EVALUATION OF THE EFFETCS OF FEDERAL GOVERNMENT POLICIES ON COMPETITIVENESS AND COMPARATIVE ADVANTAGE OF RICE PRODUCTION IN KADUNA STATE, NIGERIA

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A THESIS SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES AHMADU BELLO UNIVERSITY, ZARIA, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF DOCTOR OF PHILOSOPHY DEGREE IN AGRICULTURAL ECONOMICS

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NIGERIA

OCTOBER 2015

DECLARATION

I hereby declare that this thesis titled "**Evaluation of the Effects of Federal Government Policies on Competitiveness and Comparative Advantage of Rice Production in 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 other Institution. All borrowed information has been duly acknowledged in the text and a list of references provided.

_____ _____

Aliyu Aishat AMMANI **Date**
Student

CERTIFICATION

This thesis titled "**Evaluation of the Effects of Federal Government Policies on Competitiveness and Comparative Advantage of Rice Production in Kaduna State, Nigeria**" by Aliyu Aishat AMMANI meets the regulations governing the award of the Degree of Doctor of Philosophy of the Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

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ABSTRACT

Several agricultural policies have been targeted at improving rice production in Nigeria in the past few decades; yet, Nigeria has been listed among the leading importers of rice in the world. The ability of the policies to improve the performance and competitiveness of the rice sector to survive in the face of strong international competition is very crucial. The study evaluated the Federal Government agricultural policies on the competitiveness and comparative advantage of rice production and marketing in Kaduna state, Nigeria. A multistage random technique was employed to draw a sample of 241 rice farmers, 74 parboilers, 33 millers, 44 paddy marketers and 34 milled rice marketers in the study area. Primary and secondary data were collected and analyzed using descriptive statistics, binary logit regression and the Policy Analysis Matrix (PAM). Major findings of the study were that small-scale rice production and processing in the study area is competitive and had comparative advantage. Private profit of ₦93, 498.93, and social profit of ₦19, 793.79 per hectare were calculated under prevailing technologies, costs of inputs, output prices, and existing policy environment; the cumulative effects of policy on rice production and processing in the study area led to increase in revenue and income for small-scale farmers and processors. A positive divergence in both revenue (68,884.92) and profits (73,705.14) as well as a Nominal Protection Coefficient on Output (NPCO) value of 1.5293 indicated that existing policies increased the domestic market prices to a level of about 53% above their corresponding international reference prices. The calculated Nominal Protection Coefficient on Tradable Input (NPCI) ratio of 0.9407 suggested that farmers and processors were enjoying subsidy for the use of tradable inputs. The major constraints militating against the performance of the principal actors in rice production, processing and marketing were non-availability of credit facilities, lack of modern rice processing equipment, poor patronage and prices, poor access roads, and lack of storage facilities. The study recommended the: strengthening of existing rice price support mechanisms for both producers and processors, especially the guaranteed minimum pricing strategy by the government; enhancing the availability of subsidized credit facilities in line with the Nigeria Incentive-based Risk Sharing System for Agricultural Lending (NIRSAL) model; developing formal institutional arrangements that will guide and enforce the maintenance of quality standards such as weights, grades and measures across the rice value chain; and encouraging the relevant Research Institutes, Universities and Polytechnics to develop rice production and processing technologies that would increase the paddy-grain-conversion ratio from the present level of 0.62 calculated for the study area.

CHAPTER ONE

INTRODUCTION

1.7 Background to the Study

At the time of independence in 1960, agriculture was the mainstay of the Nigerian economy. It provided employment to over 75% of the population; more than 70% of total food consumed in the country; the bulk of the raw materials for its agro-based industry, as well as export earnings to finance imports. Peasant agricultural production for export provided the stimulus to Nigeria's overall economic growth then. However, about 21 years after Independence, Nigeria was no-longer capable of producing enough food for its fast growing population; neither could its agricultural system cope with the growing demands for agricultural raw materials to keep the country's agro-based industries running. Thus, Nigeria became incapable of meeting its food and agro-based raw materials requirement.

Several reasons were put forward to explain the progressive decline in the performance of the Nigerian agricultural sector. The most popular reason being the oil boom phenomenon which put the blame for the decline in the performance of the Nigerian agricultural sector on the neglect of the sector by the government following the exponential increased foreign exchange earnings realized from the export of crude oil between 1972 and 1980 (Asiabaka and Owens, 2002; Walkenhorst, 2007; Sekumade, 2009).

Schultz (1976) argued that much of the difference in the economic performance of the agricultural sector is a consequence of governments' intervention in agriculture. In fact, it is documented that the key assumption of the structural adjustment framework for economic policy reform in Africa was that government interventionism was the sources

of economic distortions to African economies since independence (Colclough and Manor, 1991; Lensink, 1996; Olukoshi, 2004). The effects of governments' interventionism on economic outcomes have been established in the literature (North and Weingast, 1989; Alesina and Rodrik, 1994; Besley and Coate, 1998). Government interventionism in agriculture is usually in form of agricultural policies. In principle, government's action and/or in-action is guided by policy.

Goddard, Weersing, Chen, and Turvey (1993), observed that agricultural policies influence the performance of the agricultural sector through enhancing (i) the competitiveness and efficiency of the agricultural sector by providing incentives for capacity adjustment, and (ii) inefficient allocation of productive resources which artificially increase the profitability of one production activity relative to others.

According to the Federal Ministry of Agriculture and Water Resources (FMAWR, 2007), rice is cultivated in almost all of Nigeria's 36 States; from the semi-arid regions of the Sahel savannah through the mangrove swamps of the coastal regions. Thus, Nigeria has great potentials for rice production. Nigeria is Africa's foremost consumer of rice. It is also among the leading importers of rice in the world (United States Agency for International Development, USAID, 2009). According to Federal Ministry of Agriculture and Rural Development (FMARD, 2011), Nigeria is the second largest importer of rice in the world, spending more than 356 billion Naira annually on rice imports. This substantial reliance on rice importation can be attributed to the poor performance of the Nigerian agricultural sector.

USAID (2009) estimated average yield for upland and lowland rice in Nigeria as 1.7MT and 2.2MT respectively which is short of what was expected from the adoption of improved practices 20 years earlier when the Fertilizer Procurement and Distribution

Division, (FPDD, 1989) estimated rice yield for upland and lowland rice in Nigeria with improved practices at 2-3MT and 4-5MT respectively. Thus, there are lower yields on farmers' fields. Attempts towards explaining the widening gap between the high promises of agricultural research findings and the disappointing reality on farmers' fields had led to a consensus on policy being the principal constraint facing agriculture in countries like Nigeria (Idachaba, 2002).

Seven agricultural policies that were directly targeted at rice production in Nigeria between 1992 and 2009, all of which have the common goal of achieving self sufficiency/increase rice production in Nigeria, were identified by USAID (2009). This is in addition to (a) the ongoing Agricultural Transformation Agenda (ATA) of the Federal Government, and (b) the series of trade policy instruments employed to boost domestic rice production in Nigeria such as import tariffs, import restrictions including occasional total ban on rice import over the last 30 years. Thus, Nigeria is not lacking in agricultural policies. In fact, according to the United States Department of Agriculture (USDA, 2013), the Federal Government of Nigeria (FGN) has introduced new tariff of 10% for rice imports, effective 1st July 2012, in addition to "a 100 percent levy on imported polished/milled rice effective December 31, 2012". The implication of the foregoing is that rice importers will have to pay 110% charges at the point of entry into Nigeria, thereby reducing the competitiveness of imported rice.

1.8 Statement of the Problem

The first question that arises for this study was whether rice production in Nigeria is competitive domestically and internationally? Domestically, competitiveness depicts the ability of a rice producer to make profit under prevailing input costs and output prices in Nigeria. Internationally, competitiveness, also known as comparative advantage is a

measure of Nigeria's ability to produce rice at a lower production cost than that of the rest of the world.

The second problem that arises for this study is twofold: (i) whether or not the series of agricultural policies formulated and implemented so far in Nigeria has significantly improved the performance of the Nigerian agricultural sector as evidenced from the competitiveness and comparative advantage of rice production in Kaduna State of Nigeria, and (ii) whether or not small-scale rice farmers in the study area will be able to survive in the face of strong international competition evident from massive rice imports into Nigeria. This study is therefore intended to provide answers to the following research questions:

(i) What are the socio-economic characteristics of small-scale rice farmers in the study area?

(ii) What are the socio-economic determinants of rice yield in the study area?

(iii) How competitive is small-scale rice production in the study area in terms of farm-level profit?

(iv) What is the comparative advantage of small-scale rice production in the study area in terms of economic efficiency?

(v) What are the effects of agricultural policy on domestic rice production in the study area?

(vi) What are the major constraints militating against the performance of the key actors along the rice value chain in the study area?

1.9 Objectives of the Study

The broad objective of the study is to evaluate the effect of federal government agricultural policies on competitiveness and comparative advantage of rice production in Kaduna State, Nigeria.

The specific objectives are to:

(i) Describe the socio-economic characteristics of small-scale rice farmers in the study area,

(ii) Analyze the socioeconomic determinants of rice yield in the study area,

(iii) Ascertain the competitiveness of small-scale rice production in the study area in terms of farm-level profit,

(iv) Evaluate the comparative advantage of small-scale rice production in the study area in terms of economic efficiency,

(v) Investigate the effects of agricultural policy on domestic rice production in the study area, and

(vi) Identify the major constraints militating against the performance of the key actors along the rice value chain in the study area

1.10 Justification for the Study

The justification for this study is twofold. First, Schultz (1976), while delivering the first Leonard Elmhirst Lecture, challenged agricultural economists to evaluate the economic effects of what governments 'do to agriculture' arguing that much of the difference in the economic performance of the agricultural sector is a consequence of what governments 'do to agriculture'. This study intends to take on this challenge.

Second, this study is expected to modestly contribute to the literature on our understanding of not only the effects of government policies on agricultural crop

production in Nigeria but also the competitiveness as well as the comparative advantage of rice production in Nigeria which would hopefully provide insights for policy-makers that could lead to the formulation of better rice policies in Nigeria.

1.11 Hypotheses

The following hypotheses will be tested in this study:

(i) Rice production in the study area is not competitive

(ii) Rice production in the study area has no significant comparative advantage

1.12 Assumptions of this study

(a) All rice related policies formulated in Nigeria are assumed to be similar. This is to lend credence to one key finding of Garba (2000) that "no agricultural programmes outlived the political regimes that introduced them while each new regime put in place new programmes". This assumption is supported by the fact that a review of the several agricultural policies that affect rice production in Nigeria revealed that they all have the common key goal/objective of "achieving self sufficiency/increase food production in Nigeria".

(b) All rice farmers in the study area produce similar rice varieties with similar qualities and prices. This is to ease comparison.

(c) The rice produced by farmers in the study area when processed is comparable to that commonly imported into Nigeria in terms of quality and price. This again, is to ease comparison.

CHAPTER TWO

LITERATURE REVIEW

2.1 Rice Production Systems in Nigeria

Nigeria is Africa's foremost consumer and producer of rice; it is also among the leading rice importers in the world (USAID, 2009). Over the years, rice has become an important component of the Nigerian diet especially for the urban dwellers. Akanji (1995) attributed the rise in demand for rice in Nigeria to population growth, increase in levels of income and rapid urbanization and its attendant changes in family occupational structures.

Rice is cultivated in almost all of Nigeria's 36 States (FMAWR, 2007); from the semi-arid regions of the Sahel savannah to the mangrove swamps of the coastal regions. Nigeria with a land area of 923,768 square kilometres has a total of over 79 million hectares of cultivable land of which only about 1.8 million hectares of the 4.6 million hectares suitable for rice production is currently utilized for rice cultivation (National Food Reserve Agency, NFRA, 2009). Longtau (2003), ranked rice as the sixth most cultivated crop in Nigeria with a total cultivated area of about 1.8 million ha, after sorghum (4.0 million ha), millet (3.5 million ha), cowpea (2.0 million ha), cassava (2.0 million ha) and yam (2.0 million ha). NFRA (2009) identified the three most important rice production ecologies and their extent of coverage in Nigeria as (i) Rain-fed lowland, 69.0% (ii) Rain-fed upland, 28.3% and (iii) Irrigated lowland, 2.7%; noting that more than 90% of the rice produced in Nigeria is cultivated by resource poor small-scale farmers. Thus, rice production in Nigeria is essentially rain-fed and dominated by resource poor small-scale farmers.

Akpokodje, Lançon and Erenstein (2001), IFDC (2008) and USAID (2009) identified six major rice production systems in Nigeria based on the ecology of the farm locations: (i) Rain-fed Upland (ii) Rain-fed Lowland (*Fadama*) (iii) Irrigated (iv) Deep Water

Floating and (v) Mangrove Swamp production systems. Fadama is a Hausa word which refers to low-lying relatively flat areas either in a stream-less depression or adjacent to seasonally or perennially flowing streams or rivers (Kolawole and Scoones, 1994). Table 2.1 presents a descriptive summary of the systems and their relative importance in domestic rice productions in Nigeria.

Table 2.1: Summary of Rice Production Systems in Nigeria

Production System	**Major States Covered**	**Estimated Share of National Rice-Farmed Area**	**Share of Total Domestic Production**	**Average Yield/Ha**	**Potential Yield/Ha**
Rain-fed Upland	Ogun, Ondo, Abua, Osun, Ekiti, Oyo, Edo, Delta, Niger, Kwara, Kogi, Sokoto, Kebbi, Kaduna, FCT, and Benue	30%	17%	1.7MT	3.5MT
Rain-fed Lowland (AKA *Fadama*)	Adamawa, Ebonyi, Ondo, Ekiti, Edo, Delta, Rivers, Bayelsa, Cross River, Akwa Ibom, Lagos, and all major river valleys	47%	53%	2.2MT	5MT
Irrigated	Adamawa, Niger, Sokoto, Kebbi, Borno, Benue, Kogi, Anambra, Enugu, Ebonyi, Cross River, Kano, Lagos, Kwara, Akwa Ibom, Ogun	17%	27%	3.5MT	6-7MT
Deep Water Floating	Flooded areas: Rima Valley in Kebbi State and deep flooded areas of Delta State	5%	3%	1.3MT	2.5MT
Mangrove Swamp	Ondo, Delta, Edo, Rivers, Bayelsa, Cross River, Akwa Ibom	1%	1%	2.0MT	4MT

Source: USAID (2009)

From the foregoing, it can be concluded that rice is both an important food security crop as well as an economically important commodity in Nigeria. According to FMARD

(2011), Nigeria is the second largest importer of rice in the world, with an annual expenditure of more than ₦356 billion on rice importation.

2.2 Agricultural Policies in Nigeria

Schultz (1976) argued that much of the difference in the economic performance of the agricultural sector is a consequence of governments' intervention in agriculture. In fact, it is documented that the key assumption of the structural adjustment framework for economic policy reform in Africa was that state and state interventionism were the sources of economic distortions to African economies since independence (Colclough and Manor, 1991; Lensink, 1996; Olukoshi, 2004). Government interventionism in agriculture is usually in form of agricultural policies. As observed by Idachaba (2002), attempts towards explaining the widening gap between the high promises of agricultural research findings and the disappointing reality on farmers' fields has led to a consensus on policy being the principal constraint facing agriculture in countries like Nigeria.

The process of policy conception, formulation and implementation is one of the most important processes of governance and societal development in modern nation-states. It provides the political, legal and administrative context and framework within which functionaries of government and the organs/institutions of governance interact with a myriad of non-governmental stakeholders to synthesize ideas on how to satisfy identified needs and aspirations of citizens, convert these into executive policies, and then mobilize resources to provide goods, products and services aimed at addressing these identified needs and aspirations as efficiently and effectively as possible (Mbachu, 2008).

There are several definitions of policy. Turner and Hulme (1997) defined policy as "a set of plans or guides that are used as a basis of making decisions especially in politics,

economics and business". Dunn (1981) sees policy as "a long series of more or less related choices, including decisions not to act, made by governmental bodies and officials". Waldt (2001) is of the view that policy is "the formal articulation, statement, or publication of a goal that the government intends to pursue" in order to address a need or a problem. Anderson (2003) defined policy "as a relatively stable, purposive course of action followed by an actor or set of actors in dealing with a problem or matter of concern". This definition emphasizes on what is actually done instead of what is only proposed or intended; which differentiates a policy from a decision. Friedrich (1963) defined policy as "a proposed course of action of a person, group, or government within a given environment providing obstacles and opportunities which the policy was proposed to utilize and overcome in an effort to reach a goal or realize an objective or purpose". From the foregoing, it can be concluded that a policy is a sense of direction, deliberately and consciously taken by a person, group, or government to achieve predetermined goals. Agricultural policy is an aspect of public policy.

According to Waldt (2001):

> "Public policy differs from the policy of private organizations in the sense that it is authoritative. This feature of public policy means that it can be enforced through instruments of coercion. Public policies involve the participation of government institutions and fragmented structures of semi-independent groups and organizations through a complex system of formal and informal delegation of responsibility and control. At the very least, such policies must be processed, authorized, or ratified within the framework of government. Thus, in order to be authoritative, a policy must be approved and promulgated by an institution that is authorized by statute or constitution."

Once formulated and adopted, public policies must be implemented or executed through specific programmes that may rely on existing public institutions or the government may have to establish new public institutions to implement policy programmes (Mbachu, 2008).

