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Analysis of the Profitability of Maize Products in Nigeria

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ABSTRACT

Maize has a variety of products. The underutilization of maize in Nigeria has been a growing concern over the years. Thus, there is a need to diversify the use of maize to the benefit of society. This study identifies the various processed products from maize, estimates their costs, and associated returns to maize processing. It also analyzes the profitability of maize products in Nigeria. A multistage sampling technique was usedto select 536 maize processors from six innovation platform (IP) areas of the SARD-SC project area. A structured questionnaire was employed for data collection. Descriptive statistics, budgetary, were employed to analyze the data. Seventeen maize products were identified. These include *agidi, dokunu, dunkwa, egbo, madidi/abari,* maize flour, *maize kokoro, maize kunu,* maize bran, *masa/huce/chibi, ogi/kwokwo, Pate, Pele,* popcorn, roasted corn, *and tuwo-masara.* We observed that maize-processed products were dominated by women without formal education.

1. INTRODUCTION

Agriculture is the engine of growth in most Sub-Saharan Africa (SSA). Thus, agriculture has contributed 70% employment, 40% export earnings, 30% Gross Domestic Product (GDP), and 30% foreign exchange earnings (NBS, 2010). Nigeria as a country, is traditionally an agrarian country. Thus, agriculture remains one of the mainstays of the nation's economy. Cereals production (particularly maize) and acreage cultivation have increased over time due to the growing global demand. Maize is the third largest planted crop after wheat and rice in Nigeria. Hence, maize has been the main staple food crop of great socioeconomics importance. Maize is mostly used and traded as a leading crop for animal feed production. In addition to food and feed usage, maize has a lot of industrial applications from food processing to the manufacturing of Ethanol (Abbassian, 2006). Maize with botanical name *Zea mays* originated from Mesoamerica in the South-America and introduced to Africa in the 16th century. Maize is cultivated on 1.8 million hectares of land in Nigeria by farmers on subsistence and commercial levels (Fadiji, Atala and Voh, 2005), Maize has yielded an estimate of 1.5 metric tons (FAO, 2004). Maize started as a subsistence crop which has ever since remained a strategic crop and major staple food for the livelihood of many in Africa, particularly in Nigeria. Maize has risen to a commercial crop for which many

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agro- based industries depends on for their raw materials (Oladejo and Adetunji, 2012, and Iken and Amusa, 2004). It plays a main role in the diets of many Nigerians. It is a very versatile crop used for domestic consumption and industrial use (FMARD, 2011). The utilization statistics indicates that the shelf use of maize is food which accounts for 70% while feed purpose accounts 20 %. Other uses mainly as inputs in several industries and seed accounted for 10 % (Onojah *et.al*. 2013 as cited in Paudyal *et al*., 2001). Arable land which is a natural resource base for maize production is available in abundance in the country. Maize is grown in all parts of the country as a versatile crop that adapts to a range of agro-ecological zones in all states. However, maize is majorly grown more in the Northern part of Nigeria. The potential of maize is large because it offers a source of food calories. According to International Institute of Tropical Agriculture (2013) report, maize has 80 percent carbohydrate, 10 percent protein, 3.5 percent fiber and 2 percent mineral. Maize also contains Iron and Vitamin B which makes it complete in nutrient compared to other cereal crops.

The surge in the demand for maize in Nigeria is a fall out of some policy decisions of government e.g. the ban on poultry products to improve local production, an emergence of starch-based industries in the countries, and others as a result of the country's industrialization drive, diversification drive and an increase in population. The ban in poultry product created an immediate awakening of the hitherto dead poultry and poultry feed industries which generated high demand for the crop as a raw material base (FMARD, 2011). Again, the increased awareness of farming and other agricultural activities also generated demand for maize as seeds. Some factors that make maize an ideal target crop in high production potential areas of Nigeria include its high yield potential; its diversified uses; ease of transportation, processing and marketing; and the availability of dependable research products (FMARD, 2011). Since the consumption of wheat and rice; which is largely imported is rising in urban centers (FMARD, 2011). Maize can play a major role in import substitution and sub-regional trade.

Profitability has therefore been identified as one of the major factors in an individual's decision to produce. Eghwerido (2022a), Eghwerido and Efe-Eyefia (2022b) and Lawal and Jaiyeola (2007) opined that value addition improves agricultural products shelf life and generate income for participants. The evaluation of the present state of small, medium and large scale maize processing is, therefore, imperative. Also, the critical factors that are instrumental in constraining profitability of the different maize uses are worth noting. Hence increasing value addition through maize processing will contribute to food security, employment, improvement in livelihood and increase processors' income. The Improvement in Maize usage is important as it could significantly reduce hunger, enhance food security, alleviate poverty by increasing processors purchasing power and also promote food utilization. In order to tap the full potential that maize presents. This study, therefore, tend to identify the different products of maize in Nigeria, evaluate the profitability of the products and examine factors and constraints that are likely to influence the level of processors profit. This study tends to examine the profitability of maize products in Nigeria to mitigate poor and unhealthy food security.

1.1. Conceptual Framework of Maize Processing

In order to reduce the possible glut of maize in the market, it has become important to

provide an efficient and effective way of adding value to our farm products and processing industry most, especially maize. One important advantage of maize is that it has a wide range of uses ranging from consumption to industrial use. (Cadoni and Angelucci, (2013) and FAO, 1992). Maize when processed pass through different processing operations in terms of cleaning, damping, drying, polishing, dehulling, milling, mixing, frying, pelleting, and bagging/packaging. Two types of maize were used during processing; white and yellow maize. White maize is primarily used for human consumption, while yellow maize is used for feed and human consumption. According to Food and Agricultural Organization (FAO) estimates, white maize accounts for an average of 15-35% of total cereals production (FAO 1994); although only 18 percent of maize is used for feed (USDA 2005-10).

Maize processing is, therefore, the transformation of the maize kernels (raw maize) into other valuable intermediate or finished products (FAO, 1992). Processing of maize perhaps is the best area an investor can engage in with maximum utilization. Hence, maize processing can lead to a reduction in food wastage, enhanced food security, improvement in the livelihood of low-income groups and empowerment for the youth. Processing of maize in Nigeria can be classified into two: dry-milling and wet-milling (FAO, 1992; UNCTAD, 2013; OECD, 2002; Karim, 1992 and Abbassian, 2006). Dry milling produces maize grits, maize meal and maize flour with carbon-dioxides and distillers dried grain soluble as by-products. The chemical composition of these products has been well established and their uses are extensive. Maize flour can be used exactly as wheat flour in making bread, breakfast meals, soy-ogi, semolina and more. In Nigeria about 1.5 million tons of maize is used by the brewery and bakery industries (Badu – Apraku *et al*, 2012). It is the most widely eaten flour after wheat and rice flour. It is uniquely rich in dietary fiber, protein, vitamin B6, magnesium and omega 6 acids, vital for good heart and fights against infections (Orhun, 2013).

Maize grit is produced through the process called tempering degerminating system (TD) and this process is most widely used in the food processing industry (FAO, 1992). This process yields flaking grits (12%), coarse grits (15%), regular (fine) grits (23%), meal (6%), flour (4%), oil (1%) and hominy feed (35%). Flaking grits are used almost exclusively in the manufacture of cornflakes, cheese balls, and couscous. Fine grits are frequently utilized by the snack, breakfast cereal, and brewery industries whereas cooked coarse grits are eaten as a breakfast food. Maize use as feed is an essential ingredient in animal feed because it is rich in energy. Maize grain gives the highest conversion ratio to meat, milk, and eggs when compared with other grains used as livestock feed. This is due to its high starch and low fiber content which makes it a very concentrated source of energy for livestock production (Orhun, 2013). Nearly all regions of the world have registered strong growth in feed usage of maize in recent years. Nigeria, for example, has recorded a rising demand from the livestock sector due to the ban on the importation of poultry products from the federal government (FMARD, 2011).

The wet milling yields starch and other valuable by-products such as maize gluten, maize oil, maize gluten feed, maize gluten meal and animal feed (FAO, 1992; UNCTAD, 2013). Maize starch is used as a raw material for a wide range of food and non-food products such as to produce alcohol and food sweeteners by either acid or enzymatic hydrolysis. It plays an

important role in determining the texture of many foods which is vital to both the consumer and the food manufacturer. Starch is used to produce diverse products as food, paper, textiles, adhesives, beverages, confectionary, pharmaceuticals and building materials (Chang, 2000; Karim, 1992). Some products derived from modified starch (Sanni *et al*, 2005) are; Monosodium glutamate (MSG) which is used in powder or crystal form as a flavouring agent in foods such as meats, vegetables, sauces, and gravies. The syrup is a form of glucose and dextrose which is often used as sweetening agents in confectionaries and manufacturing of noodles.

Maize oil is another important product of wet milling. The germ of maize is a rich source of oil which is popular edible oil all over the world which contains 7 – 12% oil depending on the variety (Karim, 1992). The oil is colourless and flavourless and has cholesterol free polyunsaturated fatty acids which are useful for growth, pregnancy, maintenance of normal skin, hair and kidney (Karim, 1992) and which researchers has found to contain strong antioxidant potentially mostly for controlling diabetes, prevention of heart ailments (Orhun, 2013), reduction of hypertension and prevention of neural-tube defects at birth (Adom and Liu, 2002; EGDE and Prisecaru, 2005). Industrial uses for corn oil include manufacturing of soap, salve, paint, rust proofing for metal surfaces, inks, textiles, and insecticides. Corn oil and free fatty-acids - industrial uses; chemicals and insecticides, lecithin (for pharmaceuticals, cosmetics, linoleum, printing inks, etc.), paint and varnish, printing ink, rubber substitutes, rust preventative (surface coatings), soluble oil (leather and tanning use), textiles (Orhun, 2012). Corn oil is also one source of biodiesel which is suitable for use in diesel engines.

Ethanol is an important product derived from wet or dry milling. For thousands of years, it has been used as the base for alcoholic drinks, but since the 20th century, a larger purpose has been found for it. Since 2005 and 2006 there has been a surge in industrial uses for maize, notably in the production of ethanol in the United States in 2000 and 2001 (UNCTAD, 2013). Ethanol production from corn produces both fuel and livestock feed which is quickly becoming a driving market force. In Nigeria, different uses of maize are obtained as depicted in Figure 1 below.

Processing of maize especially in Nigeria at the household level yields different traditional products. The maize is harvested in a cob, either eaten directly as green maize or stored as a grain cob which is then shelled into a grain. Maize when processed yields; maize flour, maize grit, animal feed, maize bran and a wide variety of traditional products. These products are consumed directly or used as a raw material for other products.

The traditional products are processed through traditional food processing technologies. The traditional food processing technologies are the means for the transformation of maize

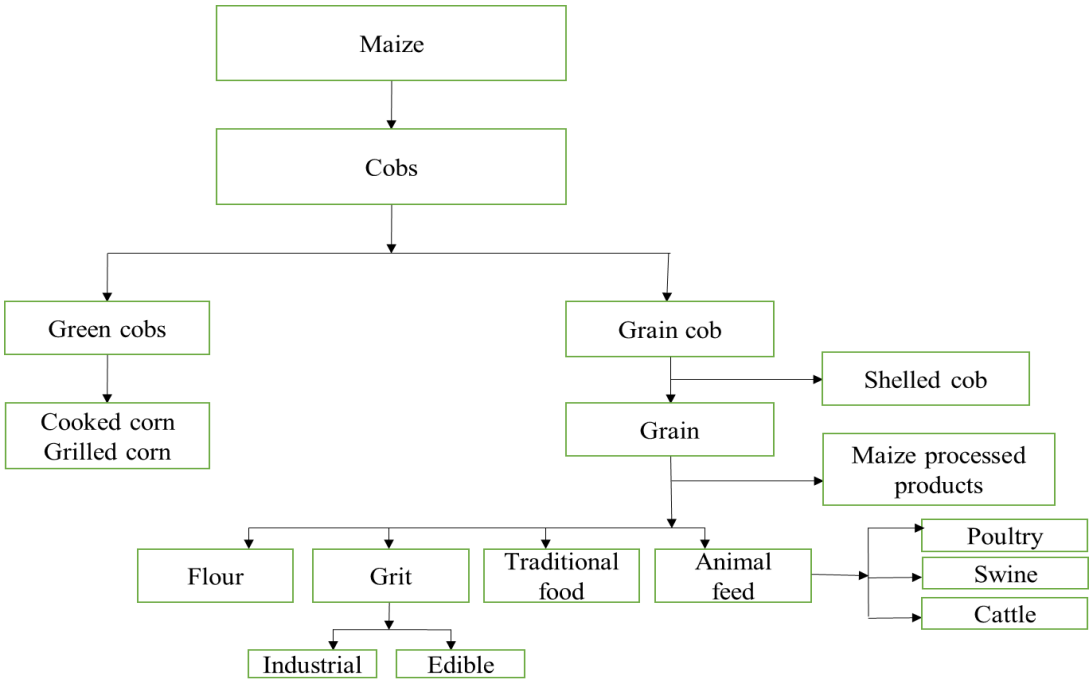

Fig. 1: Multiple Uses of Maize in Nigeria

Source: Adapted from Karim (1992: Studies on maize in Bangladesh), modified by the author

into various food products which serve as the vehicle for national food delivery and nutrition, and provide employment and income to technology users (Ackom-Quayson, 1992 and Sefa-Dedeh, 1989).

