalks are cut and squeezed for their juice. However, cutting is the most common method of harvesting throughout the world but some locations for example Florida, Louisiana and Hawaii in the United States have used mechanical harvest for several years. After cutting, the cane is loaded by hand or using mechanical grab loaders into trucks. The cane is transported to the mills using trailers trucks or tailors. The sugar cane is immediately processed after cutting because it rapidly begins to deteriorate and cannot be stored for later processing without excessive deterioration of the sucrose content.

2.3 Brown Sugar Production

Brown sugar is a sucrose sugar product with distinctive brown color due to the presence of molasses. It is either an unrefined or partially refined soft sugar. Brown sugar can be made from addition of molasses to refined white sugar. Brown sugar contains from 3.5% molasses (light brown sugar) to 6.5% molasses (dark

brown sugar) The product is naturally moist from the hygroscopic nature of the molasses and is often labeled as “soft” the product may undergo processing to give a product that flows better for industrial handling (Nutrition and Diets, 2007).

Many brown sugar producers produce brown sugar by adding cane molasses to completely refined white sugar crystals in order to more carefully control the ratio of molasses to sugar crystals and to reduce manufacturing costs. This allows the production of brown sugar in areas where the source of sugar is predominantly from beet. Brown sugar prepared in this manner is often much coarser than its unrefined equivalent and its molasses may be easily separated from the crystals by simple washing to reveal the underlying from the crystals. The molasses used is often obtain form sugar cane because the flavor is preferable over that of beet sugar molasses. Beet molasses generally carries a strong vegetable ordour and taste from its beet origins, brown sugar produced from this will have a slightly different taste and smell to that produced with cane molasses (Nutrition and Diets, 2007).

Brown sugar can be made at home by melting white granulated sugar with molasses. Using one tablespoon of molasses for every cup of white sugar (one-sixteenth or 6.25% of the total volume) through blending will yield dark brown sugar. For light brown sugar, between one and two teaspoons of molasses per cup should be used instead.

2.3.1 Nutritional value of brown sugar

Brown sugar has a slightly lower caloric value by weight than white sugar due to presence of water. One hundred grams of brown sugar contains 373 calories, as opposed to 396 calories in white sugar (New Scientist, 2006). However, brown sugar packs more densely than white sugar due to the smaller crystal size and may have more calories when measured by volume. Brown sugar is reputed to have some value as a home remedy for menstrual cramps, though is likely apocryphal as shown in table 1.

Table 2.1: Nutritional value per 100 g (3.5 oz.)

Nutrients	**Nutritional value**
Energy	1,590 kJ (380 kcal)
Carbohydrates	
Sugars	97 g
Fat	0.00 g
Protein	0.12 g
Other constituents	
Water	1.3 g
Sucrose	94.5 g

Source: USDA (2014)

2.4 Natural Brown Sugar

Natural brown sugar is a name for raw sugar which is a brown sugar produced from the first crystallization of cane. Raw sugar is more commonly used, than further processed white sugar. Such “natural brown sugar” is free of additional dyes and chemicals. There is a higher level of inclusion of molasses in brown

sugar than white sugar giving it a higher mineral content. Some instance of natural brown sugar have particular names and characteristics and are sold as such e.g. demerara or muscovado (Nutrition and Diets, 2007).

2.4.1. Health benefits of natural brown sugar in agricultural processing

Natural brown sugar is processed in a natural way completely free from any harmful chemicals such as phosphoric acid, formic acid, Sulphur dioxide, preservative, or any flocculants, surfactants, bleaching agents or viscosity modifiers. Natural brown sugar has 11 calories 4 grams (1 tea spoon). It is also nutritionally rich and retains all natural minerals vitamin content present inherent in sugar cane juice. These qualities give natural brown sugar more health benefits than the brown and refined white sugars. Experts recommended for more consumption of natural brown sugar than white and brown sugar as white is in most cases chemicalised as shown in table 2.

Table 2.2: showing nutrients content of natural brown sugar.

Nutrients	**Amount / 100 (g)**
Total mineral salts	740 mg maximum
Phosphorus (P)	3.9 mg maximum
m (Ca)	85 mg maximum
Magnesium (Mg)	23 mg maximum
Potassium (K)	100 mg maximum
Iron (Fe)	1.3 mg maximum

Imbalance in minerals is one prime cause of disease. Reason for this is over-consumption of refined products like refined sugars, refined oils and refined salt it is therefore vital to consume less processed, move natural and nutrition products such as the healthy and wholesome natural brown sugar **(**Nutrition & Diets**,** 2007).

2.5 Previous Studies on Socio-Economic Characteristics of Farmers

Socio-economic characteristics of farmers have been reported to influence their level of participation in agricultural project implementation (Olufemi *et al.,* 2001 and Banjol *et al.,* 2003). Most of the studies carried out in Nigeria have shown that, there exist a close relationship between farmer's socio-economic characteristics and their participation in agricultural food processing. Onwurafor and Enwelu (2013) found that socio-economic factors such as Age, household size, formal education, processing experience were related to processing:

Age is an important determining factor in agriculture especially in Nigeria where agricultural activities are carried out manually with minimum technical knowledge. For instance, Yusuf and Ogodo(2013), found that 44% of the brown sugar processors were within the age group of 21-40years.This is regarded as the youthful and active period when they make vital impact on agricultural production, processing and technology development generally (Fapojuwo, 2010). This supports the report of Tyabo *et al*., (2013), who assert that, in terms of agricultural productivity activities, age's 21-40years are economically viable for production of crops and processing. This could be attributed to the fact that processing activities are labour intensive which the youth are endowed with.

2.5.1 Marital status

Yusuf and Ogodo (2013), observed that majority (92%) of the processors were married. This also agrees with Fapojuwo (2010), who observed that most of the farmers engaged in agricultural production are married; this shows that there is great importance attached to marriage in the societies. This suggests that, there may be active family involvements, to meet up the extra labour force requirement for the operations and this is based on the number of children in the family.

2.5.2 Education

Odebode (2008), described education as an essential tool for effecting desirable change in attitudes, skill and knowledge of individuals. Ekong (2000), also observed that education is a dynamic instrument for enhancing farmers' participation in agricultural production. The higher the level of literacy the better the farmer's ability to understand and interpret new skills, then apply such into income generating activities which can improve their productivity and go further to value their livelihood.

2.5.3 Processing experience

Processing experience is gained with number of years spent in doing an activity (Kassie, 2009). He maintained that as the years in doing agricultural activity increase among farmers, their years of experience also increase which in turn enhances the production and or processing skill of the farmers.

2.6 Level of Farmer's Participation in Agricultural Processing

For every activity, social or economic, the extents to which people are involved are viewed to ascertain their level of involvement in it. It is therefore important to examine how people, especially in rural areas in Nigeria are engaged in agricultural activities for easy assessment of the level of production. The level of participation can be described as full time or part time when people are primarily engaged, wholly and solely in agriculture or take it as a secondary occupation respectively.

Yusuf and Ogodo (2013), noticed that 88% of the farmers were engaged in full-time production of brown sugar. This gives an indication of the peoples' interest in the processing. The full-time involvement of the famers helps them meet financial needs of their family. Yusuf and Ogodo (2013), reported that small children were involved in the sugar cane processing and this may make some of them to skip school days and some may stop completely during the processing period.

In Nigeria, both males and females are engaged in agricultural activities, but the level of involvement of a particular gender varies with the culture and religion women are involved in many agricultural activities but mostly in processing. For example, Umechukwu (2004), found that processing of Gari and groundnut are mainly in the hands of women while brown sugar and palm oil are mainly processed by men. Yahaya and Aina (2007), pointed out that it is believed that male are often more energetic for energy demanding activities such as agricultural

activities. While Oladele and Kareem (2003) stated that gender pose no barriers to active involvement of farming activities. This was seen in the male dominance of rural source of livelihood implies the laborious nature of brown sugar processing right from peeling to extraction which their female counterpart cannot easily undertake. This is because the operations require a lot of energy and is labour intensive especially in the rural area where local implements are usually used (Okwoche *et al.,* 2012).

2.7 Socio- Economic and Institutional Factors Influencing Farmers' Participation in Agricultural Processing

Theinstitutional variables to be considered in this study include extension contact, membership of association and access to credit. These variables will be tested to determine the manner and extent to which they influence the farmers' participation in processing in Kaduna state. Institutional variables are reported to have either positive or negative influence on farmers' participation in agriculture. For example, Osuagwu (2002), found a positive and significant relationship between the frequency of extension visits and participation of farmers in agricultural activities.

Access to credit facilities is also a very important factor in agricultural food processing enterprise. This indicate that for farmers to fully participate in processing there is need to access credit and this should move beyond friends and relative to functional co-operatives and other financial institutions.Equally, membership of co-operative societies are avenue that people come together to fully achieve in a group what they cannot achieve alone (Ijere, 1992).

Brown sugar when produced is sold. Yusuf and Ogodo (2013), revealed that 40% of the farmers sold their product at home. The wholesalers and retailers visit and buy the products at home. This method is preferred by the processors because even if farmers carry it to the markets, the price remains the same.

2.8 Constraints Militating Against Farmers Participation in Processing

In any activity, there are challenges that could inhibit the development of such activity. Igbozurike (1998), affirmed that middlemen exploit the sales and market of produce in no small measure in which they make more gain than the producers. Low market price for products is a major challenge faced by the processors because at times the price of the product does not worth the labour put into the processing activity. Yusuf and Ogodo (2013), reported that, poor demand for the product equally affect the market price of the product.

In production, one encounter challenges which could hinder the achievement of his set target (goal). Raw material is vital to any production process without which production is not possible. Damaged cane stalks being the main raw material for brown sugar processing when it goes bad it does not make good brown sugar and so, it makes processing more difficult and labourious which affects their returns.

Farmers are faced with the problem of inadequate fund or capital which makes them unable to expand the scope of their production, this is attributed to poor access to loans or credit from banks due to lack of cooperative among the farmers.