Pearson, Gotsch, and Bahri (2003) identified objectives, constraints, policies, and strategies as the four central components in the framework for agricultural policy analysis. Objectives are the desired goals of economic policy as defined by the policy makers who wish to achieve certain ends when they intervene in economies. Constraints are the economic realities that limit what can be accomplished. Policies are the instruments that governments can use to change economic outcomes. Effective policies change the behavior of producers, marketers, and consumers and create new economic outcomes. Strategies are the sets of policy instruments that government can use to achieve their objectives. Each strategy is enacted through the introduction of a coordinated set of policies.

Bellu and Pansini (2009) identified four categories of agricultural policies: (i) Price policies (taxes and subsidies, and international trade) (ii) Macroeconomic policies (monetary and fiscal policies, exchange rate policies, and factor price policies) (iii) Public investment policies (public investment in infrastructure, human capital, research and technology) and (iv) Direct Poverty alleviation and food security policies aimed at direct and immediate provision of food (or entitlements to food) and/or increase the well-being of the most in-need people.

The central goals of agricultural policy making are developing competitiveness and efficiency in agricultural production as well as ensuring a fair standard of living for farm families (Happe, 2004). Goddard *et al.* (1993) observed that agricultural policies influence the performance of the agricultural sector in two principal ways. First, policies enhance competitiveness and efficiency of the agricultural sector by providing incentives for capacity adjustment. Second, policies enhance inefficient allocation of productive resources which artificially increase the profitability of one production activity relative to others. According to Monke and Pearson (1989), the rationale for

government intervention through the imposition of policies on the agricultural sector are principally to accelerate the rate of income growth, correct market failures, address income distribution concerns, stabilize of prices and ensure food security and self reliance of staple food supplies.

Garba (2000) classified agricultural policies in Nigeria into five major categories: (a) agricultural policy in the development plans: First Development Plan (1962-68), Second Development Plan (1970-74), Third Development Plan (1975-80), and the Fourth Development Plan (1981-85); (b) agricultural policy in the annual budget (Fiscal policy: investment incentive policies and allocations; Institutional changes: new programmes such as Operation Feed the Nation (1976), Green Revolution (1980), transfer of agriculture from schedule I to II, integrated rural development schemes, Directorate of Food, Roads and Rural Infrastructure (DFRRI) in 1986, Agricultural Credit Guarantee Scheme (ACGSF) in 1977; Credit and interest policy; and Foreign trade policies: import and export bans, import duty relief); (c) budget and plan allocations to agriculture; (d) sectoral credit allocations to agriculture; (e) *ad hoc* agricultural policy (major agricultural policy programmes designed within budget years and announced through policy statements : the new commodity marketing system; the Green Revolution programme; the structural adjustment programme; the New Agricultural Policy; Accelerated Development Area Programme; Livestock Development Project etc) and major agricultural policy programmes: River Basin Development Authorities (RBDAs) in 1970, the Integrated Agricultural Development Projects (ADPs) in 1974, and the Directorate of Foods, Roads and Rural Infrastructures (DFRRI) in 1986.

A survey of reports and documents on agricultural policies in Nigeria from colonial period to the end of the first republic revealed that agricultural policies during the periods were biased against food crop production. They were centered on producing

agricultural raw materials for agro-based industries. However, from 1970, government policies directed towards increasing domestic food crop production, of which rice is a part, started manifesting. Table 2.2 is a summary of agricultural policies in Nigeria that affected rice (Condensed from: FMA, 1980; Garba, 2000; NPC, 2004; NFRA, 2009; USAID, 2009; and FMARD, 2011).

Table 2.2A: Agricultural Policies that Affected Rice Production in Nigeria

S/No	Policy/Programme	Year	Goal/Objectives
1	Agricultural policies in federal budgets	1976-1996	- Increase food production/self sufficiency - Adequate income to farmers - Reduced cost of food
2	Green Revolution	1980	- Self sufficiency in food production by the year 1985
3	Structural Adjustment Programme (SAP)	1986	- Trade and exchange rate liberalization - Import substitution
4	New Agricultural Policy	1988	- Self sustained growth in the agricultural sector - Self sufficiency in food production - Structural transformation of agriculture
5	River Basin Development Authorities (RBDAs)	1970	- Provide large scale farmlands - Construct dams and boreholes - Ensure large-scale multiplication of improved seeds
6	Agricultural Development Programmes (ADPs)	1974	- Raising productivity - Raising farmers' income
7	National Agricultural Seed decree	1992	- High quality improved seeds to farmers at 50% subsidy - Regulate the seed industry
8	The National Fertilizer policy	2006	- Facilitate farmers' timely access to adequate quantity and quality of fertilizer at competitive but affordable prices
9	The New National Policy Thrust on Agriculture	2002	- Self sufficiency in food production - Increase in production and processing of exportable commodities - Modernization of agricultural production, processing, storage and distribution through the infusion of improved technologies

Condensed from: FMA (1980), Garba (2000), NPC (2004), NFRA (2009), USAID (2009), and FMARD (2011)

Table 2.2B: Agricultural Policies that Affected Rice Production in Nigeria (Continued)

S/No	Policy/Programme	Year	Goal/Objectives
10	National Rice Development Strategy	2009	- Doubling rice production in Nigeria by 2016 - Double government efforts in rice technology extension services - Support private investors in establishment of modern rice processing facilities - Provide functional irrigation facilities in the major rice production areas in the flood plains of major rivers - Provide through public-private partnerships rice production, processing machinery, and market linkage systems. - Establish durable price support mechanism for stable producer prices in order to sustain farmers' interest in rice production through the guaranteed minimum price mechanism.
11	National Food Security Strategy	2009	- Ensure sustainable access, availability and affordability of quality food to all Nigerians and for Nigeria to become a significant net provider of food to the global community - To significantly improve Nigeria's agricultural productivity, expand and improve large-scale production, improve storage/ processing capacity as well as required infrastructure to achieve food stability - Derive over 50 percent of the nation's foreign exchange through agricultural exports
12	National Economic Empowerment and Development Strategy (NEEDS)	2004	- To guarantee food security, self-sufficiency and to diversify exports.
13	Presidential Initiative on Increased Rice Production Processing and Export	2003	- Reduce Nigeria's reliance on rice imports by stimulating domestic production and offering new incentives for corporate investments in value chain functions (i.e. processing) that would increase domestic value-added
14	Agricultural Transformation Agenda (ATA).	2011	- Self sufficiency in rice production - Complete substitution of imported rice by year 2014

Condensed from: FMA (1980), Garba (2000), NPC (2004), NFRA (2009), USAID (2009), and FMARD (2011)

Garba (2000), having collected, organized and presented a comprehensive documentation of agricultural policies for the period 1976–1993; computed and analyzed implementation deviation for ten agricultural policy variables, eight of which

are fiscal and two monetary; identified and analysed discontinuities in agricultural policies and computed volatility measures for ten agricultural policy instruments and six regulated commodity prices, concluded as follows:

> "The estimates of implementation deviation indicate consequential over- and undershooting of policy targets. The results show that the implementation deviation was persistent and volatile in addition to being consequential. Therefore, the concern that private agents have about government not keeping its word is legitimate. Similarly, their concern about policy discontinuities is also valid …(it was) found that no agricultural programmes outlived the political regimes that introduced them, while each new regime put in place new programmes …while the official rationales for the changes suggest that even though some of the changes could be justified by the behavior of agricultural output, productivity, prices and export revenue, political instability seems to be the driving force …even without a comprehensive evaluation of the credibility of agricultural policies, it hardly seems likely that a policy regime could be credible when implementation deviations are consequential, persistent and volatile and policy variables exhibit longterm volatility."

2.3 Approaches to Agricultural Policy Analysis

Policy analysis has several definitions. According to Walter (1971) "policy analysis is a means of synthesizing information including research results to produce a format for policy decisions (the laying out of alternative choices) and of determining future needs for policy relevant information". Nagel (1999) viewed policy analysis as the process of 'determining which of various alternative policies will most achieve a given set of goals in light of the relations between the policies and goals".

Policy analysis can be viewed from two perspectives: analysis *of* policy and analysis *for* policy. Analysis of policy (policy evaluation) on the one hand, is analytical and descriptive: measuring previous performance and comparing it to what is expected. Analysis for policy on the other hand is an *ex-ante* analysis which is prescriptive: identifying courses of action most likely to produce a favored outcome or the trade-offs or set of outcomes arising from alternative courses of action.

There are two principal approaches to policy analysis depending on the type of data utilized in the analysis: qualitative and quantitative approaches. In the words of Bellu and Pansini (2009):

> Although it is not possible to draw a precise frontier to separate qualitative from quantitative analysis, as many approaches have mixed natures; qualitative approaches for policy impact analysis essentially make use of non-numerical information. These include value judgments of key informants; non-structured interviews of stakeholders; focus groups, panel discussions etc. They can be also very detailed and context-specific, to feed the decision making process. On the other hand, quantitative approaches make use of numerical data, usually gathered by means of surveys based on structured questionnaires with close-ended questions; or from other statistical sources (e.g. national statistical yearbooks, national accounts, custom data, international databases etc). They treat information by means of mathematical methods in order to derive expected responses to variables affected by policy interventions.

Quantitative approach is of interest for this study. As Bellu and Pansini (2009) noted:

> Quantitative models for policy impact analysis are used to represent a complex socio-economic system in a stylized way and to highlight possible linkages between its different elements. Thanks to the interdependences among their constituent elements, one can analyze the impacts of a policy because they transmit changes generated by a policy measure on some variables under control of the policy maker (policy instruments), to other variables (policy objectives), by means of some transmission "mechanisms" (cause-effect relationships).

Four main models of quantitative policy analysis can be differentiated: econometric, computable general equilibrium (CGEs), accounting models, and special software packages. These approaches will be discussed in turn.

2.3.1 Econometric approach to policy analysis

Econometric models are employed in describing key economic mechanism of a national or sub-national economic system by utilizing regression analysis with different estimation methods. This enables the estimation of a model's parameters, coefficients and elasticities from available data at both the micro and macro levels.

The overall framework of the econometric approach to policy analysis, as noted by Mamingi (1997), can be laid out as follows. Macroeconomic policies (monetary policy,

fiscal policy, and trade and exchange rate policies) affect agricultural prices through their effects on real exchange rate. Agricultural prices, along with non-price factors including exogenous shocks, determine agricultural output or supply. This section focuses more on model specification than on theory and is based on Mamingi (1997).

Agricultural supply response represent the agricultural output response to change in agricultural prices or, more generally, to agricultural incentives. Agricultural supply response can be analyzed from the point of view of aggregate output or supply. The level of aggregation depends on the objective of the study as well as the availability of data. Moreover, agricultural output or supply can be captured in any of the following: (a) acreage or area under cultivation; (b) yield or product per acreage unit; and (c) product of acreage and yield.

Nerlove model is the most influential econometric model in capturing agricultural supply. Basically, the Nerlovian model is a dynamic model that states output (quantity or area) is a function of expected price, output (area) adjustment, and some exogenous variables. Thus a typical Nerlovian model can be written as follows:

A_t^D = c + a_1 P_t^e +$a_2 Z_t$+u_1 ..... (1)

P_t^e = P_{t-1}^e + β (P_{t-1} - P_{t-1}^e) ..... (2)

A_t = A_{t-1} + γ (A_t^D - A_{t-1}) ..... (3)

Where
A_t = actual area under cultivation at time t
A_t^D = area desired to be under cultivation at time t
P_t = actual real producer price at time t
P_t^e = expected real producer price at time t
Z_t = other exogenous factors affecting supply at time t
β and γ = expectation and adjustment coefficients, respectively.
With suitable definition of price, the above equations lead to the following:

Q_t = c_0 + c_1 Q_{t-1} + c_2 (P_{ct} /P_{dt}) + c_3 Z_t + u_t ..... (4)

Where

c_0 = intercept

c_1 - c_3 = coefficients

t = 1,2, … , n, is the time index

Q = agricultural output in general (area or yield per acreage or total yield)

P_c = price of the crop

P_d = price of the deflator and other variables are defined as above.

u_t = disturbance term

To sum up, at the micro level area (acreage) or output (total yield) for a given crop can be determined as follows:

$$Q = F\begin{pmatrix} + & - & - & - & - & +/- \\ P_c, & P_i, & P_a, & P_{co}, & P_u, & Z \end{pmatrix} \qquad \text{(5)}$$

Where

P_c = price of crop (as defined above)

P_i = input price

P_a = price of alternative crops

P_{co} = price of consumer goods usually captured by the consumer price index (CPI)

P_u= price of urban labour or wages

The signs in Eq. (5) indicates the nature of the impact of the variable in question in crop production. An increase in the price of the crop is an incentive to produce more. An increase in the input price increases the cost of production hence becomes a disincentive to produce more. An increase in the price of the most alternative crop is a disincentive to produce more of the main crop. An increase in the price of consumer goods as well as wages negatively affects crop production. The impact of other factors on the crop production is to be analyzed on a case by a case basis.

Econometric approach has being applied in the analysis of the impact of agricultural policies. Scobie and Posada (1977) studied the impact of high-yielding rice varieties in

Colombia. The developed econometric model allowed the measurement of the distribution of social benefits derivable from public investments on agricultural research. The study concluded that while the introduction of virus-resistant and dwarf varieties benefitted the consumers, producers suffered from a loss. López *et al.* (1995) empirically evaluated the effect of globalization and open markets policy on Mexican farmers' economic condition. Analysis of household survey data indicated a general improvement for the average farmer during the period when agricultural reforms related to markets openness were implemented. Pan *et al*. (2005), investigated the impact of the complete elimination of domestic support mechanisms and market access restrictions in the world cotton market on U.S and the rest of the world markets. Minot and Goletti (2000) studied the impacts of the liberalization of the rice market on small farmers' revenues food security in Vietnam and recommended that a policy for the liberalisation of exports should be gradually introduced by replacing quotas with taxes on exports to generate income to be distributed to the target groups of poorer people. In Egypt, Siam, (2006) studied the impact of increased self-sufficiency in wheat and a switch to a cash-transfer subsidy on cropping patterns, food consumption, production, input use and income and concluded that the policy based on an increase in self-sufficiency in wheat reduced reliance on imports but adversely affected livestock.

A major limitation of the econometric approaches, as noted by Bellu and Pansini (2009), was that they do not fully take into account general equilibrium effects of policy changes. There is a growing literature on the employment of econometric models, both at micro and macro level, in analyzing the impact of policy. See, for example, Coudouel and Paternostro (2005), Coudouel *et al.* (2006) and Sugiyarto,(2007) for a detailed presentation.

2.3.2 Computable General Equilibrium (CGE) approach to policy analysis

This section is based on Bellu & Pansini (2009) and Minot (2009). Computable models, as econometric models, also describe the key mechanisms of economic systems. Computable models are so called because, for a given policy change, or any other exogenous shock, they compute results, in the sense that they return a new set of information about prices, wages, incomes and equilibrium quantities of goods and services, all endogenously determined by the model during the simulation exercise. They are constructed as a set of simultaneous equations describing the behavior of several economic factors, like utility-maximizing households, profit maximizing or cost minimizing firms. Therefore, they usually describe how demand and supply decisions made by different economic agents determine commodity and factor prices. Computable general equilibrium (CGE) models are typically fairly large and complex, typically involving hundreds of equations and parameters. CGE models are suitable for evaluating the impact of a wide range of policy measures, such as changes in taxes and public expenditure; international trade policies; or exogenous shocks, such as changes in the international terms of trade or changes in the exchange rate etc. Also, changes in the economic and social structure of the economy, such as technology shifts or changes in consumers' tastes and behavior. CGEs can be used for a variety of purposes like the impact of policies on poverty and income distribution, other social welfare analyses, environmental impacts, natural resource uses etc.

Devarajan and Li, (1999) employed the CGE approach to estimate the fiscal and welfare impacts of trade reforms in terms of public revenues across 60 countries and found out that regardless of the level of elasticities of substitution and transformation, revenues decline following tariff reforms. In Mexico, Davis *et al.* (2002) analyzed the impacts of exogenous income changes on the mini-region's economy and discovered that technological changes that increase agricultural productivity generated important real-

income linkages in rural farm and non-farm economies. Vos *et al.* (2004) investigated the impacts of trade liberalization on the overall GDP growth and on poverty and income distribution across 16 Latin- American countries using CGE modeling and found that trade liberalization policies were neither responsible for the GDP slowdown in the region nor for the rise in poverty and inequality. They concluded that though the overall impact of trade reforms was positive it was however small. In Paraguay, Molinas and Cabello (2006) studied the impact of policy changes on foreign trade, foreign exchange market, labour market, supply and demand, as well as adjustments to exogenous shocks. Here in Africa, Bellù (2009) examined the extent to which international price shocks: notably energy, fertilizers, food price increases and cotton price decline between 2003 and 2008 affected poverty and welfare in Burkina Faso, and concluded that energy price increases affect welfare more than any other price change.

The major weakness of the CGE models is that they can only handle situations in which it is possible and relatively easy to reach "equilibrium". This is because CGE models are solved "numerically" by programmes that work out solutions iteratively, whose performances depend also on the "shape" of the functions adopted. That is why modelers often rely on "well-behaved" functional forms, i.e. functions which give rise to downward sloping demand curves and infinitely elastic (or upward sloping) supply curves, with some sacrifice of adherence to the reality. The literature on the applications of computable general equilibrium models include Devarajan *et al*, (1999); Davis *et al*, (2002); and Scandizzo, (2002).