1.2. Conceptual Frame Work of Maize Profitability

Profitability is the ability of an enterprise to produce a return to investment based on its resources. Although an enterprise can realize profit does not necessarily mean the enterprise is profitable (Hofstrand, 2009). The term profitability and profit are often used interchangeably but they are not the same. Profitability, as mentioned above is measured by the ratio of benefit to cost. The result from the analysis serves therefore as a vital tool to make informed decisions by investors.

A consideration of profitability analysis has several benefits: it identifies the extent to which major market/ business segments contribute more to profit; provide a method for management to compare performance of market /business segments and assess a product's return to investment; allow processors to estimate the profit potential of new business opportunities and helps to improve market / business processes and operational effectiveness.

On the other hand, some factors influence processing which will consequently have a cumulative effect on the processors' profit. Factors are dynamic that is, their impact on

the business changes over time. A combination of economic and processor characteristics influences processing. Economic factors include product input and output market prices. Processor characteristics include education, processing experience, gender, age and household size. All these influence the processors level of profit. Influence in the business may either have a positive or negative effect on profitability.

More so, constraints are also said to affect growth potential of the processor's profit. When constraints have a negative effect, its presence often hinders the profitability of the processor. These are done through their impact on the volume of production, the price received per unit of a commodity and the cost structure. Figure 2 shows the profitability framework of maize processing.

1.3. Factors Influencing Profitability of Maize Processing in Nigeria

There are many factors that have been identified to have an effect on the profitability of any enterprise. These include; production costs, the size of enterprise, experience in business, labor, and processors socio-economic characteristics (Ibekwe *et al.*, 2012 and Oluwemimo, 2010). For processors, net profit is critically dependent on the level of output, socioeconomic characteristics, production costs and processing activities (Oluwemimo, 2010; Ibekwe *et al*., 2012; Usman, Suleiman and Ibrahim, 2014; Usman, Suleiman and Faith, 2014). Ibekwe *et al*., (2012) found that education, household size, age and year of experience has a significant effect on profit. Where, household size and age are negatively influencing profit; education and year of experience are positively influencing profit.

In another study on determinants of factors that restrict profitability in the wheat milling and baking industries in South Africa, difficulty in obtaining the necessary capital, high overhead costs, increasing milling, baking capacity and motivated loyal labour force was seen to affect profitability (Andre, Mariette and Gerhard, 2011). Whereby, good business location, high level of integration, high-quality product, and maintaining low overhead cost were seen as factors that enhance profitability.

Oluwemimo (2010) in studying the factors affecting the profitability of cassava processing in Oyo state found that in conformity with *a priori* expectations, experience of respondents in processing enterprises, the number of labour employed and the level of education of respondents was positively related to net income. However, contrary to *a priori* expectation, the age of the respondent and the size of enterprise were negatively related to net income. The cost of production was also negatively related with net income in conformity with *a priori* expectation. Three of the variables, age of respondents, and

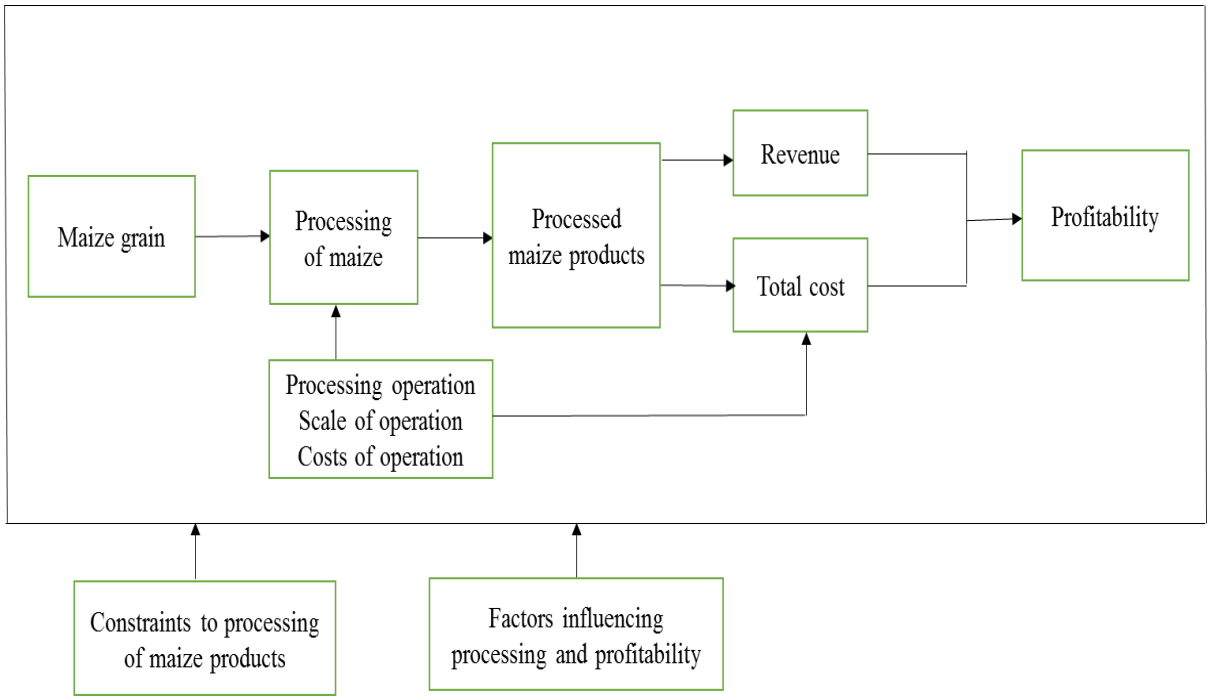

Fig. 2: Framework for Profitability of Maize Processing
Source: Compiled by the author.

experience of respondents in cassava processing enterprises and size of the enterprise were significant. Martey *et al.*, (2013) in their study revealed that contrary to *a prior* expectation, cost incurred by small-scale enterprises significantly affects the performance (profit) of business positively. These empirical studies, therefore, form the basis for determining the effect of these factors on profit of the processors by taking into account the socioeconomic factors and processing activities that affect processors profit using multiple regressions.

1.4. Constraints Influencing Profitability in Maize Processing

Processors which are engaged in processing activities are constantly faced with different constraints according to the type of product produced. Constraints are said to be factors which have a negative impact on a business thereby hindering its growth potential (Edinam, Joshua and Danso, 2015). Studies shows that processors are faced with different profitability levels (Haji, Asmiati and La Ode, 2015; Ibekwe *et al.*, 2012; Muhammad_Lawal, Omotesho and Oyedemi, 2013; Ani, Agbugba and Baiyegunhi, 2013) which are attributed to the numerous constraints that affect their business and processing operation. These constraints have an effect on the growth potential of processors profit. Processors that are faced with a high level of constraints are found to be less profitable because such high levels of constraints are detrimental and limiting to the business.

Constraints that contribute to unimpressive performance on the processor's profit have been identified in the literature. These include limited access to finance and capital which is brought about as a result of high-interest rate, lack of collateral among others (Okurut and Bategeka, 2006 and Kappel et al, 2004). The study revealed that lack of access to finance and capital has an effect on the processors' decision to upgrade their equipment, machinery and technology. High taxes and tariffs to electricity increase the cost of production especially when they are high and service poor. They also affect the volume of production. Other constraints include: labour supply problem, poor access road, problem of water supply, poor access to information, drudgery/poor access to equipment, lack of processing facilities, among others (Muhammed-Lawal, Omotesho and Oyedemi, 2013; Ani, Agbugba and Baiyegunhi, 2013).

1.5. Classification of Processing Units

According to the National Board of Small Scale Industries (NBSSI) / Business Advisory Center (BAC) (Paulina et.al, 2004; and Adejei, 2012, micro enterprises refer to any enterprises that employ less than ten workers with total enterprise investment cost not exceeding US$ 10,000 processing not less than 200kg of dry product/day.

Small scale enterprises are those enterprises which employ between 10 - 30 workers with investment cost ranging from US$10,000 to US$100,000. Enterprises whose investment costs exceed US$100,000 with a staff of more than 20 are categorized as a large scale. The fall back from the above definition does not provide any definition for medium scale enterprises.

The technology consultancy center (TCC) defines micro processing enterprises as enterprises with the total investment cost of US$500 or less. Enterprises with an investment cost of US$500 – 100,000 are defined as small scale and those with investment cost of US$10,000 – 100,000 are medium scale. Any enterprise with investment cost exceeding US$100,000 is classified as large scale. The TCC definition, although with more realistic capital investment classifications does not precisely specify the levels of output for the respective categories of enterprises, it does not spell out the exact number and type of employees for the categories. Hence, the classification of the enterprise according to the level of output monthly will be the criterion for classifying enterprises for this study.

1.6. Theoretical Framework of Maize Processing

Profitability is important and necessary for a business to remain attractive to investors. Measuring profitability is the most important measure of the success of a business. A business that is not profitable cannot survive. Conversely, a business that is highly profitable has the ability to reward its owners with a large return on their investment. This,

Table 1: Classification of enterprises

Type of enterprise	Level of output (Kilogram per day)
Micro enterprise / household level	Less than 1000
Medium scale enterprise	1000 – 5000
Large scale enterprise	Greater than 5000

Source: Paulina et al, (2004)

therefore, means that profitability is the ability of a business to earn a profit. Profitability is therefore, defined as the ability of a business to produce a return on investment based on its resources. Although an enterprise can realize a profit, this does not necessarily mean that the company is profitable. Profit measures how much money the business is earning while profitability on the other hand measures how efficient that business is (Hofstrand, 2009).

Thirukkural (1986) defined profits as the residual obtained on completion of the work in relation to the decision (target) and the constraints. That is to say he "considers the residual profit obtained after (viewing) the decision, the constraining hurdles and the completion of work (i.e., output). The implication of this definition is that profit is only seen as a residue (net) after deducting the cost. Thirukkural also strongly urge that one should undertake works only if it is profitable. He, therefore, suggest profitability as an investment criterion following the statement that: (1) processor should undertake the work after analyzing the residual profit effected after making the use of the inputs for production and (2) a processor should consider the residual profit obtained after viewing the decision (target), the constraining hurdles and the output. It has therefore been deduced that profitability being an investment criterion for a processor engaged in processing activities has both a behavioral content and a technical-economic content (economic performance of the farm as a business enterprise) (Onoja, Deedam and Achike, 2012).

Profitability plays a vital role in the decision making of investors. It provides information on the financial plan for an enterprise. Economic and financial profitability analysis have become more relevant to developing agencies to evaluate and assess the different maize products and quantify processors income obtained from the different maize products. An economic performance of the different products is, therefore, useful in identifying and evaluating opportunities available to increase household income and subsequently the standard of living. Profitability is assessed using different methods; Economic profitability and financial profitability. Economic profitability is analyzed using cost and return analysis, net present value, rate of return, benefit-cost ratio etc. while financial profitability is analyzed using several financial statements, such as income statement, balance sheet or net worth statement, cash flow statement etc.