The problem is as a result of lack of trust among the processors or attached to co-operative groups.Social factors such as government supports in terms of roads construction, provision of processing facilities could affect the sales of product and processing (Osuala, 1991). Saito and Weidemann, (1990), reported that lack of knowledge of modern and improved agricultural practices and techniques have prevented rural African farmers from being fully productive. This is in line with Ugwu (2009), who reported that productivity in Nigeria has not grown sufficiently due to under investment in new technology and slow adoption to existing improved technology. Moreover farmers depend on the use of traditional processing implement, unimproved varieties and personal savings as only source of finance (Adegboye, 2010).

2.9 Nigerian History of Natural Brown Sugar Processing

The history of indigenous processing of sugar-cane into traditional recipes in Nigeria dates back to the early 18th century. By the 1920s, the technology for the production of crude sugar cakes called *"Mazarkwaila"* (Hausa) had been developed. Reports had it that during the first world war, the British colonialists imported some mills to assist local *Mazarkwaila* makers in increasing their output of sugar cakes for consumption by African soldiers who were reported to relish it (Aikulolo, 1978)(Misari,1997). With the advent of the advanced technology of refined sugar production, nothing much happened by the way of improvement to the local processing technology. Till today, the method has remained the same with exception perhaps of the use of motorized cane crushers by some local processors, (Buasri, 1999) (NCRI, 2008). Local people using this technology are

still prevalent in many states of northern Nigeria, especially in Anchau, Makarfi and Rogo areas of Kaduna, Katsina and Kano States.

2.9.1. Traditional sugar production

As already noted, traditional processing of sugar cane into a variety of sugar products is still found in several areas of northern Nigeria. Among the most common products of cane processing are *Mazarkwaila* and *Alewa* (Hausa).

2.9.2 Brown sugar (*mazarkwaila*)

Mazarkwaila, also called *cure* in India, *panela* in South America, *Desi* in Pakistan and *Jaggery* in many parts of Africa and Asia is a conglomerate of unrefined sugar crystals and molasses prepared into a solid mass and eaten as a form of local confectionary and a ready source of energy. It is also commonly used as a sweetening browning agent. The history of *Mazarkwaila* production in Nigeria dates back to 1920's according to Busari (2004),reported that during the First World War, the British colonialists imported some mills to assist *Mazarkwaila* production to increase their output of the "sugar cake" for consumption by African soldiers (Misari and Busari, 1996). With the advent of the advanced technologies of refined sugar production, nothing happened much by way of improvement to the local processing technology in most of the producing communities. The art of *Mazarkwaila* remained the same over the years in many states of the northern

Nigeria, especially in the Makarfi, Kubau and Soba local government areas of Kaduna State (Buasri, 1999).

2.10 Nigeria Sugar Consumption Trend

Domestic sugar production was increasing very gradually and witnessing serious depression in some years, the outlook of sugar consumption was on a dramatic rise (Busari, 2004). Records show that sugar consumption in Nigeria was 43,000MT in 1955. It rose to 450,000MT in 1974. In 1982, demand had jumped to one million MT of whichthe country produced only about 40,000MT (Adelakun, 2011). Since then, domestic consumption had hovered around 800,000 – 900,000 tonnes annually up to 1992 (FOS, 1999). Indeed, a negative growth rate was recorded in sugar consumption between 1991 and 2000 (NSDC, 2004).

Nigeria's overall sugar consumption in 2010/11 is forecast to rise to about 1.45 million MT up from 1.40 million MT in 2009/10. This forecast is based mainly on population growth and declining raw sugar prices, which is expected to culminate in increased demand, especially for industrial use. The use of sugar in industrial activities such as manufacture of beverages and confectionary products, pharmaceuticals and pastries, is rising rapidly. This growth in industrial sugar is expected to continue, given the recent exploration of sugar for production of 6ethanol, electricity and alcohol, albeit still on a small scale. On the other hand, household usage/demand for sugar is growing at a slow and steady rate compared to industrial demand (Adelakun, 2011).

The fact remains however, that the bulk of the sugar consumed in the country will still be imported, either in its raw or refined form. Right from inception the sugar industry has never been able to satisfy the nations requirements, but even worse is the fact that the nation's capability to do so has been dwindling from the 1970s. Reports have shown that domestic sugar production as a percentage of consumption in Nigeria over the three and half decades (Busari, (2004), and NSDC, (2008).

2.11. Processing Techniques of Brown Sugar *(Mazarkwaila)*

The various processes involved in the production of brown sugar from sugar cane are similar for both the NCRI (National Cereal Research Institute) Badeggi mini plant and the industrial systems. The production of *Mazarkwaila* from fresh canes involves four (4) major steps, namely: Juice extraction Juice boiling and concentration, syrup cooking and dispensing of thickened syrup into molds for fuller discussion of the processing technique, Busari and Misari, (1997).

2.11.1 Extraction

One to four stalks of cane are fed at a time into the mills while it is running either on horse-powered or diesel engine. Juice is collected from a drainer into a large metal basin usually made from oil drums, cut into halves. Juice recovery (hence sugar recovery) is relatively low as the bagasse from these mills still retain a lot of juice. About 40 liters of juice is generally obtained from 100kg of cane. The common cane type used in Makarfi, Anchau and Soba areas of Kaduna state is

"farin Rake" (White cane) while in Kwaire and Danbarjiri areas the common cane used is called *"Koma"* in Hausa.

2.11.2 Juice boiling and concentration

This is carried out in a pair of open pans (*Murhu*-Hausa) made from cutting oil drums into halves and placed on permanent clay, furnaces or burners. Dried bagasse or dried sorghum/maize/millet stalks are fed through one of the furnace while the other and leads to a short chimney. Freshly milled juice (*Ruwan Rake*-Hausa) is poured into the two pans, each pan taking about 20 litres of juice. The juice is then boiled until it thickness into a brown syrup, while scum (*yadi*-Hausa) and pieces of bagasse floating on its surface are continually removed, using perforated metal ladle called *Mayadi*-Hausa. Occasionally also, droplets of vegetable oil are added to the boiling juice to prevent it from boiling over. The boiling process takes about one hour 30 minutes to two hours when the juice would have thickened enough into a strip (*Madin-rake*-Hausa).

2.11.3Cooling

The *madin-rake* is collected and poured into an earthen pot (*Kwatanniya*-Hausa) and stirred gradually using a wooden stirrer *(muciya)*. Stirring is done for about 10 minutes to cool the syrup and enable it to further thicken. The earthen pot probably represents crystallizer in modern sugar processing.

2.11.4 Dispensing into molds

Before the thickened syrup hardens completely, it is dispensed using a calabash spatula (*Ludayi*-Hausa), into small metal molds where the brown cake *(Mazarkwala)* finally cools then hardens. To ease removal of sugar cake from the molds, the inside are first rubbed with oil. After dispensing into moulds, the inside of the *Kwatarniya* (earthen pot) is scraped using sickle *(lauje*-Hausa) and the scraping called *Aje* is more valued because it contains more sugar.

2.12 Importance of Brown Sugar Processing

Sugar is used in many ways. It is not only indispensable food and sweetening agent in our household but it is used extensively in the food and sweets manufacturing industries also for the manufacture of chocolate, bakery and confectionary goods. In the pharmaceutical and related industries, sugar is an essential factor that could not be missed. In the beverage industry, large quantities of liquid sugar (syrup) are used apart from crystallized sugar. Sugar obtained and it processing activities have the following economic importance to the farmer and the general public.

2.12.1 Medical industries: -

The miraculous effect that was ascribed to sugar in ancient times as a medicine has not stood up to critical examination. As was often the case, with the healing art of old, in this case, superstition appears to have had a voice in the maker. A lot of drugs manufactured and used in clinics and hospital, these days contain some quantities of sucrose, glucose or fructose and those are all forms of sugar drugs

such as aspirin, Panadol and injections all contains some quantities of sugar which enable them to work well in the body.

2.12.2 Employment opportunity

Sugar processing is a labour intensive it therefore generates labour/employment for both skilled and unskilled personnel. Deber (1986) pointed out that many sugar producing countries have a large and rapidly expanding rural population which in conjunction with an unemployment situation can be employed in the sugar at harvest and processing For example, the savannah sugar company has a large workforce of about 1,500.

2.12.3 By-products

Anon (2006), reported that there are existing capacities for the industrialization of sugar cane processing by-product such as molasses, Bagasse boards, Bagasse purple and paper andyeast, and they have great economic importance. Molasses is a good source of fertilizer for all farmers because it has a high proportion of Nitrogen and potash. Also, it can be used for feeding livestock and large qualities of molasses are used as sweetener and in the manufacture of alcohol, ethanol, compressed yeast, citric acid and rum. Bagasse is an indispensable and exclusive fuel of the cane sugar boiling during processing, it served as fuel for the broilers and lime kilns. When pressed into blocks or briguests, the bagasse serves as a fuel for power plants (pump stations, central electric power station) and for driving small-gauge locomotives. Bagasse also is a valuable raw material in the

manufacture of coarse paper, paperboard product, panel board reconstituted, agricultural mulch and also the basic materials for the production of cellulose.

2.13 Review of Literature on Factors Influencing Participation of Farmers in Processing

The processing of brown sugar is influenced by many factors. Such factors include socio-psychological factors (traditional believes); personal characteristics of the farmers (age, educational attainment); institutional and socio-economic factors such as access to government services and low farm income, (Ukoha, 2007). Other factors associated with processing as confirmed by other researchers include; gender, age, education of household head, family size and other demographic traits that make up the household characteristics (Clark and Akinbode, 1986), Nkonya *et al.,* 1997; Ersado, *et al.,*2004). Sulumbe *et al.,* (2010) and Readen, *et al.,*(1997), also with the same view, that in Africa and elsewhere farmers decision to participate in brown sugar processing activities is critically dependent on their economic status and household size.

Ayoola *et al.,* (2011), indicated that marital responsibilities associated with cultural and religious practices of seclusion prevented women from out-door direct field activities, particularly for women within reproductive age; would most likely constrain their participation in brown sugar processing. Ayoola *etal*., also, reported that the level of inputs used by female processors of brown sugar was generally less than that of the male processors; similar finding was reported by Ezedinma (2001) , this makes it more cumbersome, which is often characterized with low

quality, low output per unit of time and drudgery. Amaza et al., (2004), attributed women's low access to processing materials to marital and religious reasons. According to Oluwemimo (1998), he stated that the number of illiterate farmers in rural areas is disproportionately high, because they do not have the necessary time to attend adult education classes; they lack the confidence and assurance to break the traditional hold on them and so cannot patronize extension services, even when they are held at their door steps. In same vein, Okerhe and Maigida (1995), reported that illiteracy makes it difficult for farmer/ processors to comprehend simple instruction for food processing and preservation, and to the adoption of innovation.