2.3.3 Accounting models approach to policy analysis

While both the econometric and computable models of policy analysis, earlier discussed, describe the main mechanisms of a given economic system, with the CGE describing equilibrium relations among different agents and components of an economic

system, taking into consideration feedback and indirect effects generated by a policy change; accounting models do not model behavioral agents' response: they only allow for evaluation of direct effects (Bellu and Pansini, 2009).

These models utilize detailed household data to generate policy scenarios, by directly introducing changes in the data base, after selection of households. Value Chain Analysis, for example, allows us to analyze the policy impacts across the economic system by tracing the path followed by a commodity. These approaches employ accounting framework without the explicit modeling of behavioral feedback. The models are normally used in association with other approaches. Prices and quantities are explicitly modeled. Because they do not model any behavioral response of economic agents to policy changes, they measure only the first order effects of policies (Bourguignon and da Silva, 2003).

There are several applications of accounting models in the literature on agricultural policy analysis. Alderman and del Ninno (1999), investigated the impact of Value Added Tax (VAT) exemptions on household consumption in South Africa and concluded that VAT exemptions for maize had a positive impact on calorie consumption by deficit households; while exemptions on items like meat favoured non-poor urban households and negatively affected the caloric consumption of rural households. Chen *et al.* (2001) studied the extent to which the Ugandan government policy of shifting from export taxation to other revenue sources affected households and firms in the country. Roland-Holst and Tarp (2003) studied the impact of unitary increase in the production cost of exogenous commodity induced by globalization process on producer, factor, and consumer price indexes in Vietnam. The employed methodology help distinguished the extent of price transmission effects explained by inter-industry linkages; the consumption expenditures of households, factor prices as

well as in the identification of the sectors that were more cost responsive to price changes taking place elsewhere in the economy.

Accounting models provide only a first approximation of the total effects of policies on households' or individuals' welfare. They are not suitable for simulating the impacts of policies with strong indirect effects and provide only a partial vision of the economy and the society. They are considered "static", in the sense that they do not explicitly take into account the 'time' dimension. There is a growing literature on the applications of the accounting approach in policy analysis. Examples include Micro-accounting frameworks (Van de Walle, 1994; Alderman, 1999; Chen *et al.,* 2001; Levy *et al.,* 2008) and Value Chain Analysis (Jernigan, 2000; Bellù *et al.,* 2008; Huan *et al.,* 2002; and Xuan, 2005).

2.3.4 Special Software Based models approach to policy analysis

2.3.4.1 International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT): This section is based on Rosegrant *et al.* (2012). It was developed at IFPRI to address a lack of long-term vision and consensus among policy-makers and researchers about the actions that are necessary to feed the world in the future, reduce poverty, and protect the natural resource base. IMPACT continues to serve as the basis for research examining the linkage between the production of key food commodities and food demand and security at the national level in the context of scenarios of future change. Studies focus on regional issues, commodity-level analyses, and cross-cutting thematic issues. IMPACT is also embedded in a variety of major global assessments to complement interdisciplinary, scenario-based work on the future of food supply and demand. The IMPACT model was disaggregated to 281 "food-producing units," (FPUs) which represent the spatial intersection of 115 economic (mostly geo-political) regions and 126 water basins out of recognition of the fact that significant climate and

hydrologic variations within regions make the use of large spatial units inappropriate for water resource assessment and modeling.

Rosegrant *et al.* (1995) conducted the first study using IMPACT where the effects of population, investment, and trade scenarios on food security and nutrition status, especially in developing countries, were analyzed. Again Rosegrant *et al.* (2001) reported the first comprehensive utilization of a set of results obtained using IMPACT to generate projections on global and regional food demand up to the year 2020 based on the prevailing policy environments globally. The IMPACT model has also been utilized in regional and sub-regional studies (Rosegrant and Ringler 2000; Rosegrant and Hazell 2000). Sulser *et al.* (2011) employed the IMPACT model in analysing food security issues in the Arab region. The model has being employed in the area of demand projections for agricultural products and their implications for policy (Rosegrant *et al.* 1999; Scott *et al.* 2000; Delgado *et al.* 1999; Delgado *et al.* 2003); and is a popular tool used in various global assessment studies (MA, 2005; World Bank, 2007;).

2.3.4.2 General Algebraic Modeling System (GAMS): GAMS is a software package for designing and solving various types of models developed by economists at the World Bank for economic models. It can also be used in solving systems of equations from any field of study. Minot (2009) expounds its applicability in the field of agricultural policy analysis.

2.3.4.3 Agricultural Policy Simulator (AgriPoliS): This is an agent-based model used in simulating the impact of a policy regime switch on structural change. Agent-based models have being increasingly employed in modeling agricultural resource issues especially those arising from the interactions between socio-economic factors,

environmental systems and land use (Balmann, 1997; Barreteau and Bousquet, 2000; Berger 2001; Evans and Kelley, 2004; and Parker and Meretsky, 2004).

AgriPoliS is a normative spatial and dynamic model of agricultural structures and explicitly takes account of actions and interactions (e.g. rental activities, investments, and continuation of farming) of a large number of individually acting farm agents. Accordingly, AgriPoliS allows for endogenous structural change and is thus particularly suited to analyzing structural, allocative, and distributive effects of policy changes on a region's agricultural structure. In contrast to many other policy models in agriculture such as single farm and regional mathematical programming models, the agent-based approach is suitable for explicitly modeling the land market to reflect the local interactions of farms, which is crucial in regard to distributional as well as the dynamic effects of agricultural policies.

As noted by Happe *et al.* (2006):

> The model establishes a virtual world of an agricultural region and comprises a large number of individually acting farms that operate in a region, as well as farms' interactions with each other and with parts of their environment. The modeler can fully control the rules of the model.

AgriPoliS has been employed in the analysis of the impact of different policy schemes. Happe *et al.* (2005) investigate the impact of policies intended to raise the efficiency of agricultural structures; Happe *et al* (2007) applied the same approach, but focus on comparing structural change in two fundamentally different regions. Happe *et al.* (2011) employed AgriPolis to examine the interactions between regional farming structure, nitrogen losses and environmental policy.

2.3.4.4 Development Policy Evaluation Model (DEVPEM): This section is based on Brooks *et al* (2011). DEVPEM was developed to analyze the welfare and distributional implications of alternative agricultural policies in developing countries. It is a rural economy model constructed by linking multiple farm household models in a general

equilibrium framework which captures four critical aspects of rural economies in developing countries: (1) the role of the household as both a producer and a consumer of food crops; (2) high transaction costs of participating in markets; (3) market linkages among heterogeneous rural producers and consumers; (4) the imperfect convertibility of land from one use to another. For a detailed motivation of the modeling approach see Brooks *et al*. (2008).

2.3.5 The Policy Analysis Matrix (PAM)

The policy analysis matrix approach to agricultural policy analysis was originally developed in 1981 by Monke and Pearson with the support of their several colleagues to establish a framework for studying changes in agricultural policies in Portugal (see Pearson, 1987). The PAM approach is a system of double-entry bookkeeping which employs the empirical construction of accounting matrices for revenues, costs, and profits based on a complete and consistent coverage of all policy influences on returns and costs of agricultural production. A PAM is constructed for the study of each selected agricultural system using data on farming, farm-to-processor marketing, processing, and processor- to-wholesaler marketing which enable applied economists to analyze and gauge the impact of commodity and macroeconomic policies by comparison with the absence of policy scenario. The approach used in PAM analysis begins with the calculation of existing levels of private (actual market) and social (efficiency) revenues, costs, and profits. This calculation reveals the extent to which actual profits are generated by policy transfers rather than by underlying economic efficiency. Agricultural scientists will then project changes in yields and inputs resulting from alternative research programmes. The effectiveness of such changes can then be gauged by an examination of how they alter private and social profits of current

technologies. This section is based on Monke and Pearson (1989). Gotsch *et al.* (2003) presented a guide on utilizing Microsoft Excel in PAM analysis.

The PAM approach can be effectively employed in the investigation of the following three fundamental issues (i) the impact of policy on competitiveness and farm-level profits (ii) the influence of investment policy on economic efficiency and comparative advantage, and (iii) the effects of agricultural research policy on changing technologies. The results obtained from PAM can be utilized in the identification of: (i) the kinds of farmers that are competitive under current policies affecting crop and input prices and how their profits change as the policies are altered based on the commodities they grow, the technologies they use, and the agroecological zones in which their farms are located. (ii) The commodity production systems that a country currently exhibit strong or weak comparative advantage, and how might it be improved through new investments, using government revenues or foreign aid funds based on technology and agroecological zone. (iii) the most productive directions for basic and applied research to raise crop yields, reduce social costs and, by so doing, increase social profits.

Each PAM contains two cost columns, one for tradable inputs and the other for domestic factors. Intermediate inputs-including fertilizer, pesticides, purchased seeds, transportation, and fuel are divided into their tradable-input and domestic factor components. This process of disaggregation of intermediate goods or services separates intermediate costs into four categories-tradable inputs, domestic factors, transfers (taxes or subsidies that are set aside in social evaluations), and non-tradable inputs (which themselves have to be further disaggregated so that ultimately all component costs are classified as tradable inputs, domestic factors, or transfers). Profitability is measured horizontally, across the columns of the matrix, as shown in Table 2.3. Profits, shown in the right-hand column, are found by the subtraction of costs, given in the two middle

columns, from revenues, indicated in the left-hand column. Each of the column entries is thus a component of the profits identity.

Table 2.3: Policy Analysis Matrix

	Revenues	Costs		Profit
		Tradable Inputs	Domestic Factors	
Private Prices	**A**	**B**	**C**	**D**
Social Prices	**E**	**F**	**G**	**H**
Divergences	**I**	**J**	**K**	**L**

Table Notes: Private profits (D) equals A - B - C. Social profits (H) equals E - F - G. 'Output transfers (I) equals A - E. Input transfers (J) equals B - F. Factor transfers (K) equals C - G. Net transfers (L) equals D - H; they also equal I - J - K. (Source: Monke and Pearson, 1989).

The following Ratio Indicators for Comparison of Outputs are derivable directly from the PAM:

(a) **Private cost ratio (PCR):** C/(A - B): The private cost ratio (PCR) is the ratio of domestic factor costs to value added in private prices. Value added is the difference between the value of output and the costs of tradable inputs; it shows how much the system can afford to pay domestic factors (including a normal return to capital) and still remain competitive. Rational entrepreneurs in the system will expect to earn excess profits (D > 0), which is achievable when/if their private factor costs (C) are less than their value added in private prices (A - B). Thus the PCR measures the competitiveness of a commodity system at the farm level. The system will be competitive if the PCR has a value of less than 1.

(b) **Domestic resource cost ratio (DRC):** G/(E - F): The domestic resource cost ratio (DRC) serves as a proxy measure for social profits. The economic efficiency in domestic resource use of a commodity system can be assessed by using this ratio. Since minimizing the DRC is equivalent to maximizing social profits, if the DRC ratio is less than 1, the system uses domestic resources efficiently. If the DRC ratio is greater than 1, then the system shows inefficiency in domestic resource use and possesses a comparative disadvantage. In other

words, an agricultural system enjoys a comparative advantage if it has a *DRC* ratio of less than one, which implies that the economy is saving foreign exchange by means of domestic production.

(c) **The nominal protection coefficient (NPC)** is a ratio that contrasts the observed (private) commodity price with a comparable world (social) price. This ratio indicates the impact of policy (and of any market failures not corrected by efficient policy) that causes a divergence between the two prices. It is a simple indicator of the incentives or disincentives in place by existing policy. The NPC can be calculated for both output (NPCO) and input (NPCI). The domestic price used in this computation could be either procurement price or farm gate price while the world reference price is the international price adjusted for transportation, marketing and processing costs.

(i) **Nominal protection coefficient (NPC) on tradable outputs (NPCO):** A/E: The NPC on tradable outputs (NPCO) ratio shows the extent to which domestic prices for output differ from international reference prices. If NPCO is greater than 1, the domestic farm gate price is greater than the international price of output and thus the system receives protection. On the contrary, if NPCO is less than 1, the system is not protected by policy.

(ii) **Nominal protection coefficient (NPC) on tradable inputs (NPCI):** B/F: The NPC on tradable inputs (NPCI) ratio shows how much domestic prices for tradable inputs differ from their social prices. If NPCI exceeds 1, the domestic input cost is greater than the comparable world prices and thus the system is taxed by policy. If NPCI is less than 1, the system is subsidized by policy.

(d) **Effective protection coefficient (EPC):** (A - B)/(E - F): The effective protection coefficient (EPC) is another indicator of incentives. This coefficient measures the degree of policy transfer from product market-output and tradable-input-policies. An EPC value of greater than one suggests that government policies provide incentive to producers and less than one indicates that producers are not protected through policy interventions. However, like in the case of the NPC, the EPC also ignores the transfer effects of factor market policies. Thus, it is not a complete indicator of incentives.

(e) **Profitability coefficient (PC):** (A - B - C)/(E - F - G) or D/H: The profitability coefficient (PC) is the ratio of private and social profits. The PC measures the incentive effects of all policies and thus serves as a proxy for the net policy transfer. Its usefulness is restricted when private or social profits are negative, since the signs of both entries must be known to allow clear interpretation.

(f) **Subsidy ratio to producers (SRP):** L/E or (D - H)/E: The subsidy ratio to producers (SRP) is the net policy transfer as a proportion of total social revenues. The SRP shows the proportion of revenues in world prices that would be required if a single subsidy or tax were substituted for the entire set of commodity and macroeconomic policies. The SRP permits comparisons of the extent to which all policy subsidizes agricultural systems. The SRP measure can also be disaggregated into component transfers to show separately the effects of output, input, and factor policies. A high *SRP* value suggests a lack of competitiveness, as the system's economic viability tends to depend on political decisions.

The data entered in the first row of the PAM table provide a measure of private profitability which refers to observed revenues and costs reflecting actual market prices

received or paid by farmers, merchants, or processors in the agricultural system. The private, or actual, market prices thus incorporate the underlying economic costs and valuations plus the effects of all policies and market failures. In Table 2.1, private profits, D, are the difference between revenues (A) and costs (B + C); and all four entries in the top row are measured in observed prices. The calculation begins with the construction of separate budgets for farming, marketing, and processing. The components of these budgets are usually entered in PAM as local currency per physical unit, although the analysis can also be carried out using a foreign currency per unit. The private profitability calculations show the competitiveness of the agricultural system, given current technologies, output values, input costs, and policy transfers.

The second row of the accounting matrix utilizes social prices, as indicated in Table 2.2. These valuations measure comparative advantage or efficiency in the agricultural commodity system. Social profits, H, are an efficiency measure because outputs, E, and inputs, F + G, are valued in prices that reflect social opportunity costs. Social profits, like the private analogue, are the difference between revenues and costs, all measured in social prices-H = (E - F - G). For outputs (E) and inputs (F) that are traded internationally, the appropriate social valuations are given by world prices: cif import prices for goods or services that are imported or fob export prices for exportables. The services provided by domestic factors of production do not have world prices because the markets for these services are considered to be domestic. The social valuation of each factor service is found by estimation of the net income forgone because the factor is not employed in its best alternative use.

The third row of the accounting matrix concerns the differences between private and social valuations of revenues, costs, and profits. For each entry in the matrix measured vertically, any divergence between the observed private (actual market) price and the

estimated social (efficiency) price must be explained by the effects of policy or by the existence of market failures.

Interpretation of the effects of divergences can be clarified by the expansion of the PAM to include six rows, as shown in Table 2.4. In this expanded PAM, each entry measuring the effects of divergences (I, J, K, and L) is disaggregated into three categories-market failures (fourth row), distorting policies (fifth row), and efficient policies (sixth row).

Table 2.4: Expanded Policy Analysis Matrix

	Revenues	**Costs**		**Profit**
		Tradable Inputs	**Domestic Factors**	
Private Prices	**A**	**B**	**C**	**D**
Social Prices	**E**	**F**	**G**	**H**
Diverges and efficient policy	**I**	**J**	**K**	**L**
Effects of market failures	**M**	**N**	**O**	**P**
Effects of distorting policy	**Q**	**R**	**S**	**T**
Effects of efficient policy	**U**	**V**	**W**	**X**

Table Notes: Private profits (D) equal A - B - C. Social profits (H) equal E - F - G. Output transfers (I) equal A - E; they also equal M + Q + U. Input transfers (J) equal B - F; they also equal N + R + V. Factor transfers (K) equal C minus G; they also equal O + S + W. Net transfers (L) equal D - H; they also equal I - J - K; and they equal P + T + X. (Source: Monke and Pearson, 1989).

PAM can be used in Comparing Agricultural Systems Producing Different Outputs. In the words of Monke and Pearson (1989):

> The entries in PAM allow comparisons among agricultural systems that produce identical outputs, either within a single country or across two or more countries. In the accounting matrix, all measures are given as monetary units per physical unit of some commodity. If interest focuses solely on a comparison of one wheat system with another, for example, the matrix entries provide all information necessary for the analysis. Comparisons can be drawn readily by construction of PAM entries for two or more different systems that produce the same quality of wheat. (If necessary, premiums or discounts can be used to correct for quality differences.) Further comparisons can be made between the wheat systems in one country and those in other wheat-producing countries; social exchange rates, incorporating corrections for differential inflation not otherwise offset by exchange-rate changes, are used to convert the other countries' currencies into domestic currency. Comparisons between wheat and barley-or apples and oranges are another story, however. To permit comparisons among systems producing different outputs, some common numeraire must be generated. One technique involves the

> expression of all values relative to a constraining domestic factor resource, such as land. A more common method uses ratios. Both the numerator and the denominator of each ratio are PAM entries defined in domestic currency units per physical unit of the commodity. Therefore, the ratio is a pure number free of any commodity or monetary designation.