1.7. Empirical Framework of Maize Processing

Many studies have been carried out to assess the viability or relative profitability on different crop processing and the factors

influencing profit. There is a rich history of researchers using gross margin, net profit, and cost and return analysis as a tool to determine the profitability of processing, regression analysis to determine factors affecting the profit and probabilistic model to determine the effects of identified constraints on business. A study on the profitability of garri processing in Owerri North local government area in Imo State by Ibekwe et al. (2012) preferred to use gross margin analysis as a proxy for profitability over net farm income because fixed cost was assumed to be negligible. More so, the study dwelt more on the socio-economic characteristics influencing profit levels of the garri processors, using ordinary least square method.

Muhammad-Lawal, Omotesho and Oyedemi (2013) carried out some work on an assessment of the economics of cassava processing in Kwara State. He used a four-point Likert-type scale to determine the mean score of the identified constraints stated by the respondents and failed to access the effects of the identified constraints to processing. Frequency and percentages were used to identify the type of cassava product produced, where cost and return of the different products were calculated using gross margin analysis. This study examined only the gross margin of the product hence omitting the fixed cost that might affect the products' net income.

Haji et al, 2015 carried out a study on profitability and value addition in cassava processing in Buton District of Southeast Sulawesi Province, Indonesia. The study considered only the processing of cassava into Kaopi. Cost and return analysis were achieved using the net profit.

Edinam, Joshua and Danso – Abbeam (2015) carried out a study to investigate the specific effects of identified constraints on the growth potential of agro MSE in the Greater Accra region, Ghana. An Ordered probit model was used to measure the effects of the identified constraint on growth potential of the business while the linear OLS model was used to measure the effects of the constraints on the growth performance.

Ishengoma and Kappel (2008) in their study on business constraints and growth potential of micro and small manufacturing enterprises in Uganda used Ordinal logit to examine the extent to which growth of MSEs' is associated with business constraints while controlling for owners' attributes and firms characteristics. The result revealed that MSEs' growth potential is negatively affected by limited access to finance, high services and lack of market access.

A study on the economics of small-scale agro-enterprises in Nigeria: a case study of groundnut processing among rural women in Kwara-state using gross margin and stochastic frontier model to analyze the data. The result revealed that the major factors affecting the efficiency of groundnut processing were farming experience and household size.

Oluwemimo (2010) carried out a study to analyze the economics of cassava processing by rural farm households in Oyo State using budgetary analysis and the Cobb-Douglas regression function. The regression analyses showed that age, experience, and size of the enterprise were significant determinants of the profitability of cassava processing enterprises while age, experience, level of education and initial capital outlay were significant determinants of the size of the enterprise.

1.8. Analytical Framework of Maize Processing

There are five methods used to determine the profitability of an enterprise. These include gross margin analysis, partial budgeting analysis, cost-effective analysis, cost utility analysis and undiscounted cost-

benefit analysis (Dijkhuizen and Huirne, 1997 and Aweriji, 2014). Methods like regression analysis and probabilistic analysis have been used to identify the factors and constraints that influence enterprise profit level. To identify factors influencing profitability, the computed net profit is regressed on a set of hypothesized explanatory variables (Oladejo, 2014; Ibekwe et al, 2012; and Mumba, 2012). Also, the probabilistic model is used to measure the processors' perception to profit growth potential (Edinam, Joshua and Danso-Abbeam, 2015; Ishengoma and Kappel, 2008).

2. Material and Methods

2.1. Study Area

The study was carried out in the Nigeria. Nigeria is a country in West Africa with its capital at Abuja. Nigeria is composed of six geo-political zones, 36 states with a distinct number of LGA's. Nigeria shares land borders with the Republic of Benin in the west, Chad and Cameroon in the east, and Niger in the north. Its coast lies on the Gulf of Guinea in the south and it borders Lake Chad to the Northeast. Nigeria lies within latitude 10^0 00'N of the Equator and longitude 8^0 00'E of Greenwich Meridian. Average annual humidity varies from 1,770mm in the west to 4,310mm in the central areas. Average temperature ranges are from 23^0C to 32^0C all year. The total area of Nigeria is 923,768km^2. 910,768km^2 of that is land while water takes up 13,000km^2. Its total boundaries are 4047km in length (Aderogba, 2011).

The agricultural area is 83.6 hacter, which comprises arable land (33.8percent), land permanently in crops (2.9 percent), forest or woods (13.0 percent), pasture (47.9 percent), and irrigable land or fadama 3 (2.4 percent) (Adetunji, 2006). Average rainfall along the coast varies from about 180cm in the west to about 430cm in certain parts of the east. Inland, it decreases to around 130cm over most of central Nigeria and only 50cm in the extreme north (Aderogba, 2011). Nigeria has a tropical climate with two seasons: Wet season, from April to October and dry season, from November to March. Nigeria's latest population estimate is 140 million, of which 65 percent live in rural areas (NPC, 2006). More than 70 percent of the farming population in Nigeria consists of smallholder farmers, each of whom owns or cultivates less than 5 ha of farmland (NARP, 1994).

The study was conducted in three innovation platform (IP) locations of Support to Agriculture in Research and Development of Strategic Crops (SARD – SC) project of the southwestern, northeastern and north central region of Nigeria; these include Kwara-Oyo IP, Nasarawa-Kaduna IP, and Katsina-Zamfara IP. The region was selected because they are the major centers of maize production in Nigeria (SARD-SC, 2011) of which major occupation of the people is farming. The study concentrated in selected states and local government of the project as indicated on the map.

Innovation platform (IP) of Support to Agriculture in Research and Development of Strategic Crops (SARD – SC) project is a platform that brings in all the stakeholders involved in the value chain. The stakeholders include farmers, security

agents, Fulani herdsmen, producers, processors, manufacturers of equipment, banks, transporters, NGO that provides extension agent, marketers etc.

Table 2 shows the 100 innovation communities selected for the study. This selection was based on the projects innovation areas where a baseline survey prior to processing aspect of the commodity value chain has not been carried out.

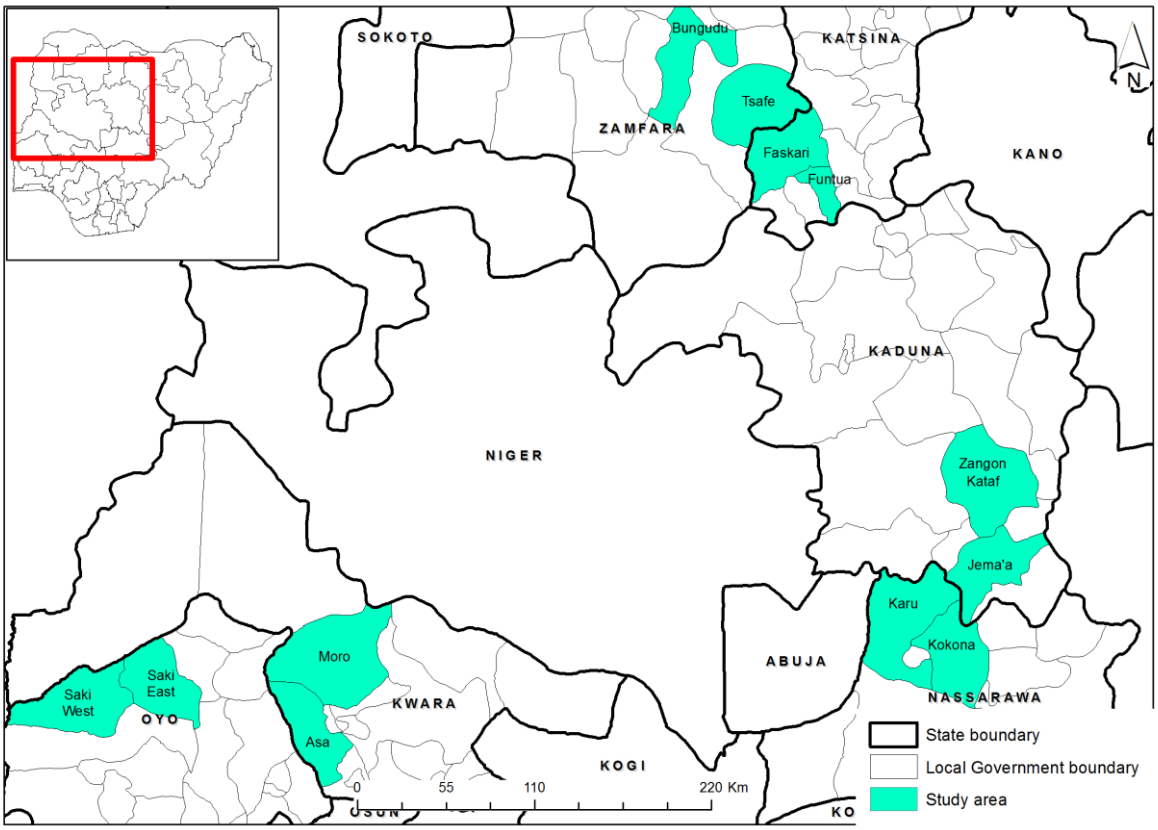

Fig 4: Map of Nigeria, Showing SARD-SC Study Areas (The Shaded Area).

Source: Geo-graphic Information System (GIS) IITA, 2013.

2.2. Data Collection

Data were collected from two sources, primary and secondary. An exploratory trip was embarked on to gather information on the maize industry which was used to design and focus the study. Information was gathered through key informants and focus group discussion. In the case of focus group discussion, the participation of the processors in the innovation communities was ensured through sitting arrangements and use of vernacular language were employed where participants were not able to communicate in English. An interpreter was also used where the processors were not able to communicate in English.

The search showed the major maize products found in Nigeria is traditional foods. The search also showed that most of the firms are engaged in similar stages of processing, which include; cleaning, polishing, damping, drying, dehulling, milling, mixing, frying and packaging.

A pre-testing of the questionnaire and recognizance survey was conducted in the IPs. This informal survey was carried out to achieve the stated objectives and to reduce ambiguities. The purpose of the survey was to gather quick information on various aspects of the study, organize a fieldwork plan, test the validity of the questionnaire and estimate various cost components such as financial costs, travel time, interview time and so on. This preliminary survey provided an opportunity to understand existing labour use, as well as input and output costs. During the informal survey, interviews were held with a processors or group of processors on one or more aspects of the study and field notes were prepared. Based on this preliminary information, the questionnaire for the final surveys was developed

Table 2: Survey State, LGA and Innovation communities

State	**Local Government**	**Innovation communities**
Kwara	Asa	Pampo, Lasoju, Temidire/Bielesin, Ajuwon, Aladere Mogaji
	Moro	Aro badi, Jehun Kunu/Omoni, Adio, Yeregi, Elemere.
Oyo	Shaki East	Odo Oba, Aba Ilero, Olugbemi, Aba Daniel and Ilado.
	Shaki West	Tenleke, Imua, wasangare Oja, Wasangare Alabafe and Wasangare Sekore.
Nassawara	Karu	Kankanya, Gidan Koro, Gitata, Angwa Ayaba and Angwa Alura
	Kokona	Sabon gida, Kokona, Angwa Doka, Kofan gwari and Bakin Ayini.
Kaduna	Jema'a	Maigizo, Mailafiya, Takua, Kwagiri and Un jibrvive
	Zango Kataf	Magemiya, Samaru Katef, Fadan Kaje, Mabushi , Madakiya
Zamfara	Bungudu	Kwarin Tsauni, Kadamu Tsawa, Tabanni, Tambaki and Un Dunya.
	Tsafe	Fegin Baza, Gidan Dawa, Bayan Banki, Langa langa, Feegin Dan Marki.
Katsina	Funtua	Ungwar Dahiru, Ungwar Kwena Guga, Layin Gara, Ungwar Danmalam and Gardawa.

Faskari	Ungwar Boka, Unguwar Barau, Zagami, Unguwar maikanwa and Kurmi Doka.