A number of factors to improved agricultural practices by farmers have been identified by researchers. For instance, credit is required to facilitate adoption of improved processing technologies and expand the scope of processing. Saito (1994), has shown that farmers face a number of barriers to obtain agricultural credit from formal lending institutions (most especially women) because most of them have no collateral.Strategies that mobilize farmers of brown sugar processing to get involved in developing innovations that enhance their access to productive resources might increase their productivity in brown sugar processing.

2.14 Theoretical Framework

According to Scott and Marshall (2005), theory embraces a set of interrelated definitions and relationships that guide our understanding of the empirical world in

a systematic way this study is guided by the social change theory, using concept of participation as the conceptual framework.

Social change theory: Social change can be viewed as a state of dynamism which precludes stagnation and if well managed and directed, always implies progress, development and functioning of social system. (Adekoya and Tologbonse, 2005). Rogers (1995) and Ekong (2003) defined social change as a process by which alteration occurs in the structure and function of a social system. Based on these definitions therefore, any change that occurs in human societies i.e. the social system that may be a social group, community, a town, city or even a nation a change in norms, values, culture, ideas, roles and social habit of a people can be referred to as social social change.

Essenceof human life is change in development and growth. However, the process of change involves interaction and so individual must be understood in terms of the group in which they belong or participate. Saltman (1972), described change in social and economic life style and values of people, technological innovation and social institution. Jibowo (2000), defines social change as any change in ideas, values, norms, social roles, habits, obligation of people, or change in lifestyle, life goals, chances, environment, or in the composition or organization of their society.

Social change can be planned and unplanned. Planned change involves human intervention in controlling the direction of change toward a definite set goal (Salawu, 2007), it could also be a conscious, deliberate and intended attempt to

bring about the change by one or more agents (Rogers, 1995).Unplanned change is that which occurs suddenly usually through the act of nature thereby affording man no chance to plan before it happens. Indeed, theory of social change has a general concern with explanations of sources of social change, the time span of change and the effect of change on the changing unit. This study was guided by planed social change, which assists in analyzing the changes in agriculture with reference to the participation of farmers in brown sugar processing. Brown sugar processing is a planned change because it deliberately seeks to increase the overall income of farmers through processing and sells of products.

2.15 Conceptual Framework

2.15.1 Concept of participation: Participation is a very broad concept (Lane 1995) that means different things to different people (Hussein 1995; Kelly 2001). The term is often used by people with different ideological positions, who give it very different meanings (Nelson and Wright 1995). Pelling (1998) identified that participation is an ideologically contested concept which produces a range of competing meanings and applications. The result is a variety of views on how participation is defined, whom it is expected to involve, what it is expected to achieve, and how it is to be brought about (Agarwal 2001).

According to Buchy, *et al.*,(2000), he stated that Participation is not a new concept. It represents a move from the global, a spatial, top-down strategies that dominated early development initiatives to more locally sensitive methodologies (Storey 1999). There are differing opinions as to the origins of participation theory. Midgley *et al.,* (1986), suggested that the historical antecedents of community participation include: the legacy of western ideology, the influence of community development and the contribution of social work and community radicalism. Buchy, *et al.,* (2000), suggested that literature on participation and participatory processes stems broadly from two major areas: political sciences and development theory. Lane (1995) added to this view, suggesting that participation is heavily influenced by theories of development and is therefore highly varied and complex due to different theoretical positions.

Ndekha,*et al.*,(2003) and Chamala (1995), define participation as 'a social process whereby specific groups with shared needs living in a defined geographic area actively pursue identification of their needs, take decisions and establish mechanisms to meet these needs' (Ndekha,*et al.*,2003).

Participation may be viewed as both an end in itself and a means of accomplishing other goals. Participation with regard to rural development include peoples involvement in decision making process in implementing programmes, their sharing in the benefits of development programme and their involvement in the effort to evaluate such programmes. Essentially, participation is all about involving a significant number of rural people in one way or the other or actions

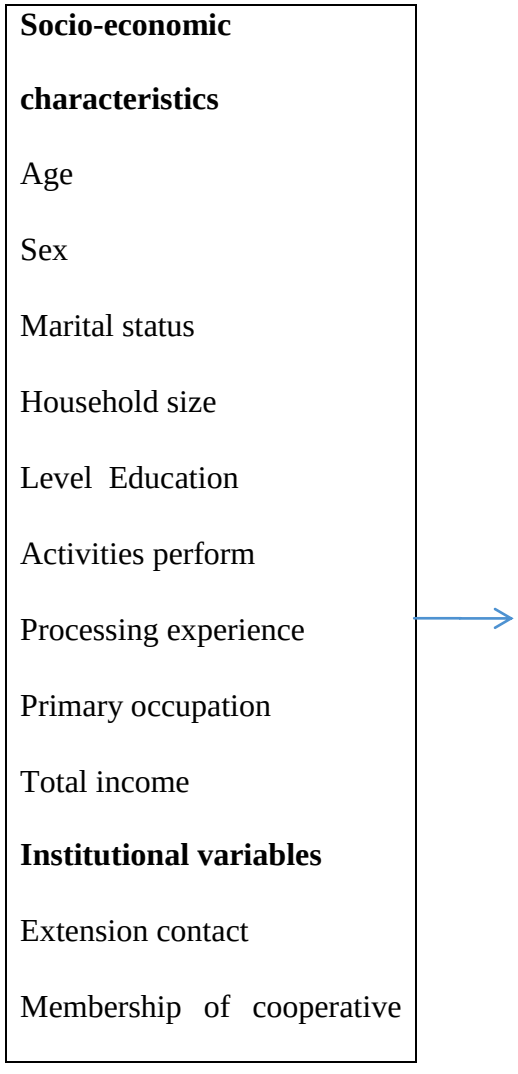
which enhance their well-being (Oakely, 2002). The rural poor must participate in designing and operating a programme which involves them.

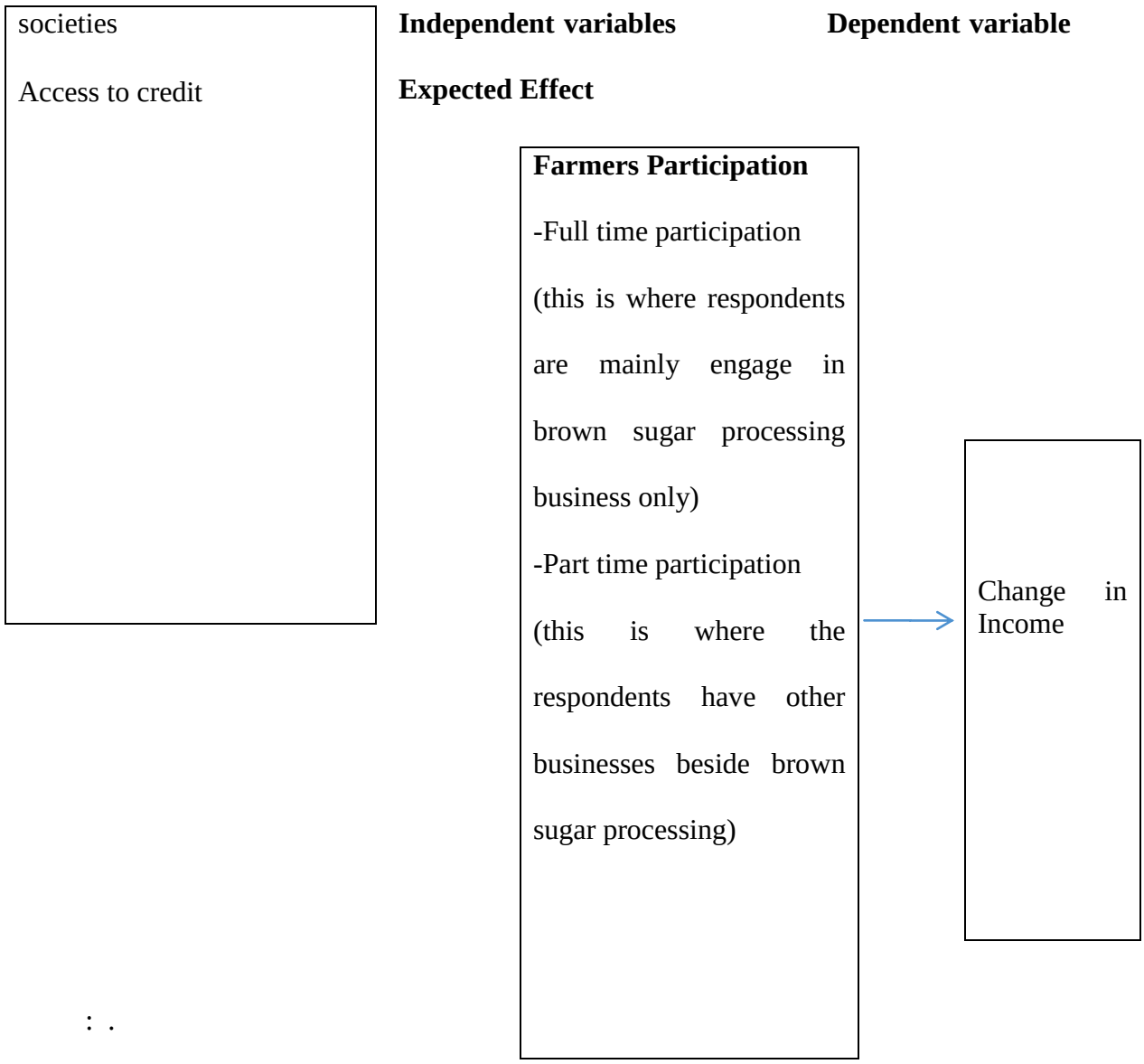
Participation points to the positive recognition of the common good by the person. It is not something which simply happens but is a result of a person's conscious striving for fulfillment and the realization that he cannot do it alone but must seek it together with others.Participation allows the person to maximize his potential inherent in him as a social creature. Participation also opens up a vast array of experiences to the person which will eventually lead him to an even deeper understanding of himself and of others. In participation, a person is called to enter into many different forms of interpersonal relations. It makes it possible for him to experience different roles in their pursuit of a common goal. A good example would be the family – each member is a unique individual whose position in the family is not something which can be replaced by anybody. Their difference also accounts for the very dynamic relationship that occurs within the family. Every member has a task to fulfill in processing which only he/she can do. All of these tasks contribute to the growth and development of brown sugar processors, not only of its members but also of the group, individual, family and the country as a whole. As persons grow, the community grows in the Process and vice versa. Participation ensures that persons fulfill themselves as they work towards attainment of common goal.