There is a growing literature on the application of the PAM approach in agricultural policy analysis (Pearson, 1987; Gotsch, 2003; Mucavele; 2000). PAM has been widely employed in several works (Fox *et al.*, 1990; Pearson *et al.*, 1995; Nelson and Panggabean, 1991; Adesina and Coulibaly, 1998; Yao, 1997; Fang and Beghin, 2000; Liverpool *et al*., 2009; Ogbe *et al*., 2011; Oguntade, 2011; Ugochukwu and Ezedinma, 2011) to evaluate the comparative advantage, profitability as well as the effects of agriculture policies in different countries since the seminal work by Monke and Pearson (1989). The possibility of incorporating environmental considerations into the *PAM* has being demonstrated (Kydd *et al.*, 1997, Pearson *et al.*, 2003). Reig-Martínez *et al.* (2008) employed the *PAM* methodology in studying the possibilities of sustaining rice cultivation in the *Albufera Natural Park*, under the post-2003 *CAP* support system by constructing two different matrices: the first based on observed values for inputs and outputs, revenues, costs and profits while the second matrix, the *efficient*, was computed using values of these variables adjusted to their respective profit-efficient levels.

Several studies were conducted to investigate the profitability, economic efficiency, and policy effects on the performance of the agricultural sector. In Pakistan, Akhtar, *et al.*(2007), studied the level of economic efficiency and competitiveness in the production of rice crops using secondary data concluded that inefficient use of resources in rice production, lack of competitiveness at the farm level, and the prevailing incentive structure affected farmers negatively. Kavèiæ and Erjavec, (2003), assessed the cost competitiveness of Slovenian livestock production on single European market after its European Union (EU) accession also using secondary data and concluded that

"EU accession - even under optimistic scenario – would not significantly improve the competitiveness of great majority of investigated commodities".

In Brazil, de Souza and Révillion, (2013), attempted an evaluation of the profitability and the effects of direct and indirect taxes on rice production in Brazil compared to other member countries of Mercosur i.e. Argentina, Paraguay and Uruguay using secondary data and found out that: (i). rice production in Argentina and Uruguay had positive social and private profitability, while in Brazil and Paraguay there were negative private results. (ii) In Brazil private revenues were lower than social revenues, evidencing that public policies are negatively affecting rice production. Nelson and Panggabean, (1991), examined the social cost of achieving the policy goal of self sufficiency in sugar production in Indonesia using secondary data and discovered that: (i). Farmers forced to grow cane on irrigated land had negative private profits (ii) the Indonesian economy lost because the social cost of cane production (and milling) was much higher than its social value.

Sangawongse *et al.* (1999), investigated the private and social profitability from dominant crops grown in the Karen communities as well as evaluated the impact of economic and social policies on different land use systems in Thailand using both primary and secondary data. They concluded that: (i). paddy rice was privately and socially profitable (ii) upland rice was privately and socially non-profitable (iii) rainfed soy beans and upland corn were not privately profitable, but socially profitable. Touré *et al.* (2013), evaluated the policy-induced effects of the WAEMU common external tariffs on the performance of irrigated rice production systems in Niger republic using secondary data and discovered that: (i). irrigated rice production system receives little protection, (ii) retail rice marketing channels are even less protected, and (iii) the

negative net policy effects indicate that greater incentives are needed for enhanced system performance.

In India, Mohanty *et al.* (2003), examined the efficiency of cotton production in five major producing states in India using secondary data and found out that: (i). that cotton is not efficiently produced in the second largest cotton producing state in the country (ii) that cotton is not the most efficiently produced crop in the other four states; (iii) that Indian policies directed at maintaining the availability of cheap cotton induced major inefficiencies in the cotton sector. Kanaka and Chinnadurai,(2013), evaluated the private and social profitability of rice systems in India using primary and secondary data and concluded that average farm makes losses, both at private and social prices.

Winter-Nelson and Aggrey-Fynn, (2008), studied the social and private profitability of six maize production systems and six rice production systems in Ghana using primary and secondary data and arrived at the following conclusions: (i). all twelve systems contribute to national economic growth and private income generation among farmers, at least under the high cereals prices that prevailed in 2007. (ii) Maize systems show a higher rate of return (lower cost/benefit ratio) than rice systems. (iii) If prices returned to lower levels experienced in 2005, however, rice systems would be privately and socially unprofitable. Finally, in Israel, Finkelshtain *et al.* (2011), assessed the government support for the Israeli agriculture and its impact on comparative advantage, agricultural trade and social profits in fruits and vegetables production using secondary data. Their findings include: (i). that in most cases the social net value of agricultural production activities is negative, (ii) fruit crops present positive private profits, (iii) profits from vegetable crops vary greatly, (ii) higher private profits are observed for the crops that have a relatively higher share of export, and (iii) that government support is very high for many of the crops that are produced for the domestic markets.

In Nigeria, Liverpool, Ayoola and Oyeleke (2009) conducted a PAM analysis on rice production in Niger state and concluded that at prevailing international price of rice, the average farmer with about 2.3 tons/ha yield of rice has comparative advantage in the production of rice with ample room for improvements and higher profitability. Ogbe,Okoruwa and Saka (2011) assesses the competitiveness of Nigerian rice production ecologies, irrigated and upland rice, using the policy analysis matrix (PAM) and concluded that the production ecologies show a strong competitiveness at the farm level and a strong comparative advantage.

2.4 Competitiveness and Comparative Advantage

Competitiveness is defined as the ability to earn profit and maintain market share. Profitability is the most important element of competitiveness and anything that would increase profitability, therefore, would improve competitiveness (Porter, 1990). Dunmore (1985) arguing based on Webster dictionary's definition of competition as, "the effort of two or more parties acting independently to secure the business of a third party by offering the most favorable terms" concluded that competitiveness is all about differences in market prices. Competitiveness, according to Havrila and Gunawardana (2003), refers to the ability of a firm to produce a particular good at a lower cost than another.

Comparative advantage refers to the economic rather than the financial profitability of an economic activity. It allows for the comparison of the real economic costs of production with reference to international price in order to "determine what the activity's profitability would be in the absence of government policies which cause local prices to be different from international prices" (Staal and Shapiro, 1994). Comparative advantage refers to the ability of a country to produce a particular good or service at a

lower marginal cost and opportunity cost than another country (Havrila and Gunawardana, 2003).

There are two variants of the theory of comparative advantage: the Ricardian (classical) model and the Heckscher-Ohlin (neoclassical) model (Ethier, 1983). The Ricardian theory attributes comparative advantage to differences in advancement of technology across countries; while the Hecksher - Ohlin theory traces comparative advantage to cost differences arising from different countries' factor scarcity or endowment (Widgren, 2005; Khatibi, 2008).

Competitive advantage is a measure of a country's profitability in one activity under "market" prices that are subject to distortion by policy or any other influence, while comparative advantage measures the profitability under "shadow" prices that capture the value of social costs and production in the absence of distortions (Hassan *et al.*, 1999; Nakhumwa *et al.*, 1999; Mucavele, 2000; Siggel and Ssemogerere, 2004).

After a review of the literature on competitiveness and comparative advantage, Dunmore (1985) concluded as follows:

> "*Comparative advantage* is an economically pure concept that must assume the world is free of distortions. That economically pure concept relates factor endowments and factor prices to the output mix and trade patterns of a particular country on a basis of opportunity costs and relative efficiencies. *Competitiveness*, however, is the "real world" or the relaxation of the assumption that "the world is free of distortion" which is associated with comparative advantage. Competitiveness is, in a sense, a strategy initiated by a nation to achieve some particular goal-a strategy or distortion employed to offset some natural or pure comparative disadvantage. Over time the use of certain domestic policies or strategies may serve to alter factor endowments and factor prices and, therefore, the comparative advantage of a particular country. Thus, the longer run dynamic aspects of comparative advantage and competitiveness are highly similar"

From the foregoing it is evident that policy influences competitiveness to a greater extent, and comparative advantage to a lesser extent. The role of policy on both competitiveness and comparative advantage were illustrated in the 2 variants of Porter's

Diamond (Porter, 1990): one for competitiveness and the other for comparative advantage.

2.4.2 Measuring Competitiveness and Comparative Advantage

A review of the literature revealed several models and empirical approaches for measuring both competitiveness and comparative advantage which include the Balassa's Index of Revealed Comparative Advantage, the Jebuni, Love and Forsyth Model of comparative advantage, the Vollrath's Index of Competitive Advantage, the White's Index of Competitive Advantage and the Domestic Resource Cost ratio. Some of the aforementioned approaches are discussed here-under.

2.4.1.1 Balassa's Index of Revealed Comparative Advantage

The Balassa's Index of Revealed Comparative Advantage is based on both the Ricardian and Heckscher-Ohlin concepts of the theory of comparative advantage. Mathematically, the model is expressed as follows:

$$R_{ij} = \frac{E_{ij}/E_{wj}}{E_i/E_w} \quad \text{---------- (6)}$$

Where,

R_{ij} = revealed comparative advantage of country i for commodity j

E_{ij} = export by country i of commodity j

E_{wj} = total world export of commodity j

E_i = total exports of country i, and

E_w = total world export

Decision or interpretation of the estimated values of R_{ij} from eqn (6) is as follows:

If $R_{ij} > 1.0$ implies that country i has comparative advantage for commodity j

If $R_{ij} < 1.0$ implies that country i has no comparative advantage for commodity j

Major limitation of the Balassa's Index of Revealed Comparative Advantage is that it does not capture the composition of imports in measuring comparative advantage. Balassa (1984) justifies the non inclusion of imports in the formula in the following words "imports will be affected by inter-country differences in tastes, as well as by inter-industry disparities in the degree of protection. Moreover, in the case of intermediate products, the export-import ratio is influenced by demand for the purpose of further transformation in producing for export".

2.4.1.2 Jebuni, Love and Forsyth Model of comparative advantage

Jebuni, *et al*. (1988) specified a model that captures factor endowments, industrial concentration, technology and economies of scale measures as determinants of comparative advantage. Empirically, the model can be stated thus:

$X_{ij} = f(M_{ij}, Sc_{ij}, Sk_{ij}, F_{ij})$ ---------- (7)

Where, for industry j of country i,

X = export performance as estimated by Balassa's RCA in eqn (4)

M = industrial concentration defined as entropy E where

$E = -\sum_{i-1}^{n} S_i \, log_2 S_i$ ---------- (8)

S_i = the market share of the ith firm in an n-firm industry

S_c = scale economies: estimated based on measures of the minimum efficient plan and the value added per establishment as proxies

S_k = skill level measured based on wage differentials

F = factor endowments of labour and capital

2.4.1.3 Vollrath's Index of Competitive Advantage

Vollrath (1991) developed a specification for revealed competitive advantage thus

$RCA^{i,r} = RACS^{i,r} - RACD^{i,r}$ ---------- (9)

$$= \ln\left(\frac{RAX^{i,r}}{RNX^{i,r}}\right) - \ln\left(\frac{RAM^{i,r}}{RNM^{i,r}}\right) \text{ ---------- (10)}$$

Where

$$lnRAX^{i,r} = \ln\left[\frac{\frac{X_a^i}{X_a^w}}{\frac{X_a^r}{X_a^w}}\right] = \ln[\left(\frac{X_a^i}{X_a^r}\right)] \text{ ---------- (11)}$$

$$lnRNX^{i,r} = \ln\left[\frac{\frac{X_n^i}{X_n^w}}{\frac{X_n^r}{X_n^w}}\right] = \ln[\left(\frac{X_n^i}{X_n^r}\right)] \text{ ---------- (12)}$$

$$lnRAM^{i,r} = \ln\left[\frac{\frac{M_a^i}{M_a^w}}{\frac{M_a^r}{M_a^w}}\right] = \ln[\left(\frac{M_a^i}{M_a^r}\right)] \text{ ---------- (13)}$$

$$lnRNM^{i,r} = \ln\left[\frac{\frac{M_n^i}{M_n^w}}{\frac{M_n^r}{M_n^w}}\right] = \ln[\left(\frac{M_n^i}{M_n^r}\right)] \text{ ---------- (14)}$$

Where,

$RCA^{i,r}$ = revealed competitive advantage,

$RACS^{i,r}$ = revealed comparative export share for commodity

$RACD^{i,r}$ = revealed comparative input share for commodity

$RAX^{i,r}$ = relative agricultural export share

$RNX^{i,r}$ = relative non-agricultural export share

$RAM^{i,r}$ = relative agricultural import share

$RNM^{i,r}$ = relative non-agricultural import share

X= value of export

M= value of import

i= home country

r= rest of the world

a= agricultural products

n= non-agricultural products, and

w= world total

The Policy Analysis Matrix (PAM) as a veritable approach in measuring both competitiveness and comparative advantage has been discussed earlier in section 2.3.5.

2.4. Conceptual Framework for Agricultural Policy and Competitiveness and Comparative Advantage

The conceptual framework of the relationship between agricultural policy on the one hand and competitiveness and comparative advantage of agricultural sector on the other, developed for this study is based on the following argument: (i) that the efficiency objective which is aimed at the allocation of resources to achieve maximum national output is one of the key objectives of governments' agricultural policy, (ii) that the attainment of this objective will depend on a combination of policy variables and exogenous non-policy variable connected through a system of structural relations (iii) that a change in any one or more of the policy variables will results into a change in the indicators of competitiveness and comparative advantage of the rice sub- sector that could be attributable to the policy in place. This framework is depicted in fig 2.1

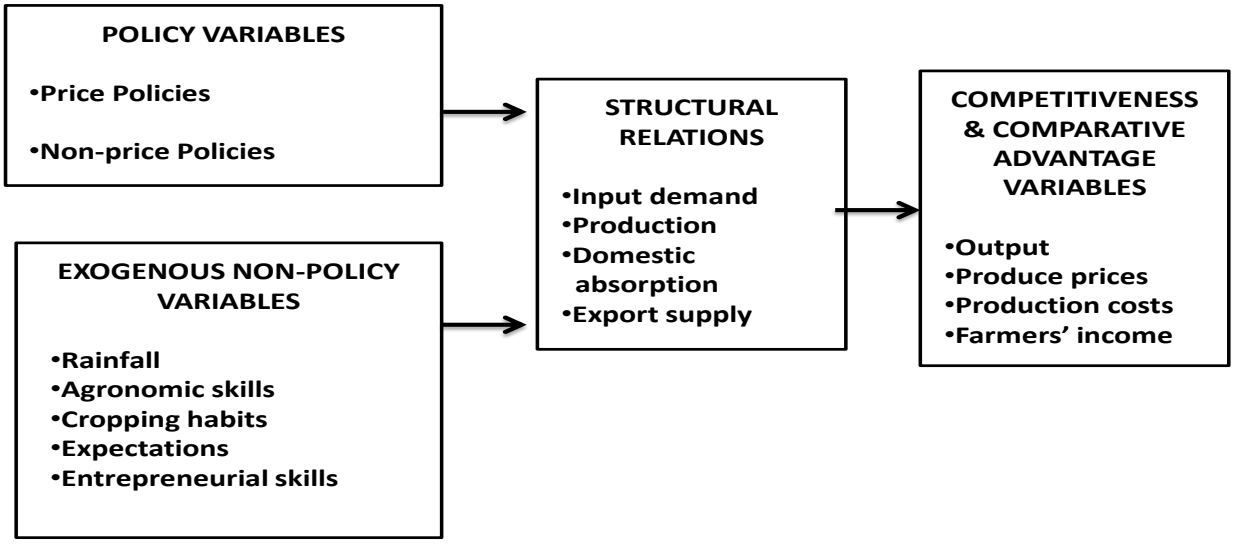


Fig 2.1: Conceptual Framework of Agricultural Policy and Competitiveness and Comparative Advantage

CHAPTER THREE

METHODOLOGY

3.1 The Study Area

The study was conducted in Kaduna State which is located between Latitudes 9 08' and 11 07'N and Longitudes 6 10' and 8 48'E, with a land mass of about 45,567 square kilometres. Kaduna State has a population of 6,066,562 inhabitants (National Population Commission, NPC, 2006), which is projected at 7,747,369 for the year 2013 (Kaduna State, KDS, 2014). It occupies a major position in the agricultural economy of Northern Nigeria (Ado, Abubakar and Mani, 1999). The annual rainfall in the area varies generally between 942mm and 1000mm and last for about six months (May to October) of the year (National Agricultural Extension and Research Liaison Services, NAERLS, 2002). The area has a suitable climate and environmental conditions favourable for cereal crop production. The major crops grown in the State include maize, sorghum, rice, millet, yams, potatoes, ginger, groundnut, chillies, sheanuts, beniseed and soyabeans. Small-scale farmers whose labour force, capital and management originate mostly from the households predominantly carry out the bulk of agricultural production. According to Cadoni and Angelucci (2013), Kaduna state, with an average annual production of more than 650,000MT, is the leading producer of rice in Nigeria. Rain-fed upland is the predominant rice production system in the State (USAID, 2009).