Source: Authors compilation

The field survey was carried out for three months. One agricultural extension agent from agricultural development project (ADP) and three agricultural graduates were involved in administering the questionnaire using face to face personal interview. The enumerators were fully trained by the lead researcher, to ensure effective and efficient administration of the questionnaire. The interview took about 35-45 minutes depending on the literacy level of the respondent. This survey achieved a response rate of approximately 98 percent. This high rate could be attributed to the interest shown by both the respondents and the interviewers. Respondents were also incentivized to participate in the research by offering light refreshments. Most respondents see participation in research as an opportunity to inform researchers and the government about the constraints and problems related to maize processing.

The primary data were collected through a well – structured questionnaire that was administered through personal interview. The variables were selected from economic theory and empirical work as presented in the literature review and conceptual framework. Data collected include; socio-economic characteristics of the household processor, processors attribute/profile, processing activities, processing operation, total revenue (output and prices), inputs, variable cost, fixed cost (measured as sum of the yearly depreciation cost of processing equipment), types of maize products produced, mill size (measured as monthly milling capacity), constraints to processing of maize products and perception of profit situation .

2.3. Sampling Technique

A representative sample was selected through a multistage sampling technique. This comprises the household processors enterprises in Nigeria. In the first stage, three geopolitical zones (North West, North Central and South West) were considered for the study of which the three intervention plate forms (IP) of the SARD-SC project were selected. These include Kwara-Oyo IP (IP 1), Kaduna-Nasarawa IP (IP 2), and Katsina-Zamfara IP (IP 3).

In stage two, two local governments (LGs) were selected purposively from each of the project IP's making it a total number of twelve (12) LGA selected for the study. The third stage involved a selection of five (5) innovation communities from which a total number of sixty (60) innovation communities were purposively selected.

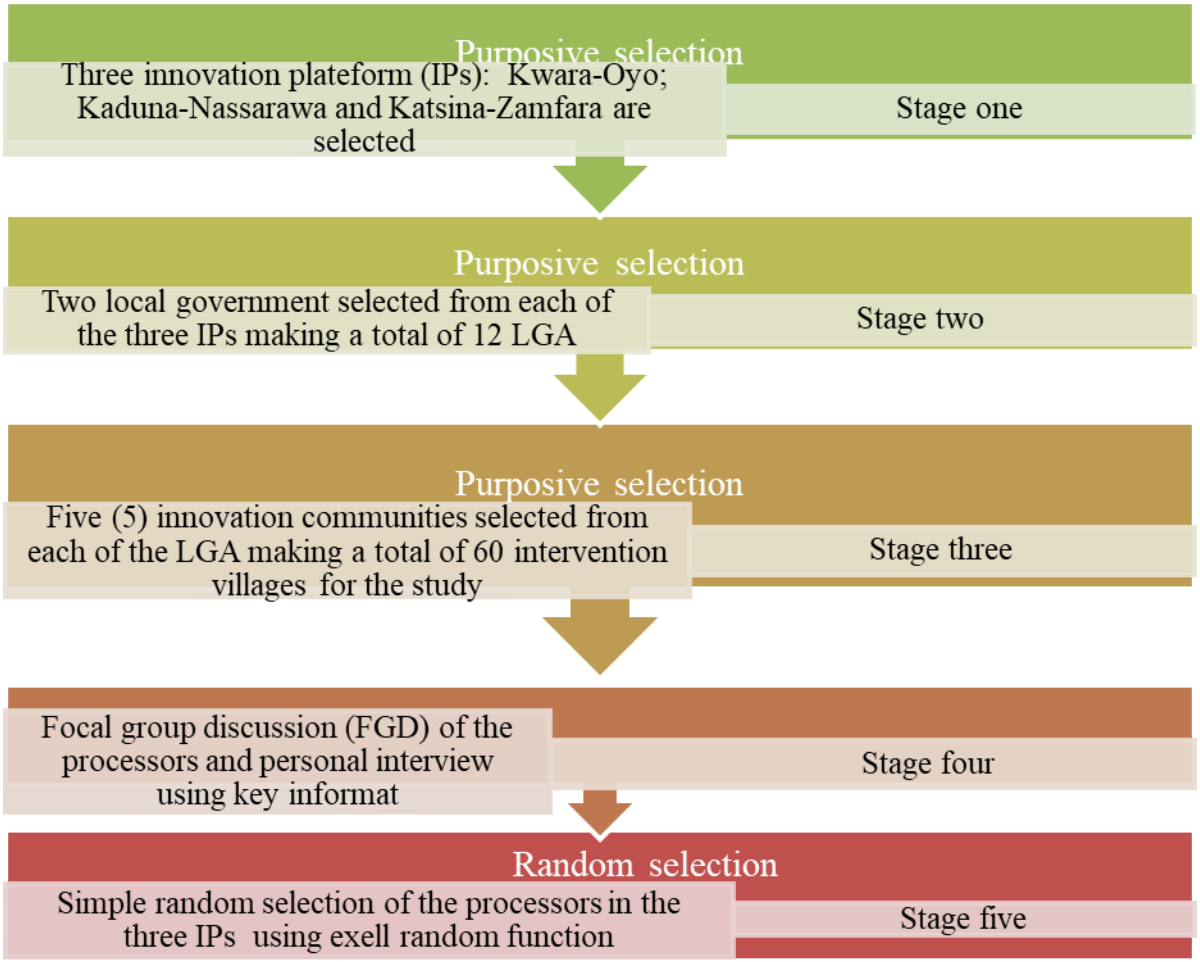

Fig 3: A Multistage Sampling Technique.
Source: Author's Compilation

Table 3: Population of Maize Processors in SARD-SC IP Locations of Nigeria.

IP Location	No. of LGAs / communes block	Number of communities	Number of Processors	Sample size
Oyo-Kwara	4	20	409	198
Kaduna – Nasarawa	4	20	423	202
Katsina-Zamfara	4	20	214	136
Total	**12**	**60**	**1046**	**536**

Source: Author's Compilation

Stage four involved a focal group discussion (FGD) with the processors in each of the innovation communities' in-order to know the population of the processors in each innovation platform. Stage five involved random selection of household maize processors in the three IP locations which made up the total number of the processors that was used for the study. Simple random sampling was used, whereby the selections of the household processors were done purely by chance.

IP 1 has a sample frame of 409 household processors from which a sample size of 198 was selected; IP 2 has a sample frame of 423 household processors from which a sample size of 202 was selected; IP 3 has a sample frame of 214 from which a sample size of 136 was selected. The selection was done using excel random function. This gives a total sample size of 536 household processors used in the study. 10 percent increase in the sample size was added for easy replacement of unavailable selected sample unit. Sampling in each of the IPs was done at the community and household level using a random procedure. Data instrument was administered to household processors processing different products of maize identified in the study area during focus group discussion.

To determine the sample size, the normal approximation to the hypergeometric distribution (population) is used (Fox, Hunn and Mathers, 2009). This is given as:

$$n = \frac{NZ^2pq}{[E^2(N-1)+Z^2pq]} \quad (3.1)$$

Where:
n = required sample size
N = population size
P and q = population proportions set at 0.5 each
Z = value that specifies the level of confidence. Level of confidence is 95%
E = accuracy of the sample proportions which can also be called margin of error. E is set at an accuracy of 5% which is 0.05.
The sample size for the study is shown in Table 3.

2.4. Budgetary Analysis

The budgetary technique such as cost and return is used to determine the gross margin and net return of maize processing. A gross margin refers to the total income derived from an enterprise less the variable costs incurred in the enterprise. Studies such as Johnson (1982) and Kay (1986) use net profit in determining the profitability of processors. Net return is realized after deducting fixed cost from gross margin. The strength of this technique is that it helps to identify all costs involved in the enterprise.

Mathematically:

$$GM = TR - TVC$$

Or (1)

$$GM = \sum_{i=1}^{n} PiQi - \sum_{j=1}^{n} PjXj$$

$$TR = PQ$$

$$TC = TFC + TVC \quad (2)$$

$$\Pi = GM - TFC$$

Where; π = Net Return,

PQ = Unit Price x Quantity (output)
TFC = Total Fixed Cost
GM = Gross Margin (₦/ton)
TVC = Total Variable Cost
TR = total revenue.

P_i = average price of output i (₦/kg), Q_i = average quantity of output i (kg).
P_j= average price of input j (₦/kg), Q_j = average quantity of input j (kg).

The results of the budgetary analysis were used to calculate profitability. Profitability measures the amount of profit a processor generates through its operation. It shows how well the processor uses its assets and equity to generate revenues and create a profit from those revenues. Profitability ratios include several different indicators that help assess a firm's profitability and record performance. The indicators such as operating expense ratio, profitability index, gross margin ratio, and rate of return on investment are valuable tools that provide useful information for decision making.

Operating expense ratio (OR) as a measure of profitability is calculated by dividing total variable cost by total return. This is giving as

$$\text{Operating Expense Ratio(OR)} = \frac{\text{Total Variable Cost (TVC)}}{\text{Total Revenue (TR)}} \quad (3)$$

Profitability index is a ratio that looks at income after all business expenses. This ratio is useful in determining the wisdom of investment in maize processing. It is calculated by dividing net income by total revenue. This ratio is giving as

$$Profitability\ index = \frac{Net\ Return\ (NR)}{Total\ Revenue\ (TR)} \quad (4)$$

Gross margin ratio is a profitability indicator that shows how much an enterprise has left from total revenue to pay operational and other business expenses. This ratio is crucial because any drop in the ratio brings a signal for immediate managerial action. It is calculated by dividing total revenue (net sales) by gross margin. The gross margin ratio is

$$Gross\ Margin\ Ratio\ (GM) = \frac{Gross\ Margin\ (GM)}{Total\ Revenue\ (TR)} \quad (5)$$

More so, the rate of return on investment is another way of considering profit in relation to capital invested in the business. It is therefore said to be a performance measure used to evaluate the efficiency of an investment. If the return on investment profit margin in business is slim, the business can hardly generate appreciable income to sustain its operation. Also, in a situation whereby the profit margin is very slim, reflecting to low return on investment, the operator will begin, to "eat" into their operating capital and the business, sooner than later, collapses (Emenyonu *et.al*, (2014).

The rate of return on investment can be expressed as:

$$Return\ on\ investment = \frac{\text{Net return}}{\text{Total Cost}} \quad (6)$$

2.5. Test of Hypothesis

In this section, we shall test the hypothesis of the different research items. The hypothesis states that profit of maize processors is not significantly influenced by age, gender, household size, marital status and education attainment. This hypothesis was tested using the t-ratios from the results of multiple regression analyses. The computed t-ratios were compared with the tabulated t-ratios at $p<0.05$ and $p<0.01$ at n-k degrees of freedom to test the hypotheses. Decision rule was to reject the null hypothesis if the t-computed value is greater than the

Table 4: Distribution of Maize Products Produced in the IPs.