2.15.2 The Conceptual Model

Conceptual model is a model made of the composition of concepts, which are used to help people know, understand, or simulate a subject the model represents. The concepts are placed within a logical and sequential design and represent less formal structure. Ekong (2003), views conceptual model as a broad system of explanation which is founded not so much on prior research findings but largely on untested and unproved assumption about social realities. Asika (2001), reported that the interrelationship that exists between the elements in a model can be depicted schematically or mathematically. Emphasis in the model is placed on the influence of socio-economic characteristic of processors of brown sugar and institutional variables on participation of farmers in brown sugar processing. Therefore, the independent variables in the model are the socio-economic characteristics of the processors and the institutional characteristicsare expected to have an influence on the dependent variables where the dependent variable is the participation of farmers (full-time participation and part- time participation) in brown sugar processing in the study area.

Based on the *a priori* expectation, it is expected that socio-economic and institutional factors such as sex, age, education, total income,household size, and activities perform and processing experience have positive influence on level of participation of farmers in brown sugar processing. Also it is expected that extension contact, credit accessibility and membership of cooperative association will exert positive influence on level of participation. Figure 1


Socio-economic
characteristics
Age
Sex
Marital status
Household size
Level Education
Activities perform
Processing experience
Primary occupation
Total income
Institutional variables
Extension contact
Membership of cooperative



: .

Figure 1, A model showing factors influencing the participation of farmers in brown sugar processing and effect on income

CHAPTER THREE

METHODOLOGY

3.1 Description of the Study Area

Kaduna State occupies part of the central position of the northern part of Nigeria (with Kaduna town as its capital) and shares common borders with Zamfara, Katsina, Niger, Kano, Bauchi and Plateau States. To the southwest, the State shares a border with the Federal Capital Territory, Abuja. The global location of the state is between longitude of 6^0 east and 9^0 10' of the Greenwich meridian and between latitude $09^0$10" and $11^0$30" north of the equator. The State occupies an area of approximately 48,473.2 square kilometers and a projected population of 7,805,131 in 2014 based on the 2006 census figure of 6,066,562 on annual population index of 3.2% (NPC 2006). Kaduna State is the third most populous State in the federation after Lagos and Kano State and represents a major focus and Centre of political and economic activities in the nation. The main ethnic groups are Bajju, Kataf, Kagoro, Moro'a, Jaba, Gbaggyi, Kanninkon, Ninzam, Hausa, Fulani, Chawai, Kurama e.t.c with Hausa, English language widely spoken. There are two marked seasons in the State, the dry windy season and rainy (wet) seasons. The wet season usually starts from April through October with great variations when you move north wards. There is heavy rainfall in the southern parts of the State like Kafanchan than northern parts like in Zaria with an average rainfall of about 1016mm.

The State extends from the tropical grassland known as guinea savannah to the Sudan savannah in the north. About 80% of the populations are engaged in peasant farming producing both food and cash crops. The crops produced in the State include cotton, groundnut, maize, yam, tobacco, beans, guinea corn, millet, ginger, rice, cassava, sugarcane, Shear nut, cowpea, mango, watermelon, kenaf, cocoyam, timber, palm kernel, banana, soya bean, onions and potatoes. During the dry season, a considerable number of people in the state engage in irrigation farming along some major rivers and dams. The crops cultivated are mainly vegetables. Another important aspect of agriculture engaged by the people is the rearing of cattle, sheep, goats, pigs and poultry farming.

The agriculture and forest resources are enormous. On the gentle rolling high plains the tropical ferruginous soils have been intensively used for cereal and cotton cultivation. In the *fadama*, the dark grey clay soils (vertisols) have become highly valued and are focused on for intensive agricultural activities especially during the dry season. Large areas of such *fadama* are being used for economically valuable

market gardening for growing tomatoes, chilies, sweet pepper, okra, onion, Irish potato and sugar cane using motorized engines to irrigate the flood plains/fadama of Galma and Tubo basins. Recently, grapevine growing has been introduced and has gained wide acceptance on the small but intensively cultivated farms. The entire land structure consists of an undulating plateau with major rivers in the state

including River Kaduna, River Wonderful in Kafanchan, Rivers Kagom, Gurara and Galma (Figure 2)

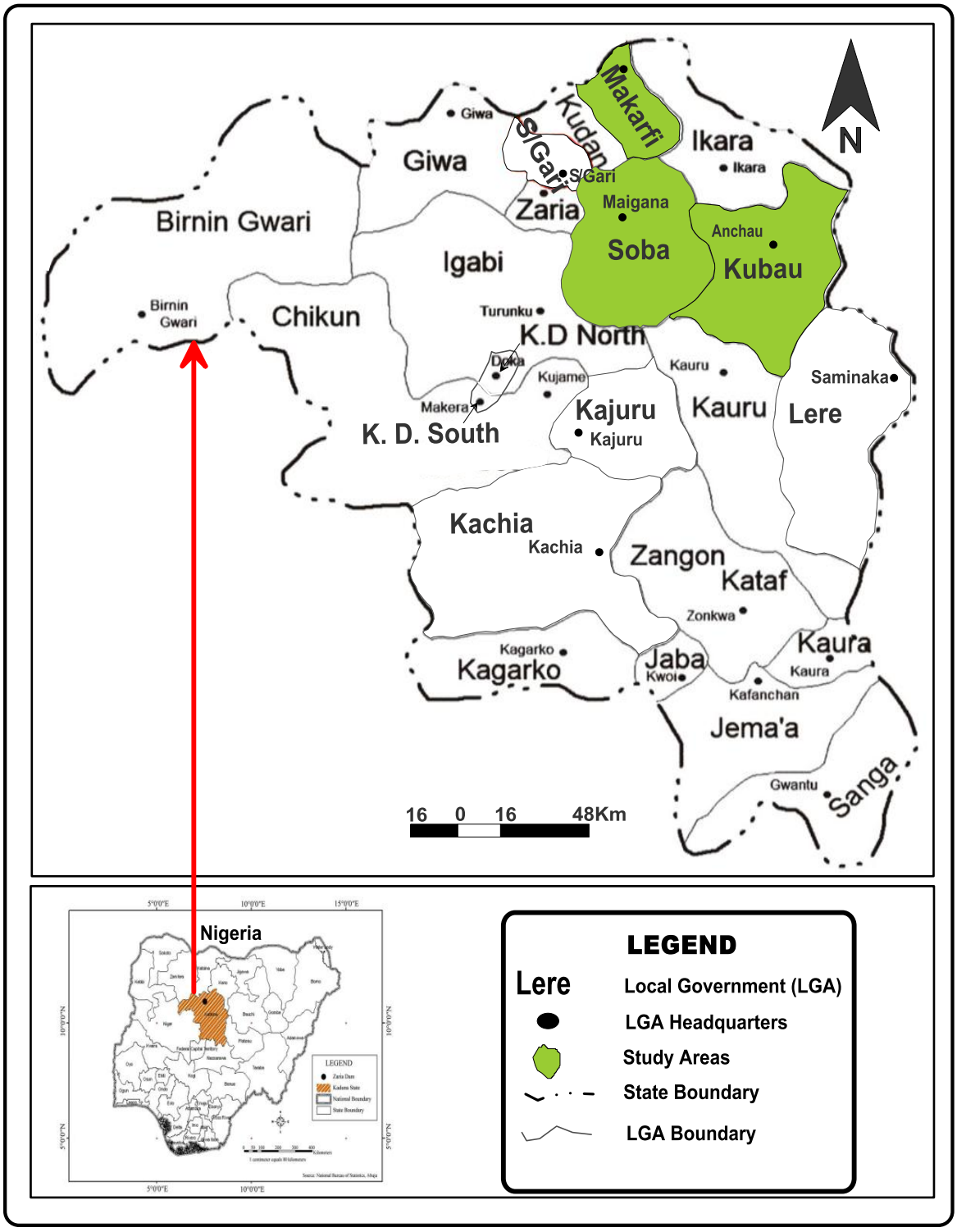


Figure 2 Map of Kaduna state showing study areas

3.2 Sample SizeandSampling Procedure

A multi- stage sampling technique was employed. In the first stage, Makarfi, Soba and Kubau Local Government Areas were purposively selected out of the 23 L.G.As in the state. This is because, they have the highest number of people (farmers) participating in brown sugar processing. In the second stage 15 villages were purposively selected (i.e. Makarfi = 6, Soba= 4 and Kubau = 5 villages) out of the three (3) Local Government Area's that were prominent in brown sugar processing. Finally out of 275 processors in these villages, a total of 138 respondents were used for this Study (Makarfi =36, Soba= 44 and Kubau= 58). That is, about 50% of the respondents that practice brown sugar processing were purposively selected from the fifteen villages. The period of study was between May – June 2015. Reconnaissance survey was conducted in 2014 and information were generated from the Agricultural Department of the LGAs (Table 3).

Table 3.1: Proportionate Sample Distribution of Respondents

LGA	Villages	Sample Frame	Selected Sample Size 50%
Makarfi	- Nasarawan doya	25	13
	- Durum	10	5
	- Rahama	8	4
	- Chakun	10	5
	- Charwa	8	4
	- Aba malam	10	5
Soba	- Yakasai	30	15
	- Tama	22	11
	- Dan-wata	16	8
	- Richifa	20	10
Kubau	- Anchau	50	25
	- Gidan gata	26	13
	- karaba	14	7
	- Kargi	4	2
	- Gadas	22	11
	Total	**275**	**138**

3.3 Method of Data Collection

Primary data were used for this study. The primary data were obtained using interview method with well-structured interview schedule administered among the respondents. Data were collected from brown sugar processors characteristics such as age, sex, education, years of experience in brown sugar processing, family size, income generated, and type of labour use on socio-economic characteristics. Information on institutional variables such as extension contact, membership of cooperative society, credit received, were collected from the respondents.