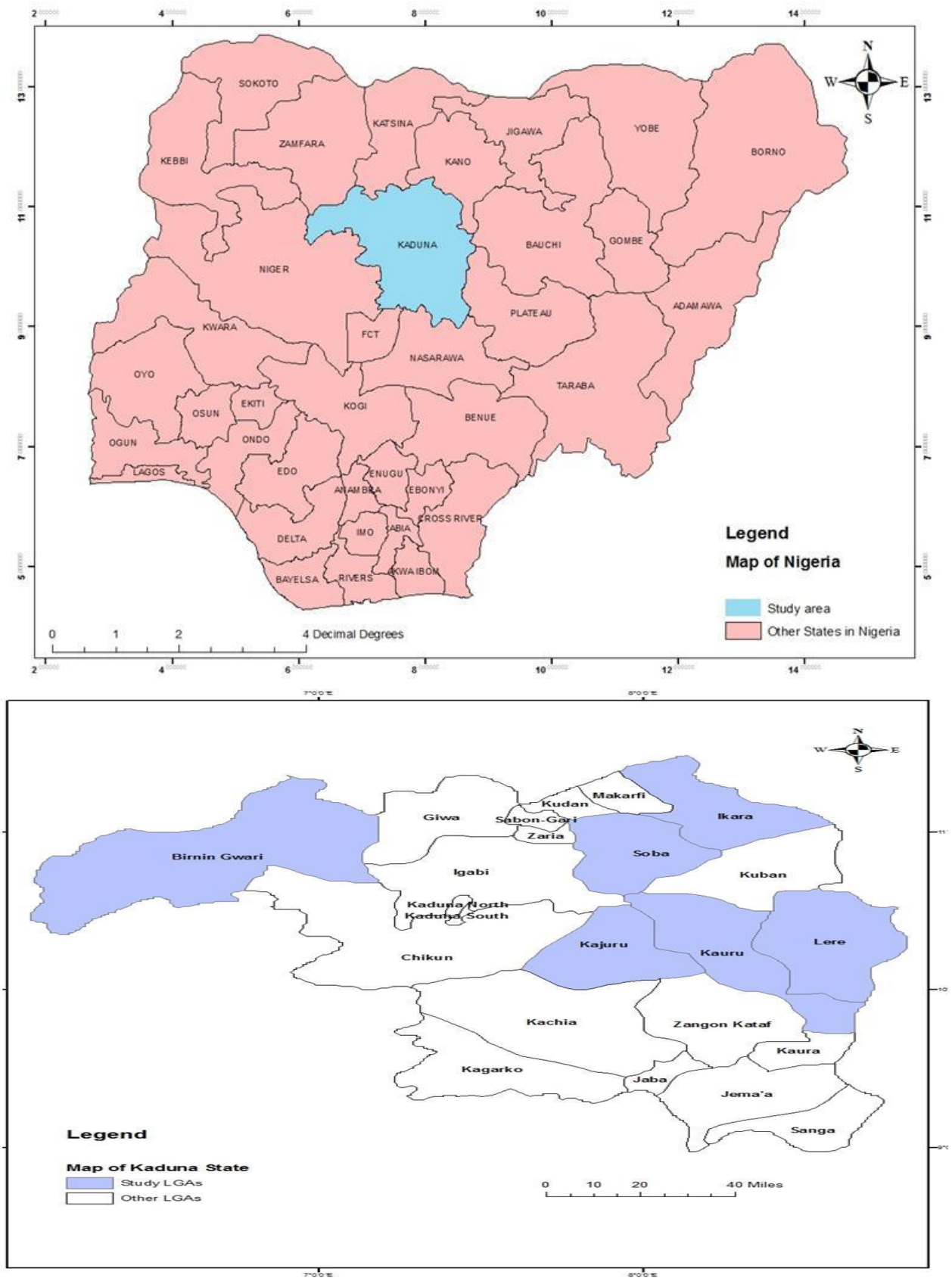


Fig 3.1: Map of the study area

3.2 Sampling Procedure

The study employed a multistage selection technique. The procedure comprised, first, the purposive selection of 3 out of the 4 zones of the Kaduna Agricultural Development Programme (KADP) notable for their importance in paddy production. The second stage was the purposive selection of two Local Government Areas (LGAs) each notable in rice production from each of the 3 ADP zones. This gave a total of 6 LGAs in the study area. In the third stage, two important rice producing communities were purposively selected from each LGA based on the concentration of paddy producers. This gave a total of 12 rice producing communities in the study area. The fourth stage was the random selection of 10% each of rice farmers, parboilers, paddy marketers, and milled rice marketers; and 33% of rice millers using simple random sampling technique whereby numbers were assigned to each potential respondent in the sampling frame developed for each selected rice producing community in the study area as shown in Table 3.1; and by using electronically generated random numbers the sample for each community was drawn. This gave a total of 241 rice farmers, 74 parboilers, 33 millers, 44 paddy marketers and 34 milled rice marketers in the study area. The number of questionnaires returned and analysed in this study were 226, 68, 33, 40 and 32 for farmers, parboilers, millers, paddy marketers and milled rice marketers respectively.

Table 3.1: Sampling Frame and Sample Size for the respondents in this study

ADP Zone	LGAs	Farmers		Parboilers		Millers		Paddy Marketers		Milled Rice Marketers	
		S-F	S-S	S-F	S-S	S-F	S-S	S-F	S-S	S-F	S-S
Maigana	Soba	379	38	123	12	21	6	76	8	69	7
	Ikara	437	44	102	10	19	6	71	7	83	8
Lere	Lere	378	38	87	9	17	6	88	9	41	4
	Kauru	397	40	103	10	11	3	46	5	30	3
B/Gwari	B/Gwari	456	46	140	14	12	4	69	7	50	5
	Kajuru	346	35	186	19	19	6	84	8	66	7
Total		2393	241	741	74	99	33	431	44	339	34

***Note**: S-F, Sampling frame; S-S, sample size as planned.*

3.3 Data Source and Collection

Two categories of data were collected and utilized in this study, namely primary and secondary.

3.3.1 **Primary data** to enable the construction of farming, marketing and processing information on the budgets of the entrepreneurs were elicited. This category of data was collected using the 5 sets of semi-structured questionnaires designed for this study and represented in the appendix 4-8.

3.3.2 **Secondary data:** 2014 data on port charges, cif (costs, insurance, freight), fob (free on board), import tariffs, international prices for imported rice and rice production inputs, and level of subsidy on rice production inputs, were collected from the following secondary sources: CBN, FAO, NAERLS, and Rice Authority (www.riceauthourity.com).

3.4 Analytical Technique

3.4.1 Descriptive Statistics: Measures of central tendency (range, mean, median, mode and percentage); and measures of dispersion (standard deviation) were used to achieve objectives (i) and (vi). The Chebysheff's theorem, which gives a more general interpretation of the standard deviation by providing lower bounds on the proportions contained in the intervals, was employed in interpreting some of the estimated standard deviations. According to Keller and Warrack (2003), the proportion of observations in any sample that lie within k standard deviation of the mean is at least

$1 - \frac{1}{k^2}\ for\ k > 1$ ---------- (15)

3.4.2. Logit Regression: The binary logistic regression methodology has been employed in several agricultural and extension studies that call for the analysis and prediction of a dichotomous outcome such as fertilizer use or non use, adoption and non adoption (see for example Neupane, Khem, Sharma and Thapa, 2002; Adunni and Doppler 2007; Benerjee and Martin, 2009). This section is based on Gujarati (2003) and Gujarati and Porter (2009). Binary logistic regression requires the dependent variable to be converted into a dichotomous binary variable coded 0 and 1. For the purpose of this study the logistic model is developed as follows:

The logit equation based on Greene, (1993) is written as

$\Pr(Y = 1) = \frac{e^{\beta' x}}{1+e^{\beta' x}}$ ---------- (16)

With the cumulative distribution function given by

$F(\beta' x) = \frac{1}{1+e^{\beta' x}}$ ---------- (17)

The cumulative logistic distribution function (Eq 17) is expressed as (after Adunni and Doppler, 2007):

$p = \frac{1}{1+e^{-z}}$ ---------- (18)

If p_i is the probability of higher paddy yield, then the probability otherwise is 1-p_i, which in logistic function can be expressed as

1-p_i=1-$\frac{1}{1+e^{-z}}$ ---------- (19)

$= \frac{1}{1+e^{-z}}$ ---------- (20)

The ratio of Eq 19 and 20 will give the odd ratio

$\frac{p_i}{1-p_i} = \frac{1+e^{-z}}{1+e^{z}}$ ---------- (21)

$\frac{p_i}{1-p_i} = e^{z}$ ---------- (22)

Equation 22 is the odd ratio in favour of higher yield. It is the ratio that a farm will produce higher yield to the probability that it will not

Taking the natural log of both sides of Eq 22

$L_i = ln\frac{p_i}{1-p_i} = z$ ---------- (23)

$L_i =$ the log odds ratio, which is also referred to as the logit

$z = \beta_0 + \beta_1 x_1 - \beta_2 x_2 + \beta_3 x_3 + \ldots\ldots\ldots\ldots + \beta_k x_k + \mu$ ---------- (24)

Where

x_i = the farm specific indicators hypothesized to influence yield

β_i = vector of parameters to be estimated using maximum likelihood method

β_0= constant term

μ = error term which is normally distributed with zero mean and variance

$\delta^2 = \frac{1}{N_i\, p_i\, (1-p_i)}$ ---------- (25)

N_i = number of observations

Although z is a linear combination of variables that have both upper and lower bounds, no bounds can be assigned to the variable z itself,as values assumed by z will depend on the values of the unknown parameters β_i s also. In other to obtain the values of z, the likelihood of observing the sample was formed by introducing a dichotomous variable Y_i such that $Y_i = 1$ and $Y_i = 0$ if otherwise. The maximum likelihood estimates of the logit model were then obtained.

For the purpose of this study, farmers with paddy harvest of less than 2.06MT/ha were assigned the value of zero, the average estimated for the sampled farmers, while those with paddy yield of 2.06MT/ha or above were assigned the value of 1. Ten socio-economic variables were hypothesized to influence famers' yield in the rice production system within the study area: farmers' age, education level, years of experience in rice

production, farm size, land tenure system, tractor use, access to credit, household dependants under 18 years of age, household dependants above 18 years of age, and seed costs. Seed cost is taken as proxy for seed type. It is assumed that improved and better seeds will cost more in the market than the locally produced and recycled seeds. Table 3.2 presents a description of the explanatory variables used in the binary logistic model designed for this study. The maximum likelihood estimates of the logit model were obtained.

Table 3.2: Description of explanatory variables used in the logit regression model

Explanatory Variable	Description of variables /Covariates	A priori expectation of relationship with yield[†]
Education Level	Primary school 1; Secondary school 2; Tertiary level 3; None 0.	(+) and direct
Years Growing Rice	Years in rice cultivation	(+) and direct
Land Tenure	Inheritance 1; Purchase 2; Borrow 3; Rent etc 4; Gift 5	(±) and direct
Farmers' age	Farmers' age in years	(±) and direct
Farm size	Farm size in hectares	(+) and direct
Access to credit	Yes 1: No 0	(+) and direct
Dependants U18	Number of dependants under 18	(-) and direct
Dependants A18	Number of dependants above 18	(+) and direct
Mode of Land Preparation	Machine 1; Manual 0	(±) and direct
Seed Costs	Costs of seeds in Naira/Kg	(+) and direct

[†]Note: (+) A positive relationship is hypothesized between such variables and crop yield. Such variables are expected to contribute to increase yield. (±) A positive or negative relationship is expected between such variables and crop yield. Such variables are expected to contribute either positively or negatively to yield depending on the values they take.

Dependent Variable: Rice Yield; below average 0; average or more 1

The logit regression model was used to achieve objective (ii) of this study i.e. evaluate the socioeconomic determinants of rice yield in the study area.

3.4.3 Policy Analysis Matrix (PAM): The PAM was constructed based on the data collected from the farmers and other relevant respondents along the rice value chain. The PAM adopted for this study is presented in Table 3.3 below and was used to achieve objectives (iii) (assess the competitiveness of small-scale rice production in the study area in terms of farm-level profit), (iv) (evaluate the comparative advantage of

small-scale rice production in the study area in terms of economic efficiency), and (v) (investigate the effects of policy on domestic rice production in the study area). Though the policy analysis matrix (PAM) is not an inferential statistical tool that could be used in hypothesis testing, several indicator ratios were estimated from the constructed PAM that were utilized to guide decision on whether to reject or not reject the "null hypotheses" formulated for this study. The PCR, SRP and DRC ratios were estimated and employed to test the hypotheses formulated as well as in conducting sensitivity analyses to simulate the effect of changes in key parameters such as costs of inputs and prices of output on the competitiveness and comparative advantage of rice production in the study area. This was done by changing one parameter at a time and determining what happens.

Table 3.3: The Policy Analysis Matrix adopted for this study

	Revenues	**Costs**		**Profit**
		Tradable Inputs	**Domestic Factors**	
Private Prices	**A**	**B**	**C**	**D**
Social Prices	**E**	**F**	**G**	**H**
Divergences	**I**	**J**	**K**	**L**

Table Notes: Private profits (D) equals A minus B minus C. Social profits (H) equals E minus F minus G. 'Output transfers (I) equals A minus E. Input transfers (J) equals B minus F. Factor transfers (K) equals C minus G. Net transfers (L) equals D minus H; they also equal I minus J minus K. (Source: Monke and Pearson, 1989).

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Socio-economic characteristics of farmers in the study area

This section reports the findings of this study with reference to the socio-economic characteristics of rice farmers in the study area.

Table 4.1: Socio-economic Characteristics of Farmers

Parameter	Min	Max	Mean	Median	SD	Skewness
Famers' age	24.00	60.00	44.12	45.00	8.06	-0.33
Dependents under 18	0.00	18.00	6.27	6.00	3.38	0.80
Dependents above 18	0.00	15.00	4.05	3.50	2.72	0.91
Years growing rice	2.00	40.00	16.85	15.50	7.11	0.70
Land area for rice	0.50	10.00	2.28	2.00	1.65	2.64
Paddy yield (MT/Ha)	0.70	3.50	2.06	2.06	602.95	0.14

4.1.1 Famers' Age

Farmers' age has a relationship with the quality and quantity of work they can carry out on the farm. Farmers' productivity is expected to increase with age, reach a maximum level, and then start decreasing with advancement in age. Result of the age distribution of respondents is presented in Table 4.1. The study revealed that all the farmers were within the ages of 24 and 60. The mean age was 44.12 years, indicating that majority of the respondents were in their agriculturally active age. Several studies have reported a strong relationship between productive age and the adoption of new agricultural technologies (Igbokwe, 1984; Okoro, 1991; Ajala, 1992; Maddison, 2006; Amsalu and de Graaff, 2007; Nhemachena and Hassan, 2007; Akudugu *et al*., 2012; Kariyasa and Dewi, 2013). The availability of farmers in their late productive age is expected to

increase the adoption of agricultural technologies and management practices which will in turn increase farm productivity which could lead to improve competitiveness and comparative advantage of small-scale rice production in the study area. However, Moscardi and de Janvry, (1977) reported that older farmers are more risk averse. Tauer and Lordkipanidze (2000), reported of some empirical evidences suggesting "that productivity of a farmer may increase with age, reach some maximum level, and then decrease with further age". Akudugu, Guo and Dadzie (2012), observed that several studies reported a significant negative relationship between age and adoption of improved technologies.

4.1.2 Dependents under 18

The number of dependents under 18 years of age among the sampled farmers in the study area is presented in Table 4.1. The mean number of dependent persons under the age of 18 was 6 persons. This suggests that most of the farmers had 6 dependents under the age of 18. The existence of a large number of dependents under 18-years implies that not only are there more mouths to feed, but also sundry expenses to attend to. This would (i) necessitates increase in productivity (output per unit area) if the consumption needs of the family is to be met which will ultimately lead to increase in competitiveness and comparative advantage of small-scale rice production in the study area; (ii) limits ability to increase productivity because home consumption has depleted resources that could otherwise be utilised in increasing productivity which could lead to decrease in competitiveness and comparative advantage of small-scale rice production in the study area

4.1.3 Dependents above 18

Results in Table 4.1 show the number of dependents above the age of 18 years among the sampled farmers in the study area. It indicates that the maximum number of dependents above the age of 18 years was 15. The mean of 4 indicates that most of the farmers had 4 dependents above the age of 18. The number of dependents above the age of 18 years could suggest the availability of family labour to be employed in carrying out agricultural production activities. Under the peasant farming system typical of the study area, which is labour intensive, family labour forms the key source of labour supply. This is because the amount of farming activities that take place is determined by the amount of labour a family can afford during the peak labour demand season, thus farmers who had large number of dependents above 18 years of age will be assumed to have less need for hired labour than farmers with a smaller number which could lead to increase in competitiveness in terms of farm-level profits as the farmer saves the money he will otherwise have spent on hired labour. However, this may not always be the case. Elderly dependents, for example, could hardly contribute to farm family labour; even among the younger ones above 18 years of age, not all could be available for involvement in farming.

4.1.4 Rice Production Experience

Years of experience in rice crop production among the sampled farmers in the study area is presented in Table 4.1. The analysis of the data revealed that the respondents had a mean of 16.85 years of experience. Applying the Chebysheff's theorem to the calculated mean (16.85) and the standard deviation of 7.113 indicated that at least 75% of the farmers had a rice farming experience of between 2.62 and 31.08 years. It could be said that the few respondents that had a minimum of 2 years experience were the new entrants into rice farming in the study area. This finding could be favourable to increased competitiveness and comparative advantage of rice production in the study

area when viewed alongside the normal expectation that the more experienced a farmer is the more likely that he would be willing to adopt new technologies and practices. Years of farming experience can be used as an indicator of a farmer's managerial capability. The more experienced the farmer, the better his or her ability to make or take sound farm decisions (Ani, 1998; Iheanacho, 2000; Ani *et al.*, 2004). Najafi (1979) and Onoja and Herbert (2012) reported a positive correlation between years of farming experience and the adoption of innovations. Thus, an experienced farming population is expected to lead to increase in the competitiveness and comparative advantage of small-scale rice production in the study area.