	Kwara-Oyo IP (IP 1)		**Nasarawa-Kaduna IP (IP 2)**		**Katsina-Zamfara IP (IP 3)**	
	Kwara	Oyo	Nasarawa	Kaduna	Katsina	Zamfara
Maize products	Frequency	Frequency	Frequency	Frequency	Frequency	Frequency
Couscous / Dambo	-	-	-	-	3 (19)	11(10.4)
Chin Chin	-	-	-	-	-	6 (5.6)
Eko	-	19 (18.2)	-	-	-	-
Dokunu	-	1 (1.1)	-	-	-	1 (1.1)
Dunkwa	12 (12.8)	1 (1.1)	-	-	-	-
Egbo	7 (7.4)	3 (2.9)	-	-	-	-
Madidi/Maize Moi Moi)/Abari	-	1 (1.1)	11 (10.1)	-	-	-
Maize Flour	1 (1.1)	3 (2.9)	29 (26.6)	8 (8.6)	8 (26.7)	5 (4.7)
Maize Kokoro	1 (1.1)	4 (3.8)	-	-	-	-
Maize Kunu	-	1 (1.1)	9 (8.2)	11 (11.8)	-	5 (4.7)
Maize Bran	-	1 (1.1)	-	-	-	-
Masa/Chibi / Huce /(Cake)	13 (13.8)	3 (2.9)	20 (18.3)	-	1 (3.3)	28 (26.4)
Pap */ Ogi / Kwokwo*	38 (40.4)	43 (41.3)	12 (11)	10 (10.7)	-	-
Pancake /Pankaso	-	-	-	-	-	4 (3.8)
Pate	-	6 (5.8)	-	3 (3.2)	1 (3.3)	-
Pele	-	1 (1.1)	-	-	-	-
Pop Corn	7 (7.4)	-	1(1.1)	-	2 (1.9)	-
Roasted Corn	-	1 (1.1)	1 (1.1)	-	-	-
Tuwo Masara	15 (16.0)	16 (15.4)	15 (13.8)	15 (16.10)	3 (10)	23 (21.7)
Livestock Feed	-	-	1 (1.1)	-	-	-
Waina	-	-	-	-	13 (43.3)	21 (19.8)
Pancake / Pankaso	-	-	8 (7.3)	10 (10.80		-
Total	94 (100)	104 (100)	109 (100)	93 (100)	33 (100)	106 (100)

Source: Author's Compilation Figures in parenthesis are percentages

2.1. Maize Based Products in the IPs

Table 4 indicates there are mainly sixteen maize products in IP 1. These include *agidi, dokunu, dunkwa, egbo, madidi/abari,* maize flour, *maize kokoro, maize kunu*, maize bran, *masa/huce/chibi, ogi/kwokwo, Pate, Pele*, popcorn, roasted corn *and tuwo masara.* As the data indicated, *agidi/eko, dokunu, madidi/abari, kunu,* maize bran, *pate, pele and* roasted corn are processed in Oyo State while the predominant products were *agidi, ogi* and *tuwo masara*. In Kwara State, *dunkwa, egbo,* maize flour, *maize kokoro, masa, chibi/huce, pap/ogi/kwokwo, popcorn* and *tuwo masara* were produced while *ogi/kwokwo, tuwo masara, masa/chibi/huce* and *dunkwa* were the predominant product. The most predominant products from the IP are *ogi/kwokwo* and *tuwo masara.*

In IP 2, there are mainly twelve maize which include livestock feed, *madidi/abari*, maize flour, *maize kunu, masa/huce/chibi, pankaso/pancake, pap/ogi/kwokwo, pate, pele*, popcorn, roasted corn, *tuwo masara* and *waina*. The products produced from each state are shown below. Nasarawa State: *burukutu, Madidi/Moi Moi/Abari,* maizeflour, *maize hunu, pancake/pankaso, pap/ogi/kwokwo, popcorn,*

Table 5: Socio-economic Characteristics of Respondents in the IP

	IP 1		IP 2		IP 3	
Characteristics	**Kwara**	**Oyo**	**Nasarawa**	**Kaduna**	**Katsina**	**Zamfara**
	Frequency	**Frequency**	**Frequency**	**Frequency**	**Frequency**	**Frequency**
Gender (dummy)						
Male	0	4 (3.8)	0	1 (1.1)	1 (3.3)	4 (3.8)
Female	94 (100)	101 (97.1)	109 (100)	92 (98.9)	29 (96.7)	102 (96.2)
Total	94 (100)	104 (100)	109 (100)	93 (100)	30 (100)	106 (100)
Education attainment						
Non-formal	85 (90.4)	81 (77.9)	58 (53.2)	13 (13.9)	23 (76.6)	87 (82.0)
Primary education	7 (7.4)	17 (16.3)	35 (32.1)	21(22.6)	4 (13.3)	9 (8.5)
Secondary education	2 (2.1)	5 (4.8)	14 (12.8)	51 (54.8)	3 (10.0)	10 (9.4)
Tertiary education	0	1 (1)	2 (1.8)	7 (7..5)	0	0
Post graduate	0	0	0	1 (1.1)	0	0
Total	94 (100)	104 (100)	109 (100)	93 (100)	30 (100)	106 (100)
Age (years)						
≤30	13 (13.8)	35 (37.2)	46 (42.2)	41 (44.1)	16 (53.3)	65 (61.3)
31 – 40	28 (29.8)	21 (22.3)	41 (37.6)	30 (32.3)	7 (23.3)	28 (26.4)
41 -50	9 (9.6)	19 (20.2)	15 (13.7)	15 (16.1)	6 (20.0)	9 (8.4)
51 – 60	21 (22.3)	10 (10.6)	6(5.5)	5 (5.4)	0	4 (3.8)
61 – 70	23 (24.5)	8 (8.5)	1 (0.9)	2 (2.1)	1 (3.3)	0
≥71	0	2 (2.1)	0	0	0	0
Total	94 (100)	104 (100)	109 (100)	93(100)	30 (100)	106 (100)
Mean	48.5	40.7	34	34.4	34.0	31.5
Marital status						
Single	0	2 (1.9)	1 (9.0)	4 (4.3)	0	0
Married	87 (92.6)	99 (95.1)	106 (97.2)	87 (93.5)	29 (96.7)	106 (100)
Divorced	0	0	2 (1.8)	1 (1.1)	0	0

Widowed	7 (7.4)	3 (2.9)	0	1 (1.1)	1 (1.1)	0
Total	94 (100)	104 (100)	109 (100)	93 (100)	30 (100)	106 (100)
Household size						
(number of persons)						
≤5	30 (31.9)	43 (41.3)	33 (30.3)	22 (23.7)	6 (20)	50 (47.2)
5 – 10	58 (61.7)	55 (52.8)	51 (46.8)	57 (61.3)	9 (30)	33 (31.1)
11 – 15	6 (6.3)	4 (3.8)	13 (11.9)	8 (8.6)	5 (16.7)	14 (13.2)
16 – 20	0	2 (1.9)	7 (6.4)	3 (3.2)	3 (10)	8 (7.5)
21 – 25	0	0	3 (2.8)	2 (2.1)	4 (13.3)	0
26 – 30	0	0	1 (0.9)	1 (1.1)	2 (6.7)	0
Total	94 (100)	104 (100)	109 (100)	93 (100)	30 (100)	106 (100)
Mean	6	6	8.4	8.2	13	7

Source: Author's Compilation Figures in Parentheses is percentages

roastedcorn, *tuwomasara and waina*; Kaduna State: *madidi/abari*, maize flour, *maize kunu*, *pankaso/pancake*, *pap/ogi/kwokwo*, *pate*, roasted corn, *tuwo masara* and *waina*. The predominant products from this IP were maize flour, *maize kunu*, *pankaso*, *ogi/kwokwo* and *tuwo masara*.

In IP 3, there are twelve maize products in this IP. These products include *couscous/dambo*, *chin chin*, *dokunu*, maize flour, *maize kunu*, *masa/huce/chibi*, *pankaso/pancake*, *ogi/kwokwo*, *pate*, popcorn, roasted corn, *tuwo masara and waina*. The products in each of the state are shown below; Katsina State: *couscous/dambo*, maize flour, *masa/chibi/huce/baked cake*,*pate*, roastedcorn, *tuwomasara* and *waina*. Zamfara State: couscous/dambo, chin chin, dokunu, maize flour, *masa/chibi/huce/baked cake*, pancake/pankaso, popcorn, tuwo masara and waina. The most predominant products from the IP were *waina*, *tuwo masara*, maize flour and *couscous/ dambo*.

2.2. Socioeconomic Characteristics of Processors

The socioeconomic characteristics of maize processors include gender, the level of education, age, marital status and household size. Choice of these characteristics for comparison is based on literature on processing (Oladejo et.al, 2014; Amao, Adesiyan and Salako, 2007; Ibekwe et.al, 2012 and Edinam, Joshua and Danso-Abbeam, 2015). Table 5 presents the basic descriptive statistics of processors characteristics in the IPs and their effects examined. The IPs in this section are referred to as IP 1 (Kwara-Oyo), IP 2 (Nasarawa-Kaduna) and IP 3 (Katsina-Zamfara).

2.3. Demography Survey of the IPs

Table 4.2 indicates the proportion of gender of the processors in each of the states. This is as shown below. Kwara state: 100 percent are female. Oyo State: 97.1 percent female with 3.8 percent male. Nasarawa State: 98.9 percent are female with 1.1 percent male. Kaduna State: 98.9 percent female with 1.1

percent male. Katsina State: 96.7 percent were female with3.3 percent male. Zamfara State: 96.2 percent female with 3.8 percent male. This reveals that the sex of the respondents is totally feminine with 97.9 percent from IP 1, 99.5 percent from IP 2and 96.3 percent from IP 3. This, therefore, indicates that maize processing in the IPs is a female-dominated activity. This agrees with the observation of Muhammed-Lawal, Omotesho and Oyedemi et al., (2013) and confirms the view that processing is predominantly a female enterprise in Nigeria (Ajayi, 1995; Oluwasola, 2010).

Kwara State: has 90.4 percent non-formal, 7.4 percent were primary education, and 2.1 percent has secondary education. Oyo State: 77.9 percent has non-formal education, 16.3 percent has primary education, 4.8 percent has secondary education and 1 percent has tertiary education. Nasarawa State: 53.2 percent have non-formal education, 32.1 percent have primary education, 12.8 percent have secondary education and 1.8 percent has tertiary education. Kaduna State: 13.9 percent have non-formal education, 22.6 percent have primary education, 54.8 percent have secondary education, 7.5 percent have tertiary education and 1.1 percent has a postgraduate education. Katsina State: 76.6 percent have a non-formal education, 13.3 percent have primary education and 10.0 percent have secondary education. Zamfara State: 82.0 percent have a non-formal education.8.5 percent have primary education and 9.4 percent have secondary education. Hence, Kwara-Oyo IP and Katsina-Zamfara IP have the highest percentage of processors with a non-formal education of 80.8 percent. In Nasarawa-Kaduna IP, 35.1 percent of the processors have a non-formal education with 64.9 percent having one form of education or the other.

This implies that processors in IP 1 and IP3 relatively has non-formal education and will not adopt new innovation easily for greater productivity. But, adoption of new technology and innovation will be somehow easy in IP2. The low literacy level of the processors could affect to a great extent the efficiency of processing in terms of adoption to innovation to improve processing since education plays an important part in information and technology acceptance. This agrees with the findings of Oluwasola (2010) and Sullumbe (2004) who found that low education level of the female gender could have serious implications on their ability to access information and adopt new technological innovations.

Kwara State has 2.6 percent married persons, and 7.4 percent were widowed. Oyo State: 1.9 percent single, 95.1percent married and 1.8 percent divorced. Naasarawa State: 9.0 percent single, 97.2 percent married and 1.8 percent divorced. Kaduna State: 4.3 percent single, 93.5 percent married, 1.1 percent divorced and 1.1 percent widowed. Katsina State: 96.7 percent married and 1.1 percent widowed. Zamfara State: 100 percent are married. This, therefore, shows that 95.8 percent in IP 1, 95.5 percent in IP 2and 99.2 percent in IP 3 are married. This implies that married persons with children could increase the level of family labour used by the processor thereby reducing the amount accrued for labour in the production cost. This agrees with Amao, Adesiyan and Salako (2007) and Ibekwe et.al (2012) were processors have dependents giving the opportunity of

using family labour as the major source of labour.

The age distribution of processors in the state with respect to the age bracket with the highest and lowest are shown in table 5 and discussed below. Kwara State: 28.8 percent of the processors ranged between 31-40 years and 9.6 percent ranged between 41-50 years and the mean age is 48.5 years; Oyo State: 37.2 percent are between ≤30 years, 2.1 percent between ≥ 71 years and the mean age is 40.7 years; Nasarawa State: 42.2 percent are between ≤30 years, 1 percent between 61-70 years and the mean age is 34 years; Kaduna State: 44.1 percent are between ≤30 years, 2.1 percent between 61-70 years and the mean age is 34.4 years; Katsina State: 53.3 percent are between ≤30 years, 3.3 percent between 61-70 years and the mean age is 34 years. Zamfara State: 61.3 percent are between ≤30 years and 3.8 percent between 51-60 percent and the mean age is 31.5 years. However, there is a wide spread of processors among all the age groups. This implies that maize processing is embraced by all age groups. Based on World Health Organization, the average life expectancy chart in 2011 is 52 years for Nigeria, it can be inferred that maize processors in the IP are within their productive life expectancy state and hence belong to the economically active age population category. This agrees with similar findings of Amao, Adesiyan and Salako, (2007); Obasi et al. (2015; 2012) and Oluwasola (2010).