3.4 Analytical Techniques

The following analytical tools were used to capture the stated objectives:

1. Descriptive statistics
2. Logit regression
3. independent t- test

3.4.2 Descriptive statistics

This involves the use of measure of central tendency, frequency distribution, percentages and means scores and ranking to achieve objective i, ii, and v

3.4.3 Logit Regression

The logit regression model was used to achieve objective iii of this study that is to determine the socio-economic and institutional factors influencing the participation of farmers in brown sugar processing; the models are express as follows;

$Y=a+b_1X_1+b_2X_2+b_3X_3+b_4X_4+b_5X_5+b_6X_6\ldots\ldots\ldots\ldots\ldots\ldots+b_{12}X_{12}+U$(Equation 1)

Where Y = Participation (part time = 0, full time = 1)

a = Constant

X_1 = Age (in years)

X_2 = Sex (Male= 1, Female = 0)

X_3 = Marital status (married = 1, single = 0)

X_4= Household size (number of persons)

X_5 = level of Education (Category of education or formal schooling)

X_6 = Primary Occupation (type of job on which the respondent depends)

X_7 = Activity perform (No of activities done)

X_8= Processing experience (years)

X_9= Extension contact (number)

X_{10} = Membership of cooperative societies (number of years spent)

X_{11} = Access to credit (Yes or No)

X_{12}= Total Income (Amount of naira earned)

b_1- b_{12}= Regression coefficients of X_1 to X_1

U = Error term (implicit)

3.4.4 One sample t-test and Independent t-test

One sample t-test andIndependent t-test, were used to achieve objective iv of this study that is the effect of farmers participation in brown sugar processing in terms of income generated, the model are express as follows; One sample t-test andIndependentt- test are expressed as follows:

$$t = \frac{\bar{X}_{ft} - \bar{X}_{pt}}{\sqrt{\frac{s_{ft}^2}{n1} + \frac{s_{pt}^2}{n2}}}$$ (Equation 2)

t = Independent t- test value

$\bar{X}_{ft}$ = Mean income of full time participation

$\bar{X}_{pt}$ = Mean income of part time participation

s_{ft}^2=Variance of full time participants

s_{pt}^2= Variance of part time participants

n = Number of respondents

Hypotheses was judge at 5% level of significance

3.5 Definition and Measurement of Variables

These variables are predictors and are expected to exert or influence participation of farmers in brown sugar processing.The independent variables include socio-economic variables such as age, educational level, marital status, household size and processing experience and institutional variables such as extension contact,

membership of co-operative and access to credit while the dependent variable was participation.

3.5.1 Independent Variables

i. Age

This refers to the actual age of the respondents at the time of data collection in the field. The ability to learn fast and decides on certain key issues and act favorable to certain information depends on age of the individual. Young people do understand faster than old people but older people have better ways of perception and think deeply before acting. Age was measured in number of years and based on the actual age of respondents given by him/her at the time of study.

ii.Educational level

This is the level of formal or informal or higher level of education attained by the respondents. Rogers and Shoemaker (1997), stressed that education is not only an important determinant of knowledge of an innovation but also an instrument for correct use of innovation for profitability. Education was measured by the category of education attained in terms of adult education.

iii. Marital status

Is the marital status of the respondent at the time of data collection in the study area. It is a condition or state of being married or unmarried as indicated by respondent. This was measured by score. (Married = 1, Single = 0)

iv.Household size

This is the number of wives, children and dependents under the care of the respondents at the time of visit. The size of household is an important factor in traditional agriculture because it influences to a large extent the supply of labour for immediate farm employment (Akinyemi, 1998). It was measured on number of people in the household.

v.Processing experience

This is the total number of years the respondents had being in brown sugar processing business/operation. It was measured in number of years the respondent reported.

vi. Extension contact

This is the frequency of contact of the respondents with extension agent within a season. It was measured on the number of contacts and visits a respondent reported to have had with the extension agents.

vii.Membership of cooperative societies

This is the number of cooperatives associations that the brown sugar processors belonged to at the time of data collection. It was measured by the total number of cooperative organizations that each respondent claimed to belong at the time of study.

viii.Access to credit

This refers to accessibility to external sources of fund to the farmers for the purpose of farming. Credit is a very strong important factor that is needed to acquire or develop farm enterprise (Ekong, 2003). Its availability could determine the participationof farmer in brown sugar production and the extent of production capacity. This was measured as Yes = 1and No = 0.

3.5.2 Dependent Variable

Participation (Y):is the participation / involvement of respondents in brown sugar processing.This was measured in two way using two point continuum namely, "Full time participation" = 1, "Part time participation" = 0.Full time participation: this means the respondents are mainly engage in brown sugar processing business only; while Part time participation: means the respondents are engaged in other activities beside brown sugar processing business. The effect of participation of farmers in brown sugar processing was determined in terms of income from brown sugar and measured as follow:

i. **Income:** this refers to the total amount of money received by the farmer as a result of the sales of processed brown sugar. It was measured in naira (N).

CHAPTER FOUR
RESULTS AND DISCUSSION

4.1 Socio-economic Characteristics of Respondents

4.1.1 Sex distribution

The study reveals that 88.4% of the respondents were male, while 11.6% were female (Table 4.1). According to Adewale *et al.*, (2003), sex is not a barrier to active involvement in farming activities. However, Oladeji *et a*l., (2003), observed that it is generally believed that males are often more energetic and could readily be available for energy demanding jobs like brown sugar production. The low percentage of the female participating in brown sugar production could be attributed to the fact that females in the study area are usually involved in several other activities outside processing like food vendors, tailoring and petty trading.

Table 4.1: Distribution of respondents based on sex

Variables	**Frequency**	**Percentage**
Sex		
Female	16	11.6
Male	122	88.4
Total	**138**	**100.0**

4.1.2 Age distribution

The ages of the respondents were studied in order to find out the age group mostly involved in brown sugar processing activities. The result in Table 4.2 reveals that 5.1% and 63.8% of the respondents were between 16-30 years and 31 –45 years, while 26.1% and 4.3% were between 46 – 60 years and 61-75, respectively. However, 7% t of the respondents were less than 30 years. The findings reveals that majority of brown sugar processors were in their middle age range of 31 – 45 years (63.8 %) with mean age of 43.3 years, who are young adults who are still strong and capable of undertaking rigorous activities in brown sugar processing. This means that, the farmers are in their active age; signifying that both categories of the respondents were within the agricultural productive age range 30-50 years quoted by Food and Agriculture Organization (FAO, 1997;2005). They have the ability to supply the labor required in processing activities and if adequate input is supplied to them, their processing activity can be boosted and improved. Similarly, their relatively young age may make them receptive to new innovations unlike of the older ones who are usually expect the maintenance of status quo.

Table 4.2: Distribution of respondents based on age.

Variables	**Frequency**	**Percentage**
Age		
16 – 30 Years	7	5.1
31 – 45 Years	88	63.8
46 – 60 Years	36	26.1
61 – 75 Years	6	4.3

Mean		**43.33**
Minimum		**25**
Maximum		**75**
Standard deviation		**9.144**
Total	**138**	**100.0**

4.1.3 Marital status

The finding reveals that 95.7% of the farmers were married and 1.4% was single, (Table 4.3). This could be due to struggle to meet the needs of their families. This is also in agreement with Soyebo*et al.*, (2005), who stated that married people often try to make ends meet in order to cater for their families effectively

Table 4.3: Distribution of respondents based on marital status.

Variables	**Frequency**	**Percentage**
Marital status		
Divorced	2	1.4
Married	132	95.7
Single	2	1.4
Widow	2	1.4
Total	**138**	**100.0**

4.1.4 Household size

The result in Table 5 indicated that more than halve of the farmers (50.7%) had 6-10 family members in their household. About 28% had 11 – 15 members whereas 13.0%, 5.8%, 2.2% had 1–5, 16-20 and 21-25 as members in their households respectively. Those that have large family members may take advantage to engage them as source of labour. However, the implication of large household size is that it will increase household consumption expenditure which will compete with production of limited financial resources within the household. This finding is also in line with Solomon (2008) and Banmeke (2003), which indicates that large household size assist more on farm and other household activities.

Table 4.4: Distribution of respondents based on household size

Variables	Frequency	Percentage
Household Size		
1 – 5	18	13.0
6 - 10	70	50.7
11 – 15	39	28.3
16 – 20	8	5.8
21 – 25	3	2.2
Mean		**9.50**
Minimum		**2**
Maximum		**25**
Standard deviation		**4.677**
Total	**138**	**100.0**

4.1.5 Level of education

The result of educational status in Table 4.5revealed that 19.6% and 12.3% had primary

and secondary education respectively while majority of the respondents 65.9% had qur'anic education and only 2.2% had tertiary education. This finding is in line with the finding of Yusuf (2009) who found out that in Kaduna, the highest level of education of the respondents is Islamic education. The trend of the results revealed that the educational level of the respondents was relatively low in the study area which may lead to low acceptance and adoption of improved technology. Education is not only an important determinant of adoption of new technology but also an instrument for successful implementation of new technology. Ndanitsa (2008) reported that the level of education influenced the quality of skills of a farmer, his locative abilities and how well informed he is of the innovations and technology around him.

Table 4.5: Distribution of respondents based on level of education

Variables	**Frequency**	**Percentage**
Level ofEducation		
Primary School	27	19.6
Qur'anic Education	91	65.9
Secondary School	17	12.3
Tertiary Education	3	2.2
Total	**138**	**100.0**

4.1.6 Primary occupation

The study in Table 4.6 revealed that majority of the respondents 44.9% are engaged in farming as their major occupation while 34.8% and 2.2% of the respondents are into food processing/ marketing and civil servant respectively.