4.1.5 Farm size

Results in Table 4.1 show the distribution of land area devoted to the cultivation of rice among the sampled farmers in the study area. The results revealed that the minimum and maximum size of rice farm holdings among the sampled farmers were 0.5 and 10 hectares respectively. The mean 2.28 suggested that most of the farmers had rice farm holdings of 2 hectares. This finding supported IFDC (2008), who found that majority of small-scale rice farmers in Nigeria cultivated 0.5 to 1.5 hectares. This is in accord with the general view in the literature that agriculture in Nigeria is essentially dominated by small-holder farmers. Though small-size farm holdings did not encourage agricultural mechanization, this finding is potentially favourable when viewed *vis-à-vis* the growing literature championing the hypothesis that small-scale farmers adopt improved agronomic practices and technologies faster than large-scale farmers (Allaudin and Tisdell, 1988; Shiyani *et al.*, 2002); and exhibit higher economic efficiency relative to larger farms (Hazel, 2003). This is expected to lead to increase in competitiveness and comparative advantage of small-scale rice production in the study area

4.1.6 Paddy Yield

Paddy harvest reported by the farmers sampled in the study area was converted to yield in MT/ha and presented in Table 4.1. The analysis of the data revealed that the minimum and maximum paddy yield were 0.7 and 3.5 MT per hectare respectively. The mean and mode of 2.06MT/ha and 2.06 MT/ha respectively suggests that most of the farmers had rice yield of about 2 MT hectares. Applying the Chebysheff's theorem to the calculated mean (2063.24kg/ha) and the standard deviation of 602.95 indicates that at least 75% of the farmers have a rice yield of between 857.34 and 3269.14 kg/ha. The average yield of 2.06MT/ha calculated for the study area is higher than the National average for upland rice reported in previous studies. IFDC (2008), USAID (2009) and Project Coordinating Unit, PCU (2002) reported average national yields of 1.7MT, 0.54MT and 1.8MT per hectare respectively for upland rice in Nigeria. The average yield which is higher than the national average yield implies that with good prices, competitiveness of small-scale rice production in the study area is relatively higher than the average of what is obtained at the national level.

4.1.7 Farmers' Sex

The sex distribution of the sampled farmers in the study area revealed that 93% were males only about 7% are females. This could be attributed to the socio-cultural background of the people in the study area where field crop production is essentially male dominated. As reported by Ayoola *et al.*, (2011), multiple roles and cultural practices prevented women from participating in direct rice field production activities. This explains the predominance of male rice farmers in the study area, which could be favourable to improved productivity and increased competitiveness of small-scale rice production in the study area because male farmers are invulnerable to the various socio-

economic factors reported by Rahman (2008) which limits or restricts women farmers ability to increase the productivity of their farms.

4.1.8 Level of Education

The distribution of the farmers according to their respective level of educational attainment is presented on Fig. 4.1. It was found that 56% of the respondents could read and write in English Language, having attended at least the secondary school level of education i.e. have attained 12 years of schooling. About 13% had attained up to the tertiary education level. This finding implies that farmers surveyed within the study area may be willing to adopt new technologies and could become model farmers for others to emulate based on several studies which reported a significant and positive relationship between education and adoption of new technologies (Okoro, 1991; Onu, 1991; Ajala 1992; Madukwe, 1995). As noted by Ani (1998), education enhances farmers' capacity towards deriving, decoding and evaluating useful information for better agricultural production. Better agricultural production leads to improved productivity which could lead to increase in competitiveness and comparative advantage of small-scale rice production in the study area.

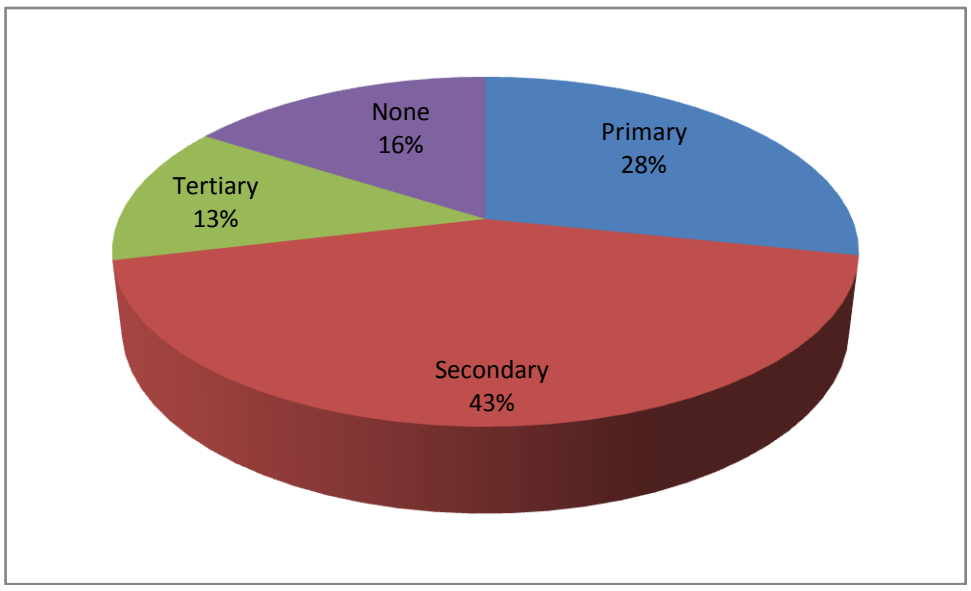


Fig. 4.1: Distribution of Farmers according to Level of Education

4.1.9 Methods of Land Acquisition

The various methods of land acquisition by the sampled rice farmers in the study area is presented in Fig. 4.2. It was found that majority (64%) of the respondents acquired their farmland through inheritance. The proportion of respondents that owned their lands through outright purchase and rent were found to be 36%. This indicates that the bulk of the land utilized for rice production in the study area was in the hands of traditional land owners who inherited the land from their parents. The implication of this finding is that land holding through inheritance usually lead to land fragmentation among heirs following the death of the owner which will subsequently lead to smaller farm-size holdings per farmer (Onyebinama, 2004). Decreasing farmers' land holdings over time is not favourable to increased production (total output) and productivity (output per unit area) which are prerequisites to increased competitiveness and comparative advantage of small-scale rice production in the study area.

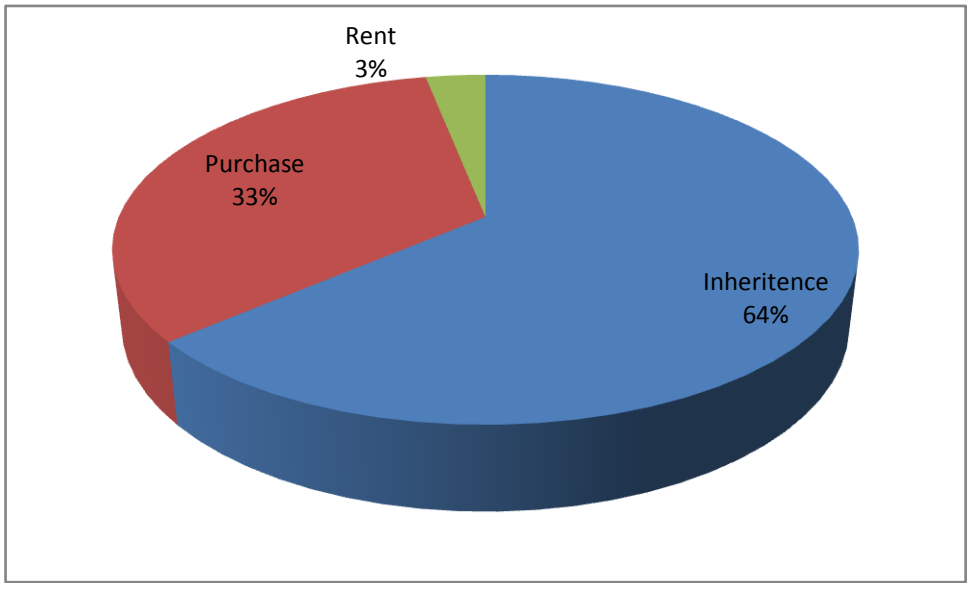


Fig. 4.2: Methods of land acquisition

4.1.10 Membership of Farmers' Association

The distribution of the sampled farmers according to their membership of farmers' association showed that 77% were not members of any farmers' association or cooperative society. This suggests that most farmers in the study area are not organised into cooperatives and associations which is not only a common trend of modern day agricultural and rural development interventions of both the government and donor agencies, but also of immense benefit to farmers. The National Smallholder Farmers' Association of Malawi, NASFAM (1999) identified the benefits derivable from membership of farmers' association to include: increased market power, economies of scale, gain from coordination, provision of missing services and representation of members at higher institutional and governmental levels.

4.1.11 Mode of Land Preparation

The distribution of sampled farmers in the study area according to mode of land preparation revealed that 58% of the respondents employed the services of tractors. This indicates that most rice farmers in the study area utilized tractor hiring services in preparing their land for rice cultivation despite their small land holdings. As observed by Takeshima *et al.* (2013), utilization of tractor services enables smallholder farmers to allocate more labour for off-farm income generating activities. Revenues accruing from off-farm income generating activities can be ploughed into rice farming to enhance the competitiveness of rice production in the study area.

4.2 Socio-economic Determinants of Yield in Rice Production in the study area

Several studies have measured and compared cereal productivity in terms of yield per hectare (Pingali and Heisey, 1999; Alston, Norton and Pardey, 1995). The extent, to which certain socio-economic profiles influence the level of crop yield on rice farms based on the estimated logit regression model an intercept, revealed that the coefficient of the intercepts in the model was -17.287, and this was not significant even at the 10% level. This suggests that an alternative model without the intercept might be better applied to the data (Peng, Lee and Ingersoll, 2002). The logit regression model was therefore re-run without the intercept and the results obtained are presented in table 4.2. The likelihood ration (LR) statistic of 203.954 with a p-value of 0.000 calculated at the 10df indicated that the specified regressors had significant effect on paddy yield. As noted by Gujarati (2003) “in binary regressand models, goodness of fit is of secondary importance. What matters are the expected signs of the regressors coefficients and their statistical and/or practical significance.”

With the exception of years of experience in rice farming, land tenure, seed costs, access to credit, and dependent under 18 years of age, all other variables in the model had negative influence on the level of yield in rice farms in the study area. This appears to contradict some of the *a priori* expectations.

The probability that a rice farmer's yield in the study area will be up to 2.06MT/Ha was significantly influenced by the following six socio-economic variables: farmers' age, level of education, farm-size, access to credit, dependants under 18 years and dependants above 18 years of age. Seed cost was taken as proxy for seed types. Conversely, experience in rice farming, mode of land preparation, seed cost, and land tenure system had no significant influence on rice yield in the study area. Each of the aforementioned significant variables will be discussed briefly in turn. In the discussion that follows, the interpretation of the coefficient of the regressors was achieved in terms of odds, as demonstrated by Gujarati and Porter (2009). The odds were derived by taking the antilog of the various coefficients.

Results earlier presented indicated that 56% of the respondents had at least attained the secondary level of education. This coefficient (-1.694) though significant at the 10% level, had a negative sign suggesting an inverse relationship between paddy yield and farmers' education level. This indicates that educated farmers in the study area are about 18% less likely to have higher yield than least educated farmers, other things remaining the same. This finding contradicts the *a priori* expectation that education level of farmers have a positive relationship with farmers' yield and appears to be in disagreement with the finding of Onoja and Herbert (2012) who found that years of formal education positively influenced rice yield. Appleton and Balihuta (1996), after reviewing several studies conducted in Africa on the effect of formal education on agricultural productivity, concluded that it is usually not significant. However, this

finding could be explained as follows: (i) that the educated farmers in the study area have little or no access to extension publications, bulletins and guides, that would expose them to improved agronomic practices capable of leading to higher crop yield; (ii) the poorly educated farmers on the other hand are tapping from the vast pool of experience available within the traditional indigenous knowledge system, coupled with the fact that the poorly educated farmers, are likely to give more care to their crops than the educated farmers who are likely to be engaged in some white collar jobs or enterprises away from the farms.

The estimated coefficient for farmers' age was significant and also had a negative sign indicating an inverse relationship between paddy yield and farmers' age. This suggests that older farmers in the study area are about 88% less likely to have higher yield than younger farmers, other things remaining the same. This contradicts a priori expectation. Moscardi and de Janvry, (1977) reported that older farmers are more risk averse. Tauer and Lordkipanidze (2000), reported of some empirical evidences suggesting "that productivity of a farmer may increase with age, reach some maximum level, and then decrease with further age". Akudugu, Guo and Dadzie (2012), observed that several studies reported a significant negative relationship between age and adoption of improved technologies.

The coefficient of farm size was significant at the 0.07 probability level. It also had a negative sign suggesting an inverse relationship between paddy yield and farm size. This contradicts *a priori* expectation. This finding indicated that farmers with bigger farm sizes in the study area were about 50% less likely to have higher yield than farmers with smaller farm sizes, other things remaining the same. This suggests that smaller farms performed better than relatively bigger farms in small-holder agriculture. This finding is in agreement with Yaron, Dinar, and Voet, (1992) and Harper, Mjelde, Drees,

and Way, (1990) that reported a negative relationship between farm size and the adoption of improved technologies. The findings also supports a growing body of literature championing the hypothesis that small-scale farmers adopt improved agronomic practices and technologies faster than large-scale farmers (Allaudin and Tisdell, 1988; Shiyani *et al.*, 2002); and exhibit higher economic efficiency relative to larger farms (Hazel, 2003).

The coefficient of access to credit was highly significant and had a positive sign, suggesting a positive relationship between paddy yield and access to credit. This indicated that farmers that have access to credit in the study area were more than 600% likely to have higher yield than farmers that lacked access to credits, other things remaining the same. This is expected as studies on adoption of improved agricultural production technologies reported a positive relationship between the level of adoption, yield, and access to credit (Yirga, 2007; Pattanayak et al., 2003).

The coefficient of dependants under the age of 18 years was significant and also had a negative sign suggesting an inverse relationship between paddy yield and number of dependants under 18 years. This finding indicated that farmers with higher number of dependants under the age of 18 years in the study area were about 77% less likely to have higher yield than farmers with smaller number of dependants under the ages of 18 years, other things remaining the same. This agrees with *a priori* expectation. Higher number of dependants under the age of 18 years limits ability to increase productivity because home consumption would deplete resources that could otherwise be utilised in increasing productivity

The coefficient of dependants above the age of 18 years was positive (0.309) and significant, suggesting direct relationship between paddy yield and number of dependants above 18 years. This again agrees with *a priori* expectation that the number

of dependents above the age of 18 years could suggest the availability of family labour to be employed in carrying out agricultural production activities. This finding indicated that farmers with higher number of dependants above the age of 18 years in the study area were about 136% likely to have higher yield than farmers with smaller number of dependants above the ages of 18 years, other things remaining the same. Croppenstedt, Demeke, and Meschi, (2003) argued that households with a larger pool of labor are more likely to adopt agricultural technology and use it more intensively because they have fewer labor shortages at peak times.

Table 4.2: Socio-economic variables influencing yield of rice in the study area

Variable	Coefficient	Std Error	Probability	Antilog of Slope of Coefficient
Farmers' Age	-0.131**	0.054	0.014	0.877
Education Level	-1.694**	0.608	0.005	0.184
Years of experience in rice production	0.085	0.059	0.151	1.088
Farm Size	-0.692**	0.256	0.007	0.501
Land Tenure	0.315	0.401	0.432	1.371
Seed Costs	0.004	0.007	0.605	1.004
Mode of land preparation	-0.375	0.618	0.544	0.687
Access to credit	8.743**	1.925	0.000	6.266E3
Dependants U18	-0.257*	0.107	0.016	0.773
Dependants A18	0.309*	0.138	0.026	1.361
LR statistic (10 df)	203.954			

***Significant at 0.01; *Significant at 0.05*

4.3 Competitiveness of small-scale rice production in the study area

The competitiveness of small-scale rice production in terms of farm-level profits is contained in the top row of the Policy Analysis Matrix estimated for rice in the study area. The results are presented in Table 4.3. It revealed that rice farmers in the study area made a positive private profit of ₦93, 498.93 per hectare under prevailing technologies, costs of inputs, prevailing output prices, and existing policy environment for the study period. This finding is in agreement with three other separate rice PAM studies (Liverpool *et al.,* 2009; Oguntade, 2011; Ugochukwu and Ezedinma, 2011; Ogbe *et al.,* 2011) where it was reported that rice farmers in Kano, Niger, Ekiti and the South eastern states of Nigeria had positive private profitability. Profitability of rice production from non-PAM studies were reported by Onoja and Herbert (2012) in Kogi state. Thus, it can be concluded that the key objectives of Nigeria's agricultural policies of increasing production and farmers' income has been attained among rice farmers in Kaduna state.