A household comprised of all persons who live under the same roof and eat from the same pot (Okorie, 2012 as cited in F.O.S., 1985). Lipsey (1986) defined a household as all people who live under one roof and make a joint financial decision. For this study, a household implies the head, wife or wives, children and other dependent living under the same roof. From the survey (Table 5) household size with the mean in the state is specified as follows. Kwara State: mean size of 6 persons, Oyo State: 6 persons; Nasarawa State: mean size of 8.2 persons; Kaduna State: mean size of 8.4 persons; Katsina State: mean size of 13 persons; Zamfara State: mean size of 7 persons. This suggests that processors are likely to have access to family labour readily which will contribute to their labour need for maize processing and consequently influence the amount spent on hired labour. It may also be noted that higher family size means more people to feed, thus putting pressure on the availability of food. Often time in a large family size a processor is faced with the challenges of providing social and welfare facilities such as feeding, education, sheltering, health care and other living expenses for such a large number of dependents. These expenses account for low profit at the end of every sale aside the fact that most produce is consumed by the large household members. In a related study, Achem, et al 2013 also found low overall output from cassava farmers as a result of large family size.

2.4. Processing Activities of Maize Processors in the IPs

The descriptive statistics of the processing variables obtained from maize processors in the IPs are presented in table 6 and described below with respect to the activity with the highest frequency. This aims at identifying different activities engaged by

the processors in the IPs. The IPs in this section is referred to as IP 1 (Kwara-Oyo IP), IP 2 (Nasarawa-Kaduna IP) and IP 3 (Katsina-Zamfara IP).

Labour is one of the factors of production which could be in the form of family labour and hired labour. In IP 1, 96.8 percent and 94.5 percent of the respondent in Kwara and Oyo state rely on family labour. IP 2: 94.5% and 94.5% in Nasarawa and Kaduna State rely on family labour. IP 3: 93.3

Table 6: Characterization of Maize Processing Activities in the IPs

	Kwara	Oyo	Nasarawa	Kaduna	Katsina	Zamfara
	IP1		IP 2		IP 3	
Variables/Activity	**Frequency**	**Frequency**	**Frequency**	**Frequency**	**Frequency**	**Frequency**
Source of Labour						
hired labour	1 (1.1)	3 (2.9)	1 (0.9)	1 (1.1)	0	0
family labour	91 (96.8)	99 (95.2)	103 (94.5)	84 (90.3)	28 (93.3)	104 (98.1)
Both	2 (2.1)	2 (1.9)	5 (4.6)	8 (8.6)	2 (6.7)	2 (1.9)
Total	94 (100)	104 (100)	109 (100)	93 (100)	30 (100)	106 (100)
Mode of Operation						
capital intensive	6 (6.4)	31 (29.8)	4 (3.7)	13 (14)	0	6 (5.7)
labour intensive	79 (84)	57 (54.8)	51 (46.8)	44 (47.3)	11 (36.7)	35 (33)
capital and labour intensive	9 (9.6)	16 (15.4)	54 (49.5)	36 (38.7)	19 (63.3)	65 (61.3)
Total	94 (100)	104 (100)	109 (100)	93 (100)	30 (100)	106 (100)
Occupation						
Primary	84 (89.4)	53 (50.9)	57 (52.2)	48 (51.6)	17 (56.7)	66 (62.3)
Secondary	10 (10.6)	51 (49)	52 (47.7)	45 (48.4)	13 (43.3)	40 (37.7)
Total	94 (100)	104 (100)	109 (100)	93 (100)	30 (100)	106 (100)
Mode of ownership						
sole proprietorship	93 (98.9)	104 (100)	109 (100)	90 (96.7)	30 (100)	100 (94.3)
Partnership	1 (1.1)	0	0	1 (1.1)	0	6 (5.7)
Cooperative	0	0	0	2 (2.2)	0	0
Total	94 (100)	104 (100)	109 (100)	93 (100)	30 (100)	106 (100)
Source of Capital at Start- up						
Family	17 (18.1)	15 (14.4)	41 (37.6)	37 (39.8)	18 (60)	51 (48.1)
own savings	77 (81.9)	86 (82.6)	61 (56)	45 (48.4)	10 (33.3)	53 (50)
Friends	0	2 (1.9)	1 (0.9)	4 (4.3)	1 (3.3)	2 (1.9)
cooperatives	0	1 (1)	3 (2.8)	4 (4.3)	0	0
Micro finance bank	0	0	3 (2.8)	3 (3.2)	0	0
bank of agriculture	0	0	0	0	1 (3.3)	0
Total	94 (100)	104 (100)	109 (100)	93 (100)	30 (100)	106 (100)
Source of Maize						
Market	92 (97.8)	56 (53.8)	109 (100)	90 (96.8)	29 (96.7)	105 (99.1)
own farm and market	2 (2.1)	35 (33.7)	0	1 (1.1)	0	0
own farm	0	13 (12.5)	0	2 (2.2)	0	0
buy from different farmers	0	0	109 (100)	0	1 (3.3)	1 (0.9)
Total	94 (100)	104 (100)		93 (100)	30 (100)	106 (100)

Quantity of output produced monthly (kg)						
≤100	35 (37.2)	30 (28.8)	29 (26.6)	44 (47.3)	2 (6.7)	16 (15.1)
101 – 200	27 (28.7)	26 (25)	33 (30.3)	16 (17.2)	4 (13.3)	11 (10.4)
201 – 300	19 (20.2)	18 (17.3)	10 (9.2)	11 (11.8)	10 (33.3)	32 (30.2)
301 – 400	4 (4.3)	6 (5.8)	10 (9.2)	13 (14.0)	6 (20)	21 (19.8)
401 – 500	5 (5.3)	1 (1)	9 (8.2)	1 (1.1)	2 (6.7)	10 (9.4)
501 – 600	3 (3.2)	1 (1)	0	1 (1.1)	2 (6.7)	7 (6.6)
>600	1 (1.1)	22 (21.2)	18 (16.5)	7 (7.5)	4 (13.3)	9 (8.5)
Total	94 (100)	104 (100)	109 (100)	93 (100)	30 (100)	106 (100)
Mean	175.2	263.2	262.8	188	342.9	315.2
Processing Experience (years)						
≤10	40 (42.5)	62 (59.6)	93 (85.3)	67 (72.0)	19 (63.3)	78 (73.5)
11 – 20	21(22.3)	22 (21.1)	14 (22.0)	22 (23.7)	9 (30)	11 (10.3)
21 – 30	24 (25.5)	6 (5.8)	2 (1.8)	3 (3.2)	1 (3.3)	4 (3.7)
31 – 40	8 (8.5)	7 (6.7)	0	0	1 (3.3)	0
41 – 50	1 (1.1)	5 (4.8)	0	0	0	0
51 – 60	0	2 (1.9)	0	0	0	0
>60	0	0	0	1 (1.1)	0	0
Total	94 (100)	104 (100)	109 (100)	93 (100)	30 (100)	106 (100)
Mean	17.2	14.1	6	6.7	7.5	5.7

Source: Author's Compilation Figures in Parentheses are percentages

percent and 98.1 percent in Katsina and Zamfara state rely on family labour. This is attributed to the large household size revealed by the study as the individuals in the household are a potential source of labour (see table 4.3).

Labour is one of the factors of production which could be in the form of family labour and hired labour. In IP 1, 96.8 percent and 94.5 percent of the respondent in Kwara and Oyo state rely on family labour. IP 2: 94.5% and 94.5% in Nasarawa and Kaduna State rely on family labour. IP 3: 93.3 percent and 98.1 percent in Katsina and Zamfara state rely on family labour. This is attributed to the large household size revealed by the study as the individuals in the household are a potential source of labour (see Table 6).

Mode of operation of the processors is an important factor that determines the level of productivity. The result in table 4.2 shows that in IP 1:84 percent and 54.8 percent of processors in Kwara and Oyo state are labour intensive, 6.4 percent and 29.8 percent is capital intensive while 9.6 percent and 15.4 percent are both. IP 2:49.5 percent capital and labour intensive, 46.8 percent labour intensive and 3.7 capital intensive in Nasarawa State. In Kaduna State 47.3 percent is labour intensive, 38.7 percent is capital and labour intensive and 14 percent capital intensive. IP 3: 36.7 percent is labour intensive and 63.3 percent both capital and labour intensive in Zamfara state. In Katsina state 61.3 percent is capital and labour intensive, 33 percent is labour intensive and 5.7 percent is capital intensive. The result, therefore, revealed that the mode of operation of the processors is labour intensive.

Table 6 shows that in IP 1, 98.9 percent and 100 percent of the maize processing business is owned solely by the processor in Kwara and Oyo state while 1.1 percent is being owned through partnership. In IP 2,

100 percent and 96.7 percent are sole proprietors in Nasarawa and Kaduna state, meanwhile in Kaduna state, 1.1 are into partnership and 2.2% are in cooperative. In Katsina and Zamfara state, 100 percent and 94.3 percent of the processor own the business themselves while 5.7 percent processors engage in partnership business. The distribution of the respondents according to their form of business revealed that majority of the processors in the IPs operates as a sole proprietorship. This agrees with the fact that they are categorized as micro-enterprise.

Processing as an occupation plays an important role in increasing the revenue which is essential for optimum profitability. The study shows that in IP 1, the majority of the processors (89.4 percent and 52.2 percent) in Kwara and Oyo state are engaged in maize processing as a primary occupation, while 10.6 percent and 49.0 percent of them engage in it as a secondary occupation. In IP 2, 52.2 percent and 51.6 percent of the processors in Nasarawa and Kaduna state are engaged in maize processing as a primary source of income. Further analyses revealed that 47.7 percent and 48.4 percent of the respondents are engaged in the business as a secondary occupation. In IP 3, 56.7 percent and 62.3 percent in Katsina and Zamfara state are full – time processors, while others (43.3% and 37.7%) engaged in occupations aside the processing business (see table 4.3) . This indicates that higher proportion of the respondents take maize processing as a business venture. Processors who engaged in other activities often time are said not to re-invest properly into the business as they usually tend to diversify their income into various activities they engage in.

Table 5 shows that in IP 1 81.9 percent and 82.6 percent of the maize processors in Kwara and Oyo state depend solely on their own saving as their source of capital at start-up, while few others sourced capital from family (18.1 percent and 14.4 percent). In IP 2, 56.0 percent and 48.4 percent of the processors in Nasarawa and Kaduna state used own savings while 37.6 percent and 39.8 percent relied on family, 0.9 percent, and 4.3 percent got their capital from friends, 2.8 percent and 4.3 percent got from cooperatives while 2.8 percent and 3.2 percent got their capital from microfinance bank. In IP 3, 60 percent and 48.1 percent from Katsina and Zamfara state financed their business with assistance from their family while 50 percent and 33.3 percent of the processors used their personal savings. In both states, 3.3 percent and 1.9 percent of the business were financed by their friends while 3.3 percent was financed by the bank of agriculture in Zamfara State. It can be inferred that processors in the IPs do not enjoy credit facility from financial institutions/agency. This is because financial institution such as bank and other lending agencies appears either not accessible or have a stringent condition attached to their services such as hiding charges thereby making loan inaccessible to micro enterprises. These, of, course will hamper production and the level of profit generated to a large extent. However, Anon, (2009) asserted that loan is a crucial input and can be used to establish and expand businesses thereby increasing production.

2.5. Source of Maize grain

Maize processors in the IPs source their maize grains from two points; the market

and from own farm and market. From the result of the analysis in table 4.3, it is revealed that in IP 1, 97.8 percent and 53.8 percent source their maize in from the market in Kwara and Oyo state, while 2.1 percent and 33.7 percent source from own market and farm. In IP 2,100 percent and 96.8 percent source their maize from the market in Nasarawa and Kaduna State. In IP 3, 96.7 percent and 99.1 percent in Katsina and Zamfara state source maize from the market. On the other hand, 3.3 percent and 0.9 percent of the processors source their maize from different farmers. This implies that the processors in the IPs source their maize grain from the market.