Table 4.6: Distribution of respondents based on primary occupation

Variables	Frequency	Percentage
Primary Occupation		
Faming	62	44.9
Teaching	8	5.8
Civil servant	3	2.2
Food Processing/Marketing	48	34.8
Produce Marketing	17	12.3
Teaching	8	5.8
Total	**138**	**100.0**

4. 1.7 Years of processing experience

Table 4.7 also revealed that 31.2% and 29.7% had processing experience of 15-21 years and 8-14 years respectively while8.7% and 2.2% had processing experience of 22-28years and 36-42 years respectively. This implies that brown sugar processors in the study area have fairly long period of processing experience which will in no doubt lead to increase in specialization of skills and knowledge required in facilitating their processing ability.This study agrees with Abadi and Pannel (1999) who argued that learning over a given period of time is an important factor in the adoption process of technologies. The assumption therefore is that farmer's exposure to brown sugar processing technologies would reduce their uncertainty and improve chances of participation.Also, the year of experience in processing help to know how long the farmers have been involved in processing. The longer in the processing the more experienced he becomes.

Table 4.7: Distribution of respondents based on yearof processing experience

Variables	Frequency	Percentage
Years of Processing Experience		
1 – 7 Years	23	16.7
8 -14 Years	41	29.7
15 – 21 Years	43	31.2
22 – 28 Years	12	8.7
29 – 35 Years	16	11.6
36 – 42 Years	3	2.2

Total	**138**	**100.0**
Mean		**16.41**
Minimum		**1**
Maximum		**40**
Standard deviation		**8.993**

4.1.8 Type of processors

The result in (Table 4.8) reveals that there are two types of processor in brown sugar processing in the study area; they are full and Part time processors. The result showed that 68.8% account for part time processors of brown sugar this indicate that majority of the respondents have other businesses doing apart from processing of brown sugar while 31.2% account for full time processors of brown sugar.

Table 4.8: Distribution of respondents based on type of processors

Variables	Frequency	Percentage
Type of processors		
Full time processing	43	31.2
Part time processing	95	68.8
Total	**138**	**100.0**

4.1.9 Level of production

The result in (Table 4.9) reveals that 55.8% of the respondents are into small scale processing due to lack of improve processing equipment's which leads to drudgery during processing while 26.8% of the respondent are into medium scale of brown sugar processing.

Table 4.9: Distribution of respondents based on level of production

Variables	Frequency	Percentage
Level of production		
No response	15	10.9
Large scale processing	9	6.5
Medium scale processing	37	26.8
Total	**138**	**100.0**

4.1.10 Methods of processing

The result in Table 4.10 revealsthat 65.2% of the respondent used Lister engine machine, 29% used horse driven and 5.6% used manual methods of processing brown sugar in the study area.

Table 4.10: Distribution of respondents based on method of processing

Variables	Frequency	Percentage
Method of processing		
House driven-method	40	29.0
Lister engine machine	90	65.2
Manual	8	5.8
Total	**138**	**100.0**

4.1.11 Membership of cooperative societies

Cooperative groups are organized for the promotion of special interest or meet certain needs that cannot be achieved by the individual efforts. They contribute to the dissemination of new ideas, practices and products as well as in sourcing for loan and farm input. The findings revealed that 92.0% of the respondents were members of cooperative society, while 8.0% of the respondents did not belong to any cooperative society (Table 4.11). This result further buttressed Olukosi *et al.,* (2008), assertion that cooperatives evolve out of need of members who want to solve their common problems by pooling their limited resources together.

Table 4.11: Distribution of respondents based on their membership of association

Variables	Frequency	Percentage

Membership of association	11	8.0
No		
Yes	127	92.0
Total	**138**	**100.0**

4.1.12 Extension contacts

Finding on extension services rendered to the farmers in the study area is discouraging, as about 72.5% of the farmers indicated that they don't have contact with extension agents only 27.5% reported that they had access to extension agents as shown in Table 4.12. According to Adebayo (2006) and Yusuf and Adenegan (2008), since the withdrawal of the World Bank in 1995 from funding the Agricultural Development Programs (ADP) in Nigeria, the extension services has not been effectively felt again. This is a clear indication that the farmers are no longer updated with agricultural innovations as before.

Table 4.12: Distribution of respondents based onextension contact

Variables	**Frequency**	**Percentage**
Extension contact		
No	100	72.5
Yes	38	27.5
Total	**138**	**100.0**

4.1.12 Access to Credit

Capital is an important factor of production. Findings indicated that 44.9% of the respondents had access to credit for brown sugar processing and majority 55.1% did not have access to credit facilities (Table 4.13). Credit is a very strong important factor that is needed to acquire or develop farm enterprise (Ekong, 2003). Its availability could determine the extent of production capacity. Also the finding in Table 4.13 showed that about 65.2% of the farmers depend on their personal savings as capital. The implication of this is that farmers had little or no access to financial institutions which give out loans /credit facilities. The result agreed with Stephen*et al*., (2006) who reported that about 95.58% of cowpea farmers within the same study area depended on their personal money as source of capital for their farming business.

Table 4.13: Distribution of respondent based on their accessibility to credit and sources of capital

Variables	Frequency	Percentage
Access Credit		
No	76	55.1
Yes	62	44.9
Capital Source		
Commercial Bank Loan	4	2.9
Cooperatives	25	18.1
Friends	11	8.0
Personal Savings	90	65.2
Relations	8	5.8
Total	**138**	**100.0**

4.1.13Income generated in brown sugar, molasses, bagasse

The result presented in Table 4.14 shows the percentage of income generated by farmers from the sales of brown sugar. About 52.2 % of the processors generated income of ₦ 100,000 – 200,000 while 3.6% and 13.0 % generate ₦400, 001 – 500,000 and less than ₦100, 000 respectively. About72.5% of the respondents did not respond on the income generation on molasses while 8.0% made less than ₦100, 000 (Table 4.14). Furthermore, Table 4.14 reveals that 75.5% and 13% of the respondents did not respond and make less than ₦100, 000 incomes on bagasse respectively. 51.4% of the respondents generate total income of N100, 001 -

200,000 while 3.6% generate income of between ₦400, 001 -500,000. This implies that brown sugar processing assist in generating household income.Therefore to support the activities there is need to support them with credit.

Table 4.14 Distribution of respondent based on their income generated in brown sugar, molasses, and bagasse

Brown sugar income			**Molasses Income**			**Bagasse Income**			**Total Income**		
Income	Frequency	Percentage	Income	Frequency	Percentage	Income	Frequency	Percentage	Income	Frequency	Percentage
Less than 100,000	18	13.0	No response	100	72.5	No response	104	75.4	Less than 100,000	18	13.0
100,000–200,000	72	52.2	100,001–200,000	4	2.9	10,001 – 15,000	5	3.6	100,001–200,000	71	51.4
200,001–300,000	16	11.6	200,001–300,000	7	5.1	15,001 – 20,000	5	3.6	200,001–300,000	8	5.8
300,001–400,000	12	8.7	300,001–400,000	8	5.8	20,001 – 25,000	1	.7	300,001–400,000	7	5.1
400,001–500,000	5	3.6	400,001–500,000	5	3.6	25,001 – 30,000	1	.7	400,001–500,000	5	3.6
Above 500,000	15	10.9	Above 500,000	3	2.2	Above 30,000	3	2.2	Above 500,000	29	21.0
			Less than 100,000	11	8.0	Less than 10,000	19	13.8			
Total	**138**	**100**									
Minimum		**27000**			**25000**			**2250**			**27000**
maximum		**1200000**			**550000**			**37500**			**307801.1**
Mean		**238866.6**			**240455.26**			**11048.53**			**307801.1**
Standard deviation		**216221.34**			**164414.63**			**9964.46**			**333445.8**

4.2 Socio – Economic and Institutional Factors Influencing the Level of Participation of Farmers in Brown Sugar Processing.

The logit regression model was used to achieve objective iii and hypothesis I which state that there is no significant relationship between socio-economic and institutional characteristics of the respondents and their participation in brown sugar processing. The empirical estimation of the logit analysis as presented in Table 4.15, revealed a log likelihood of -30.76368, Pseudo R^2 of 0.6498 and chi-squared statistic(LR) statistic of 114.15, all significant at 1 percent level of probability; this shows that the model had a good fit. In other words, the joint influence of the socio-economic and institutional factors on participationin full time brown sugar processing was significant at 1percent level of probability.The value of coefficient of determination of theadjusted $R^2$was 0.64968. This implies that about 65% of the variation in the participation of farmers in brown sugar processing is explained by the independent variables in the logistic regression model.

Considering the p>|z| values for all the variables included in the model as shown in Table 4.15, only activities perform, total income were significant at 1 percent level of probability while household size and extension contact are significant at 5 percent level of probability. However, coefficient of Sex, Age, Marital status, Household size, Level of education, Primary occupation, Activities perform, Processing experience, Extension contact, Access to credit, Cooperative association and Total income had positive relationship with participation of farmers in brown sugar processing. The implication is that, one unit increase in the

level of any of theseindependent variable's coefficients will lead to an increase in participation of the full time participant in brown sugar processing. The results further revealed that four independent variables were found to be significant; activities perform and total income at 1percent level of probability, household size and extension contact at 5 percent level of probability. However, variables such as Sex, Age, Marital status, Level of education, Primary occupation, Processing experience, Access to credit, Cooperative association were found to have positive coefficient, though, not statistically significant in influencing full time participation in brown sugar processing.

Table 4.15 Logit regression result showing Socio –economic and institutional factorsinfluencing the level of participation of farmers in brown sugar processing.

Variable	Co-efficient	Standard error	Z-statistics
Sex	0.94	0.83	-0.07
Age	1.03	0.04	0.74
Marital status	1.08	0.36	0.24
Household size	1.20	0.10	2.26**
Level of education	0.69	0.33	-0.78
Primary occupation	1.01	0.37	0.03
Activities perform	1.01	0.00	4.36***
Processing experience	1.03	0.04	0.74
Extension contact	0.06	0.07	-2.53**
Access to credit	0.73	0.64	-0.36
Cooperative association	0.90	0.66	-0.14
Total income	1.00	0.00	-2.6***
Constant	1.06E-15	8.42E-15	-4.33***
Log likelihood = -30.76368,			
LR statistic of 114.15,			
Pseudo R2 =0.6498,			
Prob > chi 2 = 0.0000,			

******Significant at 1%, and ** Significant at 5%***

4.2.1 Test of hypothesis I: Socioeconomic and institutional characteristics of the respondents do not influence their participation in brown sugar processing significantly.