Table 4.3: Constructed Rice PAM for the Study area

	Revenue	**Costs**		**Profits**
		Tradable Inputs	**Domestic Factors**	
Private	199,043.52	41,499.63	64,044.97	93,498.93
Social	130,015.90	44,114.73	66,250.09	19,793.79
Divergence	68,884.92	-2,615.10	-2,205.12	73,705.14

Values of ratios estimated from the PAM: PCR, 0.4065; DRC, 0.7699; SRP, 0.5662; NPCO, 1.5259; NPCI, 0.9407; EPC, 1.8310

Sensitivity analyses were conducted to test the likely effects of changes on the costs of fertilizers and pesticides; price of output and paddy-grain conversion ratio on farmers' profit. The results are presented in Table 4.4. Results of the sensitivity analyses indicated that a 25% and 50% increase in fertilizer costs will reduce farmers' profit to ₦87, 661.00 and 81,825.80 respectively. Likewise, a 25% and 50% increase in the costs of protection chemicals is estimated to respectively reduce farmers' profit to ₦92,

295.00 and ₦91, 091.14. A 100% increase in the costs of rice seeds is expected to reduce farmers' profit to ₦80, 161.07 i.e. by just 14%!

Results of the sensitivity analysis on a 25% and 50% increase in paddy-grain conversion ratio indicate an increase in profit to ₦144, 867.15 and 193,022.24 respectively. Results of the sensitivity analyses presented in table 4.4 supports (Gotsch *et al.,* (2003) findings that changes in inputs costs have much smaller effects on profits than changes in the prices of outputs. It can also be concluded that technological changes that could lead to increase in paddy-grain conversion ratio would lead to higher profit.

A PCR value of 0.4065 estimated (PCR<1) indicates that rice production in the study area is competitive. That is, rice farming in Kaduna state is profitable under prevailing policy environment. The SRP of 0.5663 (SRP<1) calculated also implies the competitiveness of the system. Thus, the 'null hypothesis' is rejected and it can be concluded that rice production in the study area is competitive.

Table 4.4: Sensitivity Analysis on Private Profit

Parameter	**Profit at 25% increase (₦/ha)**	**Profit at 50% increase (₦ /ha)**
Fertilizer Costs	87,661.00	81,825.80
Pesticide Costs	92,295.00	91,091.14
Paddy-Grain Conversion Ratio	144,867.15	193,022.24
Rice Price	143,259.81	193,020.69
Seeds Costs (100% increase)		80,161.07

4.4: Comparative advantage of rice production in the study area

The comparative advantage of small-scale rice production in the study area in terms of economic efficiency is presented in the middle row of the Policy Analysis Matrix estimated for rice in the study area. The results are presented in Table 4.3. It revealed

that social profit for rice farmers in the study area was positive with a value of 19,793.79 suggesting that the cost of domestic production is lower than the economic efficient cost of production implying that the domestic rice sector has comparative advantage. This finding is in agreement with Liverpool *et al*, (2009), Ugochukwu and Ezedinma (2011) and Ogbe *et al.*, (2011) who found a positive social profit for rice farmers in Kano, Niger, Ekiti and five South-eastern States of Nigeria.

Sensitivity analyses were conducted to test the likely effects of increases on the international parity prices (IPP) of rice and paddy-grain conversion ratio on economic efficiency i.e. social profit. The results are presented in Table 4.5. Results of the sensitivity analyses indicates that a 25% and 50% increase in the IPP of rice will increase social profit to ₦52,336.63 and 84,879.48 respectively. On the other hand, a 25% and 50% increase in paddy-grain conversion factor from the present value of 0.62 is estimated to respectively increase social profit to ₦53,384.51 and ₦84,874.10.

Table 4.5: Sensitivity Analysis on Social Profit

Parameter	**Profit at 25% increase (₦/ha)**	**Profit at 50% increase (₦ /ha)**
International rice prices	52,336.63	84,879.48
Paddy-grain conversion factor	53,384.51	84,874.10

4.4.1 Test of Hypothesis II

A DRC ratio of 0.7699 (DRC<1) was estimated which indicates the presence of comparative advantage in rice production system in the study area. Thus, the 'null hypothesis' is rejected and it can be concluded that rice production in the study area has comparative advantage. Therefore, the series of agricultural policies in Nigeria aimed at

increasing production, self-sufficiency in rice production and farmers' income has been able to make domestic upland rice production internationally competitive.

4.5 Effects of prevailing policies on small-scale rice production in the study area

The effect of prevailing policies on small-scale rice production in the study area is shown in the third row of the Policy Analysis Matrix estimated for rice in the study area presented in Table 4.3. It revealed positive divergence in both revenue (68,884.92) and profits (73,705.14) indicating that farmers in the study area are receiving more than the social value of their crop. These findings is attributable to the prevailing 10% import duty and 100% import levy on rice which mandated rice importers to pay 70% tariff. The negative divergence in tradable inputs indicates that farmers are enjoying some subsidy for the use of these inputs. The negative divergence (-2,615.10) represents the average cost per hectare of the subsidy on the government. The negative divergence (-2,205.12) for domestic factors indicates that farmers in the study area are paying about ₦ 2,205.12 less than the social value of domestic factors such as labour. This implies that such domestic factors are cheaper in the domestic market than their international market equivalent.

An NPCO value of 1.5292 (NPCO>1) was estimated suggesting that the existing policies are increasing the domestic market prices to a level of about 53% above their corresponding international reference prices, also attributable to the prevailing rice import duty and levy. An NPCI ratio of 0.9407 (NPCI<1) was calculated, implying that domestic prices of tradable inputs are slightly lower than their equivalent international prices. This is expected as rice farmers essentially purchase these inputs from the open market.

4.6 Constraints militating against the performance of the key actors along the rice value chain in the study area

4.6.2 Constraints faced by rice farmers

The problems militating against rice farmers' ability to expand their production is presented in Fig 4.3. More than 83% of the respondents considered poor finance as the most important constraint. This suggests that most farmers in the study area had no access to formal credit which could lead to the problem of underinvestment. Generally, poor financing limits the farmers' ability to prepare bigger land; purchase improved inputs such as seed and fertilizer; pay for the services of machinery and equipment; timely harvesting of farm produce, storage and marketing activities and the avoidance of sale of their paddy immediately after the harvest at low prices. According to Phillip *et al.* (2009), several studies have established a positive relationship between farmers' access to agricultural finance and agricultural productivity. The implication of this finding is that with the rising cost of farm inputs, most farmers in the study area will find it difficult to engage meaningfully in rice production and will thus be forced to continue producing at low productivity with attendant low output volume and quality.

About sixty-five percent of the respondents considered low paddy prices in the market and high fertilizer cost as a major problem that militates against their ability to expand rice production. As observed by Kormowa *et al.* (2003) and Mudahar (1985), high cost of fertilizer, low producer price and lack of credit facilities are the major constraints to increased production by small-scale farmers. This finding has a very strong implication on farmer-incentive to continue in the business of rice production. According to Olukosi and Isitor (1990), usually, prices of cereal grains such as rice are depressed to the lowest level at harvest time and then rise as the season progresses, reaching a peak just before the next harvest. Baanante and Thompson (1988) and Thompson (1991) noted that

cereal crop prices determine the profitability of their production and the use of purchased inputs especially fertilizer to enhance production.

Poor quality rice seeds were another constraint militating against small scale rice production in the study area. This constraint resulted in the observed farmer practice of using recycled seeds in the study area. As observed by IFDC (2008), in most cases, farmers recycled seeds that were purchased only once in "every so many years". The use of poor quality rice seeds will result in poor yields which will in turn lead to poor competitiveness and comparative advantage for rice production in the study area. Prevalence of adulterated pesticides in the market, and the attack of pests and diseases of rice are other important problems. These rice production constraints are similar to those reported by Erenstein *et al.* (2003), USAID (2009) and IFDC (2008).

Results in Fig. 4.3 also indicated that farmers in the study area faced the problem of lack of threshers. They utilized traditional methods of threshing rice due to the non-availability of mechanical threshers. The traditional approach involves threshing the rice manually by beating with stick or against drums or pounding. This method is not only inefficient, but also lead to the lost of rice quality as (i) dirt, stones and other foreign materials got mixed with the rice, and (ii) rice grains got broken in the process.

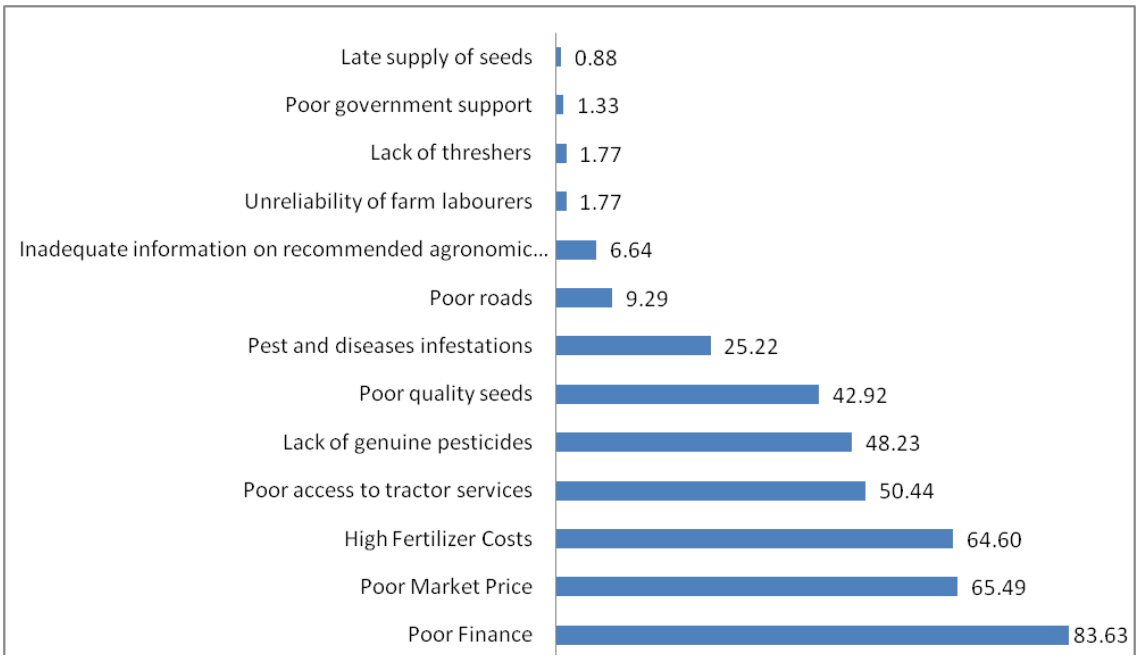


Fig 4.3: Rice farmers' Constraints (%)

(Multiple response; n=226)

4.6.2 Constraints of small-scale processors

Rice processing in the study area almost always includes parboiling and milling operations. Both operations are usually carried out by either the same person or enterprise, or by two different persons or enterprises. As observed by IFDC (2008), the most common practice is to first parboil the paddy. This is done by either the farmers or specialized parboilers, mostly women. After parboiling, millers will then process the parboiled paddy for the producers, traders, or consumers at a fee. This section discusses the constraints militating against rice processors in the study area.

The problems militating against small-scale parboilers' ability to expand their processing capacity is depicted in Fig. 4.4. More than 95% of the respondents are of the opinion that lack of modern rice parboiling equipment is the most important constraint faced. This lack of modern rice parboiling equipment could be as a result of non-availability or non-affordability of modern rice parboiling equipment in the study area.

About sixty-eight percent of the respondents considered the low amount of money paid by their client for their services as another major constraint. Lack of drying equipment, which can be conveniently subsumed as part of lack of modern parboiling equipment, is another important constraint. Poor access to credit facilities, poor patronage and to a lesser extent high costs of firewood were also considered as other important problems.

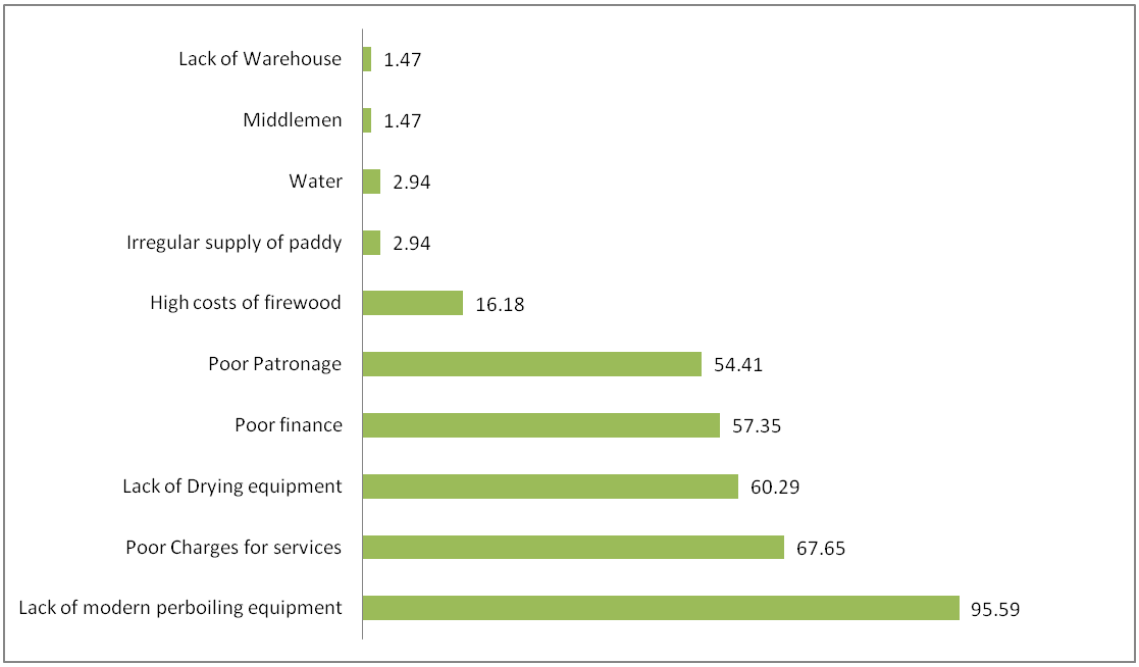


Fig 4.4: Constraints faced by parboilers (%)

(Multiple response; n=68)

The problems militating against small-scale rice millers' ability to expand their processing capacity is shown in Fig. 4.5. About 94% of the respondents were of the opinion that lack of modern rice milling machines is the most important constraint faced. More than 84% of the respondents considered poor patronage and lack of access to credit facilities as other major constraints. High costs of spareparts and repairs, Poor electricity supply, poor charges paid for their (millers') services and to a lesser extent high costs of diesel were also considered as other important problems. Erenstein *et al* (2003) reported rice processing problems to include limited access to processing facilities, rice quality problems, lack of capital and credit problems. According to

USAID (2009), Most of the rice parboiling and milling equipment used in Nigeria is imported from China, the UK, Korea and other countries and are not appropriately scaled or adapted to Nigeria's conditions. Very few milling equipment are produced locally.

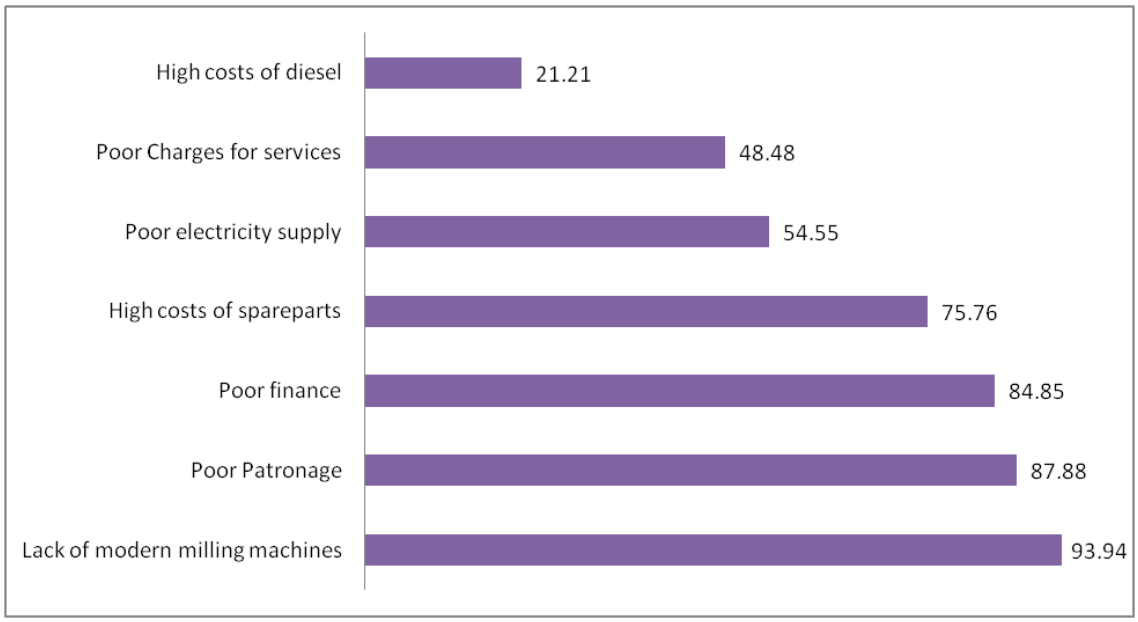


Fig 4.5: Millers' Constraints (%)

(Multiple response; n=33)

The aforementioned constraints militating against small-scale processors in the study area are discussed as follows:

Lack of processing equipment: The absence, or non-affordability, of modern processing equipment limits the processors' ability to expand capacity and improve the quality of their processed products. As observed by Phillip *et al.* (2009), rice processing in Nigeria is mainly done at the cottage level by individual small-scale processors. Thus, domestic paddy processing is predominantly small scale. According to CARD (2010), small rice processing mills have the key disadvantages of a high broken rice rate and poorer milled quality. Paddy processing in the study area as in most rural rice producing communities is essentially done manually. This leads to increased processing time and less efficiency

for paddy processors especially parboilers. There is the non availability of de-stoning machines and modern technology for the drying of parboiled paddy in the study area. Thus, paddy drying is usually done under the sun on bare ground or by the road side, which contributes to the presence of foreign bodies such as stones in the processed rice. The resultant effects of the lack of modern processing equipment is low quality processed rice characterized by sand and stone contamination, broken grains and lack of uniformity of grains. These negative characteristics lead to poor acceptance by the consumer.