2.6. Milling Capacity

The result of the analysis shows that the average monthly milling capacity of the processors in IP 1 is 175.2kg and 263.2kg for Kwara and Oyo state with 37.2 percent and 28.8 percent processor processing less than 100kg of maize monthly. In IP 2 are 262.8kg and 348.9kg for Nasarawa and Kaduna state. Majority of the processors (30.3%) milling capacity in Nasarawa state ranges from 101 – 200kg per month while in Kaduna state the highest milling capacity of the processors is between the ranges of less than 100 kg (47.3%) per month. In IP 2, 342.9kg and 315.2kg are the average milling capacity for processors in Katsina and Zamfara state with 33.3 percent and 30.2 percent of the respondents processing between 201-300kg of maize products monthly. This implies that the quantity of products produced vary with respect to the scale of production. This agrees with Paulina et al, (2004) findings, hence the processors are classified as microenterprise since there level of output is less than 1000kg per day (see table 4.3).

2.7. Processing Experience

Processing experience among the processors is an important determinant of agricultural profitability. (Amao, adesiyan and Salako, 2007; Ibekwe *et.al*., 2012). The result shows that the average processing experience in IP 1 for Kwara and Oyo state is 12 years. In IP 2, for Nasarawa and Kaduna state the mean number of years of processing experience is 6 years and 7 years while in IP 3, the processors in Katsina and Zamfara on the average have 7 years and 5 years of experience respectively. This, therefore, implies that majority of the processors are experienced maize processors and the number of years a processor spent in the business is an indication of the practical knowledge acquired and introduction of any change in technology may be difficult to accept and adopt. A similar finding was made by Muhammad-Lawal, Animashaun and Towoju, (2012).

2.8. Cost, Return and Profitability Analysis to Maize Products in Nigeria

Data were analyzed to estimate the production costs and returns from maize processing. The return was computed as actual prices paid and received by processors from the sale of maize products. The monthly costs and returns of different products from maize processing in the three IPs were estimated. Production costs are divided into fixed and variable costs. The valid measure is in terms of monetary value

which is used for cross-comparisons across the IPs.

The net return, profitability index, gross margin and rate of return on investment were used for the cost and revenue analysis. This analysis uses total revenue (TR), total variable cost (TVC) and total fixed cost (TFC). The rate of return on investment (RRI) is used to show the returns per naira on investment of processing the different products of maize identified in the IPs. Total fixed cost includes cost such as the cost of frying pan, sieve, frying spoon, knives, mortar, pot, basin, basket, container, and bucket. The fixed cost is calculated using straight line method. Total variable cost are cost such as cost of maize grain, cost of grinding, cost of firewood, cost of kerosene, cost of water, plastic bag and other costs (this include: cost of frying, cost of mixing, cost of ingredients, cost of groundnut oil etc.). The rate of return per naira invested in the maize products was evaluated by computing the rate of investment for each of the processed maize products that were produced by the processor. A high rate of return signifies a profitable enterprise.

Assessment of profitability levels of the products found in the IPs involves comparison of the maize product with the highest and lowest profit with respect to the mean cost of production (variable and fixed cost), mean return, profitability index, gross margin ratio and rate of return on investment. This was done to show the differences in profitability of the products (see tables 7, 8 and 9).

2.9. Profitability Analysis to Maize Processing in Kwara-Oyo IP

The result of the analysis is shown in table 4.4 and discussed below. In Kwara State: the mean production cost for *tuwo masara* is ₦25,348 followed by *egbo* (₦49,978.5) and *tuwo masara* (₦25,348) having the lowest production cost. In Oyo State: the average production cost for *tuwo masara* was the highest (₦82,529) of which 96.2 percent represent the total cost with fixed cost accounting for only 3.8 percent followed by *kokoro* (₦76,359.38) and maize flour which gave the lowest (₦213,608) net return of ₦-18,371. In Oyo State, *egbo* has the highest total revenue of ₦160,333 with a gross margin of ₦105,933 and net return of ₦103,665.The result further revealed that *ogi/kwokwo* in Oyo state has a negative gross margin of ₦-4,992.75 and a negative net return of ₦-6,969.7 (see Table 4.4). Usman, Suleiman and Ibrahim (2014) reported gross margin of ₦41.33 for popcorn for the popcorn processors per kg of maize processed and a gross margin of ₦44.95 for maize flour.

In Table 7, profitability ratios for the product identified in the IP with respect to the product with the highest net return shows that: In Kwara State, *tuwo- masara* has a net return of ₦33,709 with a profitability index of 0.57 which implies that 57 percent of the total revenue generated from *tuwo-masara* constitutes the net return. The operating expense ratio of 0.38 shows that the variable cost consumed 38 percent of sales. Also, the rate of return on investment of ₦1.33 implies that processors' recorded 1.33k as gain for every ₦100 invested in *tuwo-masara* processing. This reveals an appreciable level of profit from processing maize into *tuwo-masara*. Hence,

showing that *tuwo-masara* enterprise is a profitable business in the IP. In Oyo State, *huce/masa/baked cake* has a net return of ₦74,721.66; profitability index of 0.64 which suggest that 64 percent of the total revenue generated constitute the net return. The operating expense ratio of 0.32 implies that the variable cost consumed 32 percent of sales while the rate of return of ₦1.77 shows that for every ₦100 invested the investor will earn a profit of 1.77k.

This shows that *tuwo masara* and *huce/masa/*baked-cake processing in IP 1 is a profitable business. And hence, processors' were operating at a profit and making profit. This also applies to all other products produced by the processors (see table 7).

Table 7: Profitability Analysis to Maize Processing In Kwara-Oyo IP per Month

Items	**Maize flour(₦)**		**Tuwo masara (₦)**		**Popcorn (₦)**		**Ogi/Kwokwo (₦)**		**Huce/masa/baked cake (₦)**		**Ebgo (₦)**	
	Kwara	**Oyo**	**Kwara**	**Oyo**	**Kwara**	**Oyo**	**Kwara**	**Oyo**	**Kwara**	**Oyo**	**Kwara**	**Oyo**
Total Revenue	**63600**	**260000**	**59057**	**85129**	**35750**	**-**	**56321**	**58253**	**48529**	**117000**	**67600**	**80333**
Variable Items						-						
Cost of maize	35360	115700	8462.9	54243	19972	-	20143.8	39983.16	12800	16466.67	14857.1	39000
Cost of water	-	-	3493.1	1300	-	-	6344	3575	-	2600		
Cost of kerosene	-	14733	-	3120	-	-	-	3328	-	-	-	8400
Cost of firewood	-	-	2800	2800	-	-	7890.91	5540	-	2600	-	-
Cost of packaging material	-	13000	-	3315	5600	-	7800	2392	-	1040	-	-
Cost of groundnut oil	-	-	-	-	15600	-	-	-	11786.7	3120	7366.67	-
Cost of grinding	4200	28000	5492.3	11822	-	-	5617.5	8427.586	4403.64	4000	2800	7000
Cost of polishing	-	-	3200	1400	-	-	-	-	4137.78	-	4993.33	-
Labour cost		42000	-	-	5950	-	-	-	560	7560		
Other cost	-	-	2156	1400	5473.3	-	3600	-	4535	-	13556.5	-
Total Variable Costs of Inputs	**39560**	**213433**	**22804**	**79400**	**52595**	**-**	**51396.3**	**63245.75**	**38223.1**	**37386.67**	**43573.6**	**54400**
Gross Margin	24040	46567	36253	5728.8	-16845	-	4924.73	-4992.75	10305.9	79613.33	24026.4	105933
Fixed Cost												
Depreciation cost of equipment	500	175	2543.3	3129	1525.8	-	2551.37	1976.957	1377.55	4891.667	6404.86	2268.4

Total Cost	**40060**	**213608**	**25348**	**82529**	**54121**	**-**	**53947.6**	**65222.7**	**39600.6**	**42278.34**	**49978.5**	**56668**
Net Return	**23540**	**46392**	**33709**	**2599.8**	**-18371**	**-**	**2373.36**	**-6969.7**	**8928.37**	**74721.66**	**17621.5**	**23665**
Profitability index	**0.37**	**0.18**	**0.57**	**0.03**	**-0.51**	**-**	**0.042**	**-0.12**	**0.18**	**0.64**	**0.26**	**0.29**
Operating Expense Ratio	**0.62**	**0.82**	**0.38**	**0.93**	**1.47**	**-**	**0.91**	**1.08**	**0.78**	**0.32**	**0.64**	**0.67**
Rate of Return on Investment	**0.58**	**0.22**	**1.33**	**0.032**	**-0.33**	**-**	**0.044**	**-0.11**	**0.23**	**1.77**	**0.35**	**1.83**

Source: Field Survey

Table 7 continue

Items	**Kokoro (₦)**		**Dunkwa (₦)**		**Pate (₦)**		**Agidi/Eko (₦)**		**Kunu (₦)**	
	Kwara	**Oyo**	**Kwara**	**Oyo**	**Kwara**	**Oyo**	**Kwara**	**Oyo**	**Kwara**	**Oyo**
Total Revenue	**57520**	**110500**	**40092**	**-**	**-**	**59280**	**-**	**49806.25**	**-**	**41600**
Variable Items										
Cost of maize	-	-	10931.82	-	-	25471.33	-	29043.53	-	13000
Cost of water	-	975	-	-	-	-	-	3315	-	650
Cost of kerosene	-	-	-	-	-	-	-	-	-	-
Cost of firewood	-	7000	-	-	-	4200	-	4000	-	1800
Cost of packaging material	-	10140	3120	-	-	-	-	2920	-	15600
Cost of groundnut oil	-	3900	7897.5	-	-	-	-	-	-	-
Cost of grinding	2800	10253.33	4044.444	-	-	4340	-	8235	-	4200
Cost of polishing	8400	-	-	-	-	-	-	-	-	-

Labour cost	2800	8900	2800	-	-	5600	-	-	-	-
Other cost	11200	5600	78368.33	-	-	-	-	-	-	-
Total Variable Costs of Inputs	**47600**	**72768.33**	**46762.65**	**-**	**-**	**39611.33**	**-**	**47513.53**	**-**	**35250**
Gross Margin	**9920**	**37731.67**	**-6670.65**	**-**	**-**	**19668.67**	**-**	**2292.72**	**-**	**6350**
Fixed Cost										
Depreciation cost of equipment	1308.333	3591.042	2650.434	-	-	5446.96	-	1921.963	-	966.6667
Total Cost	**48908.33**	**76359.38**	**49413.08**	**-**	**-**	**45058.29**	**-**	**49435.49**	**-**	**36216.67**
Net Return	**8611.667**	**34140.62**	**-9321.08**	**-**	**-**	**14221.71**	**-**	**370.7575**	**-**	**5383.333**
Profitability Index	**0.149**	**0.308**	**-0.232**	**-**	**-**	**0.239**	**-**	**0.007**	**-**	**0.129**
Operating Expense Ratio	**0.82**	**0.65**	**1.16**	**-**	**-**	**0.66**	**-**	**0.95**	**-**	**0.84**
Rate of Return on Investment	**0.18**	**0.45**	**-0.19**	**-**	**-**	**0.32**	**-**	**0.0075**	**-**	**0.15**

Source: Field Survey

Table 8: Profitability Analysis to Maize Processing in Nasarawa-Kaduna IP per Month.