The result of the test that there is no significant influence of the socioeconomic and institutional factors on full time participation in brown sugar processing was significant. The chi-squared statistic was 114.5 and was significant at 1% level of probability. The null hypothesis was thus rejected, that is, there is a significant influence of the socio-economic and institutional factors on full time participation.

4.3 Effectof Brown Sugar Processing on Income of Processors

The result of one sample t- test presented in Table 4.16 reveals that difference exist between the mean income of brown sugar, molasses, bagasse and their total income. The mean income of brown sugar (₦ 39,615.66) is higher than that of bagasse (₦12,311.70) and molasses (₦31,303.42), this implies that brown sugar are sold at a higher price than the other product though the processors do earned some income from the sales of other products. The mean difference of brown sugar (₦31,303.42) is higher than that of molasses and bagasse with 138 observation and is significant at 1% while molasses and bagasse had 38 and 45 observation respectively and are all significant at 1% difference exist between the four t-value and so, it has significant effect on their income. Therefore, the null hypothesis is rejected. Furthermore, Brown Sugar processing has a significant effect on income of processors in the study area at 1%.

Table 4.16: obj. 4: Effect of participation of farmers in brown sugar processing on their income generation.

Variable	Brown sugar	Molasses	Bagasse	Total income
Mean	39615.66	31303.42	12311.70	83230.78
Standarddeviation	39922.89	24167.56	11915.19	8215.77
Standard Error	5948.30	3920.50	1014.29	699.37
Mean difference	31303.42	3905.66	12311.70	30908.56
Observation	138	38	45	221
t – value	12.14	7.99	6.66	44.20
Significance	0.000	0.000	0.000	0.000

***Multiple responses =221**

4.3.1 Effect of the type of participation on the income of the processors

The result of the independent t-test in Table 4.17 reveals that, their exist difference between the mean income of full time participant in brown sugar processing (₦15, 160.88) and that of the part time participant (₦9, 918.40) though the total number of observation of the part time participant are higher than that of the full time participant but the mean difference and the t- value was 2.63 and was significant at 1% level of probability. This implies that there is significant effect on their income from sales of brown sugar.

Table 4. 17: Independent t – test result showing the effect of participation type on income of processors. (Brown sugar processors)

Variable	Full time	Part time
Mean	15160.88	9918.40

Standard deviation	1678.82		1162.51
Standard error	13325.18		10067.59
Observation	63		75
Mean difference		5242.47	
t – value		2.63	
Significance		0.010	

4.3.2 Molasses

The empirical result of Table 4.18 reveals that the mean of the full time participants and that of the part time participant on molasses differs from each other, the mean of the full time participants are higher than that of the part time participant (₦34,856.88) and (₦28,426.80) respectively. The total number of observation of the part time participant is higher than that of the full time participants t- value was 0.422 and was not significant this implies that the income of molasses has no significant effect on the income of both the full and part time participants.

Table 4.18 Molasses processors

Variable	**Full time**	**Part time**

Mean	34856.88		28426.80
Standard deviation	26446.75		22395.65
Standard error	6414.28		4887.13
Observation	17		21
Mean difference		6430.08	
t – value		0.81	
Significance		0.422	

4.3.3 Bagasse

Table 4.19 reveals that the mean of full time participant (₦44,706.18) is different from that of the part time participants (₦35,543.24) in income of bagasse the mean difference of 9162.94 and t- value was 0.76 which shows that no significant effect on their income.

Table 4.19 Bagasse processors

Variable	Full time (₦)	Part time (₦)
Mean	44706.18	35543.24
Standard deviation	50840.68	28877.07
Standard error	11368.32	5775.41
Observation	20	25
Mean difference	9162.94	
t – value	0.76	
Significance	0.450	

4.3.4 Total income of processors of brown sugar

The result in Table 4.20 reveals the effect of brown sugar processing on total income of the two processing types with a mean of (₦31,329.83)for full time participant and (₦30,407.05) part time participants. From the result it is observed that the mean difference between the part time and full time participants was slightly higher showing a value of 922.78. The t-value calculated is 0.66 while the p-value which depict significance was 0.513 from the result it implies that no significant difference between the mean income of part time and full time at either 1% level of probability. Even though the mean difference between the part time and full time participant was 922.78 yet that difference is not enough to be a difference statistically. But for brown sugar sales and income the t- value was 2.63 and was significant at 1% level of probability. This implies that there is significant effect on their sales of brown sugar.

However for Molasses the t- value was 0.422 and was not significant which implies that income of molasses has no significant effect on the income of both the full and part time participants. Similarly for bagasset- value was 0.76 which shows that no significant effect on their income. From the result most farmers use only brown sugar sales as their major sources of income than selling molasses and bagasse. While cumulativelytotal income of the processors type has no impact on their variation on income. However consolidating the data and assessing the impact of brown sugar processing on income of processors regardless of whether they were on part time or full time the result varies. The t-value of brown sugar was 12.14 for Molasses 7.99 for Bagasse 6.66 for total income all are significant at 1% level of probability.

Hypothesis II - Participation of farmers in brown sugar processing does not significantly influence their income. When the hypothesis was tested, it was found that brown sugar processing significantly influenced the farmers' income at 1% level of probability. This is evidenced in the fact that brown sugar alone contributed about 48% to the processors income. Therefore null hypothesis was rejected.

Table 4.20 Total income of processors of brown sugar

Variables	Full time	Part time
Mean	31329.83	30407.05
Standard deviation	8461.31	7951.717
Standard error	977.03	1001.82
Observation	75	63
Mean difference		922.78
t – value		0.66
Significance		0.513

4.4 Constraints Faced by Brown Sugar Processors in the Study Area

There are appreciable numbers of farmers involved in brown sugar processing in the study area. However, there are a number of problems affecting their processing activities. These problems may have effect on their output and income. The identified problems are presented in Table 4.21. The highestrank which shows that (50.0%) of respondents indicated that insufficient capital to expand their processing business as their major problems. Lack of improve processing equipment at subsidize rates were reported by (22.5%) of the respondents. Other problems indicated included lack of Good roads network (5.6%), poor market links (5.6%), Insufficient Complementary raw materials (5.6%), high cost of transportation of brown sugar to market (4.2%), insufficient extension trainings to

farmers in cultivating and processing (2.8%), high cost of spare parts (2.8%), and Poor marketability (0.7%).

Table 4.21Distribution respondents according to Constraints facing them

Variable	Frequency	Percentage	Ranking
Insufficient capital for expansion	71	50.0	1st
lack of improve processing equipment	32	22.5	2nd
Lack of good roads network	8	5.6	3rd
Lack of marketing links	8	5.6	3rd
Insufficient complementary raw Materials	8	5.6	3rd
High cost of Transporting of brown sugar to market	6	4,2	6th
Insufficient Extension trainings to farmers in cultivating and processing	4	2,8	7th
High cost of spare parts	4	2.8	7th
Poor marketability	1	0.7	9th
Total	**142**	**100.0**	

*Multiple responses existed, n> 142

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

This study was designed to determine the factors influencing farmers' participation in brown sugar processing in selected areas of Kaduna State, Nigeria. A multi-stage sampling procedure was used in the study. Random sampling was used to select 15 villages from the study area. These villages are Nasarawan-doya, Durum, Rahama, Chakun, Charwa, Aba - malam, Yakasai, Tama, Dan-wata, Richifa, Anchau, Gidan-gata, Karaba, Kargi and Gadas. Thesample size was 138 respondents, which were purposively selected and the data were collected from farmers in 2015. Descriptive statistics, logit regression model, one sample t-test and independent t-test were used to analyze the data.

Thisstudy revealed that 63.8% of respondents were between the ages of 31-45years. About 50.7%, of the respondents had 6-10 people in their household, and 95.7% were married.Furthermore 88.4% of the respondents were males, and about 66% had Qur'anic education. Similarly, 31.2% of the respondents had 25-21 years of processing experience, about 92.0% were members of associations, and 44.9% had access to credit facilities.

The result of logit regression analysis showed that the adjusted R^2 =0.6498,meaning that about 64% of the variation in the participation of farmers in brown sugar processing is explained by the independent variables specified in the logistic regression model.

The result of one- sample t-test showed that significantdifference exists between the mean income from brown sugar, molasses, bagasse and their total income. The mean income of brown sugar (₦39, 615.66) is higher than that of bagasse (₦12, 311.70) and molasses (₦31, 303.42)

The result of t-test independent shows that difference exist between the mean income of full times participant in brown sugar processing (₦15, 160.88) and that of the part time participant (₦ 9,918.40), with a t- value of 2.63 was significant at 1% level of probability, implying that there is significant effect on their income from sales of brown sugar.Insufficientcapital to expand, lack of improve processing equipment, Lack of good roads network and lack of marketing links were the major problems faced by the respondents.

5.2 Conclusion

The socio- economic and institutional characteristics of the respondents were found to influence farmers' participation in brown sugar processing in the study area. The result of this finding shows that about 97% of the respondents had one form of education of another; this can help in the spread of information (printed materials) on any new/ improved technological practices to the brown sugar processors. It was found that majority 65% of the respondents could not access credit from the listed sources. Findings reveal that 72.5% of the respondents had never come in contact with extension agents. Logit regression analysis showed that level of activities perform, total income, household size and extension contacts

were significantly related to level of participation at 1% and 5% level of significance respectively.

5.3 Recommendation

i. Majority of the farmers source their credit from personal savings and relatives which are mostly not adequate for appreciable production and is an important factor which significantly influences processing. Agricultural loan facilities should be made accessible to brown sugar processors by the government and non-governmental agencies on time and adequate to ensure proper utilization. This can be achieved through government support on credit scheme

ii. Large scale production of brown sugar should also be encouraged among processors through provision of modern processing facilities which could be assisted by government or Non-Governmental Organizations (NGOs).

iii Government and Research Institutes like NCRI Badeggi should make improved processing equipment's available to the farmers (processors) at subsidize rates, so as to boost processing of brown sugar in the study areas.

iv. Majority of the processors confirmed that they had not come in contact with extension agents in the study area. It is therefore recommended that Government, Non- governmental and Extension Research Institutes should make efforts to provide extension services to the study areas so that they can benefit from their wealth of experience and also more extension agents

should be recruited to improve their work and terms of coverage in the studied area.

v. Poor road condition and marketing of brown sugar are some of the factors affecting the sales of the products, road are bad which leads to high cost of transportation of goods while the activity of the middle men affect marketing channel. It is therefore recommended that Government should provide rural infrastructures (such as road network) that will aid movement of products to the market and rural markets should be linked to the urban market to attract good value for brown sugar products thereby increasing/enhancing the income and living standard of the farmers in the study areas.

vi. There is need to increase efforts targeted at cooperative development and improvement of existing horizontal alliances. The study revealed that there are few processors that are members of a processing group. Therefore there is need to sensitize the farmers on the benefits that can be derived from processors group action. The processing group associations do not necessarily need to be organized by government alone, but the farmers can be encouraged to come up with such alliances themselves, registered to fully enjoy the benefits of group dynamic if they are to operate private and viable agribusinesses.

vii. Further research on brown sugar processing should be carried out to reinforce the existing knowledge and increase awareness on the benefits of brown sugar processing, not just to the rural farmer but more so in the learning institutions.

5.4 Contribution to Knowledge

i. Farmers' socio-economic characteristics and institutional variables collectively contributed 65% to the level of participation of farmers in brown sugar processing.

ii. The mean income of brown sugar processors from brown sugar sales (₦ 39,615.66) was higher than that of the bagasse (₦12, 311.70) and molasses (₦31, 303.42).

iii. The study reveals that the effect on the type of participation on the mean income of the full –time participant (₦15, 160.88) differs with that of the part –time participant (₦9, 918.40) of brown sugar with a t- value of 2.63 and significant at 1% level of probability. This implies that there is significant effect on their income from sales of brown sugar.

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APPENDICES

A QUESTIONNAIRE ON FACTORS INFLUENCING FARMERS PARTICPATION IN BROWN SUGAR PROCESSING IN SELECTED LOCAL GOVERNMENT AREAS OF KADUNA STATE, NIGERIA.

Dear Respondent,

The information for this study is to enable the researcher investigates "Factors Influencing Participation of Farmers in Brown Sugar Processing in some Local Government Areas of Kaduna State, Nigeria" as pre-requisite for the award of M.Sc. Agric. Extension and Rural Sociology, Ahmadu Bello University, Zaria. Be assured that, all information given remains confidential.

FARMERS' BACKGROUND INFORMATION

Name of village----------

A. SOCIO- ECONOMIC CHARACTERISTICS OF RESPONDENT

1. Sex of farmer (a) male [ ]

(b) Female [ ]

2. Age ----------

3. Marital status

(a) Married [ ]

(b) Single [ ]

4. Household size ----------

5. Level of Education

School	**No. of year spent**	**Qualification**
Qur'anic school		
Primary school		
Secondary school		
Tertiary education		
None of the above		

6. Primary occupation

(a). farming [ ]

(b). teaching [ ]

(c). civil servant [ ]

(d). produce marketing [ ]

(e). food processing/marketing [ ]

(f). others (specify) ----------

7. For how long have you been involved in brown sugar processing (mazarkwaila)? (Years) ----------

8. What attracted you most into brown sugar processing (mazarkwaila)?

(i)----------

(ii) ----------

B. LEVEL OF PARTICIPATION OF FARMERS IN THE STUDY AREA

9. Are you a full time or part time processor of brown sugar?

(a) Full time processing [ ]

(b) Part time processing [ ]

10. If full time processing, are you into

(a) Large scale processing [ ]

(b) Medium scale processing [ ]

(c) Small scale processing [ ]

11. If you are into Large scale processing please state

(a) Number of machines owned----------

(b) Capital owned (processing equipments) ----------

(c) Labour involved ----------

(d) Number of infrastructure in place----------

(e) Others (specify)----------

12. If part time processing, are you into

(a) Small scale processing [ ]

(b) Medium scale processing [ ]

13. What is the Level of Participation/ involvement of farmers in brown sugar Processing

Activities	**Number of Males**	**Number of Females**
Peeling		
Grating		
Squeezing		
Boiling		
Packing		
Drying		
Storing		
Bagging		

14. How did you get into the brown sugar processing business?

(a) Inherited (family [ ] (b) interest [ ]

(c) Government programme [ ] (d) training [ ]

(f) Others (specify)----------

Sources of labour

15. What is your source of labour in processing?

(a) Family [ ]

(b) Hired [ ]

(c) communal [ ]

(d) Others (specify) ----------

16. If the source of labour is through hired labour, how do you pay your labourers?

(a) In cash [ ]

(b) In Kind [ ]

17. If in cash state amount paid? ----------

i. Hourly [ ]

ii. At the end of each stage [ ]

iii. Daily payment [ ]

iv. Weekly payment [ ]

v. Monthly

Others specify----------

18. If in kind state the specified the type used to pay workers

i)----------

ii) ----------

19. What determines the amount you pay your labourers?

(a) The quantity of sugarcane processed [] (b) Amount of brown sugar produced [] (c) Prevailing labour wage rate [ ] (d) Hours spent working [ ]

(e) Others (specify) ----------

D. SOCIO-ECONOMIC AND INSTITUTIONAL FACTORS OF FARMERS IN THE STUDY AREA

Access to extension agent

20. Did extension officers visit you in your area in the last one year (a) Yes [ ] (b) No[]

21. How often does the EA/BEA visit you? (Tick)

(a). Never [ ] (b). Once a week [ ] (c). 2-3 time a week [ ]

(d). Once a month [ ] (e).2-3 time in a month [ ] (f). Others (specify) ----

22. Did you ever invite the EA/BEA for advisory services on a specific problem on your processing business? (a) Yes [ ] (b) No [ ]

23. If yes state the problem----------

Access to credit facilities

24. Did you benefit from credit facilities for your processing business in the last one year? (a). Yes [ ] (b) No [ ]

25. If yes, which credit institutions did you patronize TICK

i. Friends/relatives [ ]

ii. Cooperative [ ]

iii. Commercial bank. [ ]

iv. Community bank [ ]

v. Agric. bank [ ]

vi. Informal Lending (e.g. Money Lenders cooperative) [ ]

Others (specified) ----------

26. Amount of credit obtained----------

27. Do you belong to any cooperative association in your area? (a) Yes [ ] (b) No []

28. If yes, how many cooperatives association do you belong to? ----------

29. Years of membership of cooperative----------

30. What is your major source of capital for processing sugar cane?

(a) Friends [ ]

(b) Relations [ ]

(c) Personal saving [ ]

(d) Cooperatives [ ]

(e) Commercial bank loan [ ]

(f) Government programme [ ]

(g) Others specify----------

Access to market

31. How much worth of your products do you sell per week? ----------

32. To whom do you sell your mazarkwaila?

(a). consumers [ ]

(b). middlemen [ ]

(c). retailer [ ]

(d). wholesaler [ ]

(e). others (specify) ----------

-

33 How do you transport your product to the market? ----------

34. How much does it cost you to transport your product? ----------

35. Where do you sell your produce? ----------

Product	**Market point**	**Quantity sold in kg**	**Price N/ kg**
Brown sugar (mazarkwaila)			

Molasses			
Syrup			
Bagasse			

36. What determines the price of your products in your locality?

(a). demand/ supply [ ] (b).Season [ ] (c). Price of sugarcane [ ]

E. EFFECT OF PARTICIPATION ON INCOME GENERATION OF FARMERS IN THE STUDY AREA

37. What quantity of sugar cane do you process per day? ----------

38. What quantity of brown sugar (mazarkwaila) (in unit) do you produce weekly?

39. How many bundles or sticks of sugarcane do you use in a week? ----------

-

40. How much does it cost you to process that quantity of sugarcane? ----------

-

41. How much do you spend on labour for the processing per week? ----------

42. How much does a unit/kg/tone of brown sugar cost? ----------

43. What types of product do you get from your processed cane stalks?

(a) Natural brown sugar (mazarkwaila) (units) [] (b) Molasses (litres) [ ]

(c) Sugar syrup (litres) [ ] (d) Bagasse (kg) [ ]

(e) Other (specify) ----------

-

Which of the above gives you the highest income? ----------

-

F. PROCESSING TECHNOLOGIES AVAILABLE TO FARMERS IN THE STUDY AREA

44. What method(s) of processing do you use?

(a) Manual [ ]

(b) horse- driven method [ ]

(c) lister engine machine [ ]

(d) Others specify----------

45. Which of these methods gives you the highest income? ----------

-

46. which other technology for processing brown sugar (mazarkwaila) apart from those mentioned above do you know or use?----------

Please provide information regarding processing inputs used and their cost

47. List the equipment's you are using in processing brown sugar

Equipment	**Number**	**Cost (value)**

48. How do you get your raw materials (cane stalks) for processing (mazarkwaila)?

(a). purchase from other farmers [ ] (b). from my farm [ ]

(c). a and b above [ ] (d). Others specify ----------

49. What quantity do you use per day? ----------

50. What is the cost of the quantity used? ----------

-

51. How do your store your processed products for future use? ----------

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52. How long can you store these and remains fit for human consumption? --------

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-

53. Briefly describe the method you use to process brown sugar (mazarkwaila):

(i)----------

(ii)----------

(iii)----------

(iv)----------

54. Has government helped you in any way in your brown sugar processing?

i. Provision of squeezer [ ]

ii.Provision of grater [ ]

iii.Provision of peeler [ ]

vi. Provision of boiler [ ]

v. Provision of soft loan [ ]

vi. Provide capacity building training [ ]

vii. Provide extension services [ ]

None specify ----------

D. CHALLENGES / CONSTRAINTS FACING FARMERS IN THE STUDY AREA

55. What challenges/ constraints do you face during processing of brown sugar (mazarkwaila)?

(a). insufficient raw materials [ ]

(b). distance between the farm and the processing site [ ]

(c). inadequate man power [ ]

(d). seasonal nature of raw material availability [ ]

(e). others (specify) ----------

56. Suggest possible solution

i. ----------

ii. ----------

57. What suggestion do you have in other to improve on brown sugar processing in Kaduna state? (i)----------

(ii)----------

` Thanks! May God bless you