Items	**Maize flour (₦)**		**Tuwo masara (₦)**		**Ogi/Kwokwo (₦)**		**Huce/masa/baked cake (₦)**	
	Nasarawa	**Kaduna**	**Nasarawa**	**Kaduna**	**Nasarawa**	**Kaduna**	**Nasarawa**	**Kaduna**
Total Revenue	**151114.7**	**113286**	**50873.33**	**44554.6**	**29791.67**	**31922.2**	**37375**	**47600**
Variable Items								
Cost of maize	57769.52	72816.3	9914.667	9660	10811.67	8814	10217.2	9568
Cost of water	4576	-	1007.5	2971.43	2773.333	3120	2236	1863.33
Cost of kerosene	-	-	-	-	-	-	-	-

Cost of firewood	-	-	7830.769	9250	4466.667	6800	4575	8464.44
Cost of packaging material	3640	8200	1560	4160	3250	-	2600	1300
Cost of groundnut oil	-	-			-	-	8900.667	8986.25
Cost of grinding	7164.706	6520	3686.667	2706.67	3440	2280	2763.765	4210
Cost of polishing	8800	-	1680	2520	-	-	1610	2600
Labour cost	-	-			-	-	-	-
Other cost	-	-			-	-	2250	4300
Total variable costs of inputs	**81950.23**	**87536.3**	**25679.6**	**31268.1**	**24741.67**	**21014**	**35152.63**	**41292**
Gross margin	**69164.47**	**25749.5**	**25193.73**	**13286.5**	**5050**	**10908.2**	**2222.369**	**6307.97**
Fixed cost								
Depreciation cost of equipment	1370.503	761.5	4984.669	6674.68	2696.111	2366.84	1328.66	3130.32
Total cost	**83320.73**	**88297.7**	**30664.27**	**37942.8**	**27437.78**	**23380.8**	**36481.29**	**44422.4**
Net Return	**67793.97**	**24988**	**20209.06**	**6611.77**	**2353.889**	**8541.38**	**893.7088**	**3177.6**
Profitability Index	**0.44**	**0.22**	**0.39**	**0.12**	**0.07**	**0.26**	**0.97**	**0.06**
Operating Expenses Ratio	**0.54**	**0.77**	**0.50**	**0.70**	**0.83**	**0.65**	**0.94**	**0.86**
Rate of return on investment	**0.81**	**0.28**	**0.65**	**0.17**	**0.086**	**0.37**	**0.024**	**1.00**

Source: Field Survey

Items	**Kunu**		**Pankaso / pancake**		**Waina**	
	Nasarawa (₦)	**Kaduna (₦)**	**Nasarawa (₦)**	**Kaduna (₦)**	**Nasarawa (₦)**	**Kaduna (₦)**
Total Revenue	**25257.56**	**42380**	**29737.5**	**43420**	**-**	**50886**
Variable Items						
Cost of maize	6326.667	9572.73	5655	8398	-	8807.5
Cost of water	1248	5096	1072.5	1430	-	2860
Cost of kerosene	-	-			-	
Cost of firewood	3290	8855	5050	6660	-	9133.3
Cost of packaging material	7800	3900	-	3856.67	-	1950
Cost of groundnut oil			10400	12642.5	-	8951
Cost of grinding	2400	5022	2560	4100	-	3733.3
Cost of polishing	-	-			-	
Labour cost	-	-			-	
Other cost	-	-			-	3900
Total Variable Costs of Inputs	**21064.67**	**32445.7**	**24737.5**	**37087.2**	**-**	**39335**
Gross Margin	**4192.893**	**9934.27**	**5000**	**6332.83**	**-**	**11551**
Fixed Cost						
Depreciation cost of equipment	1810.698	3185.68	1414.393	2568.65	-	1080.6
Total Cost	**22875.36**	**35631.4**	**26151.89**	**39655.8**	**-**	**40416**
Net Return	**2382.196**	**6748.59**	**3585.608**	**3764.18**	**-**	**10470**

Profitability Index	**0.09**	**0.15**	**0.12**	**0.08**	**-**	**0.79**
Operating Expense Ratio	**0.83**	**0.76**	**0.83**	**0.85**	**-**	**0.77**
Rate of Return on Investment	**0.10**	**0.19**	**0.14**	**0.095**		**0.26**

Source: Field Survey

Table 9: Profitability Analysis for Maize Processors in Katsina-Zamfara IP

Items	**Maize flour (₦)**		**Tuwo masara (₦)**		**Huce/masa/baked cake (₦)**		**Kunu (₦)**	
	Katsina	Zamfara	Katsina	Zamfara	Katsina	Zamfara	Katsina	Zamfara
Total Revenue	**105040**	**-**	**36400**	**37824**	**-**	**45714**	**-**	**27040**
Variable Items								
Cost of maize	55055	-	7670	12599	-	14931	-	16432
Cost of water	1213.3	-	910	966.88	-	960.87	-	962
Cost of kerosene	-	-	-	-	-		-	-
Cost of firewood	-	-	2600	4663.6	-	5926.4	-	3440
Cost of packaging material	2470	-	800	505	-	1040	-	-
Cost of groundnut oil	-	-		-	-	10944	-	-
Cost of grinding	7240	-	2786.7	2300.9	-	3222.2	-	3752
Cost of polishing	-	-		-	-		-	-
Labour cost	-	-		-	-		-	-
Other cost	-	-		5026.7	-		-	-
Total Variable Costs of Inputs	**65978**	**-**	**14767**	**26062**	**-**	**37025**	**-**	**24586**

Gross Margin	**39062**	**-**	**21633**	**11763**	**-**	**8689**	**-**	**2454**
Fixe Cost								
Depreciation cost of equipment	2245.9	-	3917	2707.1	-	2551.3	-	1150.3
Total Cost	**68224**	**-**	**18684**	**28769**	**-**	**39576**	**-**	**25736**
Net Return	**36816**	**-**	**17716**	**35117**	**-**	**6137.7**	**-**	**1303.7**
Profitability Index	**0.35**	**-**	**0.48**	**0.92**	**-**	**0.13**	**-**	**0.04**
Operating Expense Ratio	**0.62**	**-**	**0.40**	**0.68**	**-**	**0.80**	**-**	**0.90**
Rate of return on investment	**0.54**	**-**	**0.95**	**1.22**	**-**	**0.16**	**-**	**0.051**

Source: Field Survey

Items	**Pankaso / Pancake**		**Waina**		**Dambo/Couscous**		**Chin Chin**	
	Katsina	**Zamfara**	**Katsina**	**Zamfara**	**Katsina**	**Zamfara**	**Katsina**	**Zamfara**
Total Revenue	**-**	**35425**	**51280**	**46311**	**-**	**45618.2**	**-**	**31200**
Variable Items								
Cost of maize	-	7670	13580	18045.2	-	14654.6	-	10192
Cost of water	-	520	910	1625	-	910	-	4000
Cost of kerosine	-	-	-	-	-	-	-	1300
Cost of firewood	-	2940	3800	6725.33	-	4060	-	
Cost of packaging material	-	1820	2600	2860	-	2470	-	
Cost of groundnut oil	-	18893.3	9620	9802	-	8468.57	-	8406.67

Cost of grinding	-	2180	550	2980	-	2765.45	-	2030
Cost of polishing	-	-	-	-	-	-	-	
Labour cost	-	-	-	-	-	-	-	
Other cost	-	-	1248		-	5707	-	1300
Total Variable Costs of Inputs	-	**34023.3**	**32308**	**42037.6**	-	**39035.6**	-	**27748.7**
Gross Margin	-	**1401.7**	**18972**	**4273.38**	-	**6582.6**	-	**3451.33**
Fixed Cost								
Depreciation cost of equipment	-	699.697	1981.44	3258.68	-	4284.92	-	1182.56
Total Cost	-	**34723**	**34289.4**	**45296.3**	-	**43320.5**	-	**28931.2**
Net Return	-	**702.003**	**16990.6**	**1014.7**	-	**2297.68**	-	**2268.78**
Profitability Index	-	**0.01**	**0.33**	**0.02**	-	**0.05**	-	**0.73**
Operating Expense Ratio		**0.96**	**0.63**	**0.90**	-	**0.85**	-	**0.88**
Rate of Return on Investment	-	**0.020**	**0.49**	**0.022**	-	**0.053**	-	**0.078**

Source: Field Survey

2.10. Profitability Analysis to Maize Processing in Nasarawa-Kaduna IP

Table 8 shows that in Nasarawa State, on the average, monthly production cost for maize flour gave (₦83,320.73) with a gross margin of (₦69,164.47) and net return of (₦67,793.97), followed by *tuwo masara* (₦30,664.27) with a gross margin of (₦25,193.73) and net return of (₦20,209.06) and the lowest is *huce/masa/baked cake* which accounts for ₦36,481.29 production cost, gross margin of (₦2,222.36) and net return of (₦893.70). With respect to the product with the highest profit (maize flour), the profitability analysis shows a gross margin of ₦69,164.47 and an average net return of ₦67,793.97. The ratios indicate a profitability index of maize flour as 0.44 which suggest that 44 percent of the total revenue generated by the processors constituted the net return. The operating expense ratio of 0.54 shows that the variable cost consumed 54 percent of sales. The return per naira of investment on the processing of maize into maize flour is 0.81k implying that the processors recorded 0.81k as gain for every ₦100 invested in maize flour.

In Kaduna State, Table 8 shows on average monthly production cost for maize flour gave (₦88,297.7) with a gross margin of (₦25,749.5) and net return of (₦24,988), followed by *waina* (₦40,416 production cost) with a gross margin of (₦11,551) and net return of (₦10,470) and the lowest is *huce/masa/baked cake* which accounts for ₦44,422.4 production cost, gross margin of (₦6,307.97) and net return of (₦3,177.6). With respect to the product with the highest profit, the profitability ratios shows that the total estimated production cost for maize flour gave ₦88,297.7. The study shows estimated total revenue of ₦113,286, gross margin of ₦25, 749.5 and an average net return of ₦88, 297.7. The profitability index of processing maize into flour was 0.77, suggesting that 77 percent of the total revenue generated makes up the net return. The operating expense ratio of 0.77 shows that the variable cost consumed 77 percent of sales. The rate of return on investment of 0.28k indicates that processors of maize to flour earn 28 k profits on every ₦100 naira invested.

This therefore shows that processing maize to maize flour is a profitable enterprise in IP 2. Hence, the processors' were operating at a profit and generating income. (see Table 8). This also applies to all other products produced by the processors.

2.11. Profitability Analysis to Maize Processing in Katsina-Zamfara IP

Table 9 shows that in Katsina State, the product with the highest profit (maize flour) has on the average a monthly production cost of ₦68,224, gross margin of ₦39,062 and net return of ₦36,816. Followed by *tuwo masara* (₦18,684 production cost), gross margin of ₦21,633 and a net return of ₦17,716. More so, the lowest is *waina* which accounts for ₦34,289.6 average production cost, ₦18,972 gross margin and a net return of ₦16,990.6. With respect to product with the highest profit (maize flour), the profitability ratios shows that the profitability index of processing maize into flour was 0.35, suggesting that 35 percent of

the total revenue generated makes up the net return. The operating expense ratio of 0.62 implies that the variable cost consumed 62 percent of sales. The rate of return on investment of 0.54 indicates that processors of maize flour earn 54k profits on every ₦100 naira invested.

In Zamfara State, the total estimated production cost for *tuwo-masara* gave ₦28,769 with gross margin of ₦11,763 and net return of ₦35,117. This is followed by *huce/masa/baked cake* which gave a production cost of ₦6,137.7, with gross margin of ₦8,689 and net return of ₦6,137.7 with the lowest *waina* which accounts for ₦4, 5296.3 production cost, gross margin of ₦6,582.6 and a net return of ₦1,014.7. With respect to the product with the highest profit (*tuwo-masara*), the profitability ratios shows a profitability index of processing maize into flour as 0.92, suggesting that 92 percent of the total revenue generated makes up the net return. The operating expense ratio of 0.68 implies that the variable cost consumed 68 percent of sales. The rate of return on investment of ₦1.22 indicates that processors of *tuwo-masara* earn 1.22k profits on every ₦100 invested. This thereby shows that processing maize to *maize flour and tuwo masara* is a profitable enterprise and the processors' were operating at a profit and generating income in IP 3. (see Table 8).

mitigating against maize processing such as drudgery/poor processing equipment, high electricity tariff, lack of credit, expensive credit, epileptic electricity supply and high-interest rate is eliminated and properly addressed.

4. CONCLUSIONS

This study evaluated the profitability of maize products in Nigeria. The result showed that maize processing into *tuwo-masara* and *huce/masa/*baked-cake in IP 1; maize flour in IP 2; maize flour and *tuwo-masara* in IP 3 are profitable based on the net return, profitability index, operating expense ratio and rate of return on investment result. These products therefore, have the highest potential for income diversification. More so, socioeconomics characteristic such as age, gender, household size, education attainment and marital status; processing activities such cost of maize grain, cost of grinding, depreciation cost, years of experience, location, milling size, current capital and working cost significantly influence the profit level of the processors. Although the products were profitable, profit will increase if constraints

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