Low amount of money paid for processing services: As mentioned earlier, processors in the study provide their services to farmers, marketers and consumers at a fee. However, the fees paid for processing services, milling and parboiling, are very low. As observed by USAID (2009), the value of the actual processing services is quite low, usually "less than one percent of the end value of the rice". Such small fees paid for processing services as observed in the study area could serve as disincentives to investment into the improvement of small-scale rice processing capacity.

Poor access to finance for investment in rice processing: Processors in the study area are finding it difficult to have access to sources of finance to enable them expand their capacity by limiting the capability of processors to buy, store and process paddy. This constraint of poor finance is common to agricultural investments in Nigeria. The World Bank (2008) reported that the cost of capital in Nigeria was about 30 percent in 2007 when all charges were taken into account. This implies a high cost of finance that is capable of depressing returns on investment. A poor return on investment will frustrate economic growth and competition.

Poor patronage of processing services in the study area be attributed to the poor quality of most locally produced and processed rice which is characterized as unpolished, having great color variation, containing a mixture of several varieties in a single bag, and having stones and sand.

High costs of firewood and diesel: rice processing in the study area is energy intensive. A lot of energy is required especially in paddy parboiling.

4.6.3 Constraints of paddy and milled rice marketers

Two categories of marketers are involved in the marketing of rice in the study area: unprocessed paddy marketers and the marketers of processed milled rice. This section discusses the constraints militating against each of the categories of marketers in the study area. The method of presentation is to begin by presenting the constraints of each of the 2 categories of marketers, after which the general discussion follows.

The problems militating against small-scale paddy marketers' ability to expand their capacity is presented in Fig. 4.6. More than 97% of the respondents considered poor finance as the most important constraint. About 68% of the respondents considered poor market price as another constraint followed by poor patronage from consumers and processors with 63%. Poor access roads, lack of storage facilities and poor quality of paddy are other important constraints.

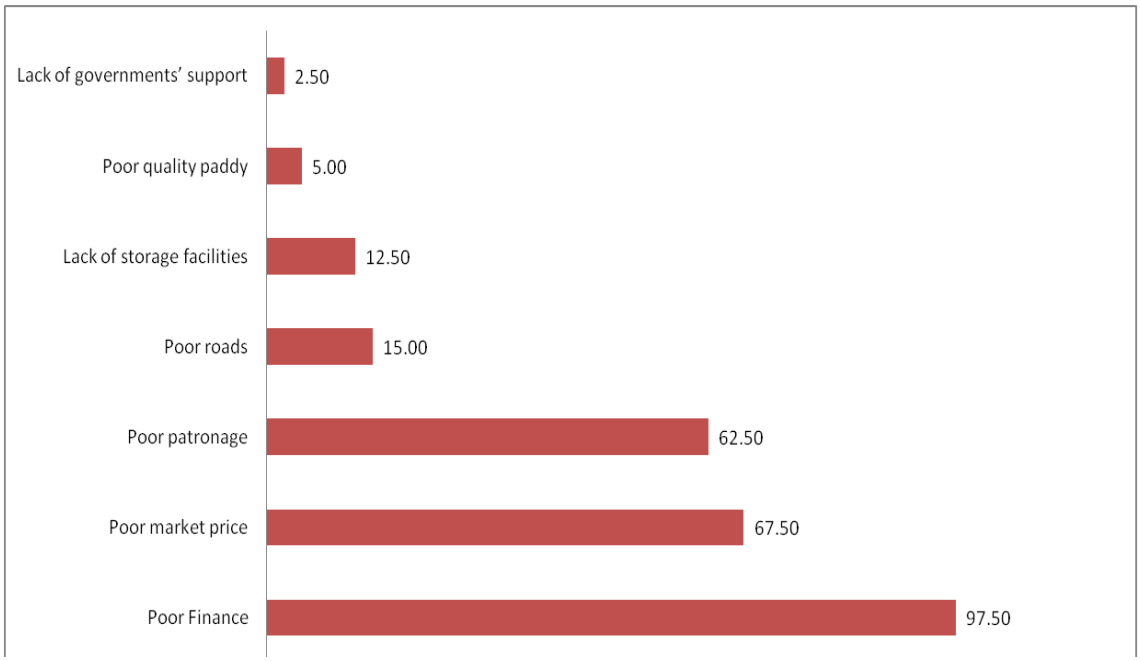


Fig 4.6: Constraints faced by Paddy Marketers (Multiple response; n=40)

The problems militating against small-scale milled rice marketers' ability to expand their capacity in the study area is shown in Fig. 4.7. A total of 94% of the respondents considered poor finance as the most important constraint. Seventy-five percent of the respondents considered poor patronage from consumers as another important problem while 63% viewed poor market price as constraint. Poor access roads, poor quality of processed domestic rice and lack of storage facilities are other problems. Erenstein *et al* (2003) reported major problems facing domestic rice marketing to include transport/accessibility problems, limited demand for local rice, low producer prices and an unfavorable market structure for producers.

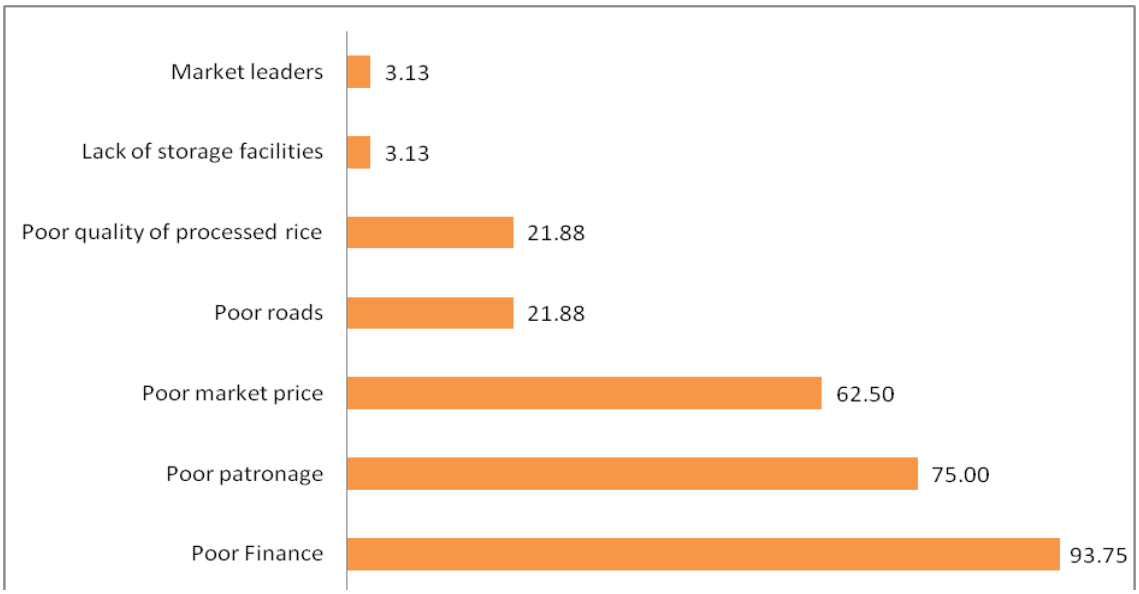


Fig 4.7: Constraints faced by Milled Rice Marketers (%)

(Multiple response; n=32)

Poor finance was the major constraint to rice marketers. The problem of poor finance is common to all key actors in the rice production and marketing chain interviewed in the study area. Poor finance limits marketers' ability to purchase and store paddy at a time when prices are favourable. It is observed that generally, paddy market experienced a scarcity of paddy supply during the period of rice cultivation which is the rainy season, and abundance of paddy supply in the harvesting period which is the dry season. During the rainy season, markets could not satisfy the total demand for paddy. This forces paddy prices to go up. However, in the dry season markets have abundant supply and prices tend to be very favorable. Thus, poor finance militates against the competitiveness of rice processors in the study area.

Poor market price: Poor market price for parboiled and milled rice simply means a loss of income and profits to the marketers who usually bear the cost and risk of storage of the paddy from procurement at the farm-gate through parboiling and/or milling until they are presented for sale to processors and consumers at the market. A loss of profit

will discourage marketers from further investing in their businesses which stifle the growth and development of rice production and processing in the study area.

Poor patronage from consumers and processors: The poor patronage for rice produced and processed in the study area could be attributed to the very low quality of both the produced paddy and processed rice. Some farmers in the study area produced poor quality paddy resulting from their use of recycled and non-improved seeds. Different farmers used different types and quality of seeds. The processors non-homogenous rice by assembling rice stocks from different producers and mixing different varieties in batch processing in addition to the presence of pebbles, stones, sand and other contaminants in the finished product combined to make the locally produced paddy and processed rice non attractive to processors and consumers respectively.

Poor access roads: Poor transportation infrastructure leads to high transportation costs which hamper the development of efficient system of transport for agricultural production, marketing and processing. High transport costs can alter incentives for agricultural investment and impede growth, development and competitiveness. World Bank (2008) observed that the most binding constraint to greater and more widespread private investment in Nigerian agriculture is deficient infrastructure especially transportation.

Inadequate storage facilities: Rice storage by farmers in the study area is very minimal as most rice storage functions are performed by marketers who trade in paddy and processed rice. Farmer's in the study area stored their paddy in bags within a room in their place of dwelling. This is the same with most marketers. Such method of rice storage is implicated in leading to the degradation of rice quality arising from the activities of rodents and poor storage temperature control.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

The broad objective of the study is to evaluate the impact of federal government agricultural policies on profitability and comparative advantage of rice production in Kaduna state. Specifically, the objectives are to: (i) Describe the socio-economic characteristics of small-scale rice farmers in the study area, (ii) Ascertain the socioeconomic determinants of rice yield in the study area, (iii) Assess the competitiveness of small-scale rice production in the study area, (iv) Evaluate the comparative advantage of small-scale rice production in the study area, (v) Investigate the effects of policy on domestic rice production in the study area, (vi) Determine the major constraints militating against the performance of the key actors along the rice value chain in the study area. The study was conducted in Kaduna State and employed a multistage random technique to draw a sample of 241 rice farmers, 74 parboilers, 33 millers, 44 paddy marketers and 34 milled rice marketers in the study area. Primary and secondary data were collected and analyzed using descriptive statistics, binary logit regression and the policy analysis matrix (PAM) to achieve the study's objectives as well as test the formulated hypotheses

Highlights of the major findings of the study include:

(i) The probability that a rice farmer's yield in the study area will be up to 2.06MT/Ha was significantly influenced by the following six socio-economic variables: farmers' age, level of education, farm-size, access to credit, dependants under 18 years and dependants above 18 years of age.

(ii) Rice production and processing in the study area made a positive private profit of N93,498.93 per hectare under prevailing technologies, costs of

inputs, prevailing output prices, and existing policy environment during the study period.

(iii) Social profit, a measure of economic efficiency, for rice production and processing in the study area is positive with a value of 19,793.79 suggesting that the domestic small-scale rice sub-sector has comparative advantage.

(iv) A positive divergence in both revenue (68,884.92) and profits (73,705.14) indicates that the cumulative effect of policy on domestic rice production is that producers and processors in the study area are receiving more than the calculated social value for their economic activities. An NPCO value of 1.5293 was estimated suggesting that the existing policies are increasing the domestic market prices to a level of about 53% above their corresponding international reference prices.

(v) The negative divergence in tradable inputs (-2,205.12) indicates that farmers and processors are enjoying some subsidy for the use of these inputs. An NPCI ratio of 0.9407 was calculated, implying that domestic prices of tradable inputs are slightly lower than their international prices. This is attributable to the prevailing 110% rice import levy and tariff.

(vi) The major constraints militating against the performance of the principal actors in the rice value chain in the study area were: (a) farmers: non-availability of credit facilities (83%) and the combination of low paddy prices in the market and high fertilizer cost (65%); (b) parboilers-processors: lack of modern rice parboiling equipment (95%) and low amount of money paid by their client for their services (68%); (c) millers-processors: lack of modern rice milling machines (94%), poor patronage and lack of access to credit facilities (84%) and high costs of spare-parts and repairs; (d) paddy

marketers: non-availability of credit facilities (97%), poor market price (68%), poor patronage from consumers and processors (63%). Poor access roads, lack of storage facilities and poor quality of paddy; and (e) milled rice marketers: non-availability of credit facilities (94%), poor patronage from consumers (75%) and poor market price (63%) followed by poor access roads, poor quality of processed domestic rice and lack of storage facilities.

5.2 Conclusion

Based on the findings of this study it was concluded that small-scale rice production in the study area is competitive in terms of profitability at the national level and had comparative advantage in terms of profitability calculated using international prices of output and factors of production. However, this presence of competitiveness and comparative advantage in small-scale rice production and processing could be attributed to the 110% tariff (duty: 10%; levy: 100%) placed on rice importation in Nigeria effective 1st July 2012 through the period of the study which widened the gap between the international parity price of rice in Kaduna (N101.75/kg) and the actual landing price of imported rice in Kaduna (N240.75/kg).

5.3 Recommendations

In view of the findings of this study, the following recommendations are advanced to enhance the competitiveness and comparative advantage of rice production and processing in the study area. It should be noted that since this is a policy related study, recommendations are made on what government should do to improve the system.

(i) Strengthen the existing rice price support mechanisms, especially the guaranteed minimum pricing strategy in such a way that farmers and processors can obtain

fairly good prices for their products. This will address the problem of poor prices reported by all categories of actors along the rice-production-processing-marketing chain surveyed in this study.

(ii) Enhance the availability of subsidized credit facilities. This will increase farmers, processors and marketers access to resources by removing or minimizing financial constraints, a common constraint reported by all categories of respondents in this study. To this end the activation or full implementation of the Nigeria Incentive based Risk Sharing System for Agricultural Lending (NIRSAL) programme as proposed in the ongoing agricultural transformation agenda of the federal government is appropriate. NIRSAL is designed to not only realign the agricultural value chains, of which rice is one, in such a way that Banks can confidently lend into them but also to encourage "Banks to lend into the agricultural value chains by offering them strong incentives and technical assistance".

(iii) Strengthen the existing agricultural extension delivery organizations and encourage the emergence and growth of private agricultural extension delivery outfits to enhance the adoption of improved technologies and agronomic practices which will lead to significant increases in yield. As demonstrated via sensitivity analysis in this study, an increase in yield will lead to significant increase competitiveness and comparative advantage of small-scale rice production in the study area.

(iv) Develop formal institutional arrangements that will guide and enforce the maintenance of quality standards such as weights, grades and measures across the rice value chain from input suppliers, especially ensuring the supply of quality rice seeds and genuine agrochemicals through processing to marketing;

as well as the grading and standardization of domestically produced rice. This would not only enhance the competitiveness of the domestic rice vis-à-vis imported rice through increasing the attractiveness of domestic rice by addressing the problems of poor patronage and prices recorded in the study area, but also help in strategically enhancing Nigeria's share of the international rice market.

(v) The study has demonstrated, through sensitivity analysis, the potential effects of improving paddy-grain-conversion ratio on the primary output, as well as the competitiveness and comparative advantage, of the domestic rice industry. Thus the need for the government to encourage the relevant Research Institutes, Universities and Polytechnics to develop rice production and processing technologies that would increase the paddy-grain-conversion ratio from the present level of 0.62 calculated for the study area.

5.4 Contributions to knowledge:

(i) The study revealed that small-scale rice production and processing in the study area is competitive. A positive private profit of N93,498.93 per hectare under prevailing technologies, costs of inputs, prevailing output prices, and existing policy environment was calculated for rice production and processing during the study period.

(ii) Small-scale rice production and processing in the study area has comparative advantage. A social profit of N19,793.79 per hectare was estimated for rice production and processing in the study area

(iii) The cumulative effects of policy on rice production and processing in the study area lead to increase revenue and income for small-scale farmers and

processors. A positive divergence (PAM row three) in both revenue (68,884.92) and profits (73,705.14) as well as an NPCO value of 1.5293 indicates that existing policies increased the domestic market prices to a level of about 53% above their corresponding international reference prices; and that producers and processors in the study area are receiving more than the calculated social value for their economic activities. The negative divergence in tradable inputs (-2,205.12) and the calculated NPCI ratio of 0.9407 suggests that farmers and processors are enjoying some subsidy for the use of tradable inputs.

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Appendix 1: Private Prices Budget

P-Budget	Item	Quantity	Unit of Price (N)	Amount (N)
Tradables	Fertilizers	237.50	98.30	23,346.25
	Pesticides	5.23	920.75	4,815.52
	Seeds	80.64	165.40	13,337.86
Factors	Land Preparation (Mandays equivalent)	17.65	850.00	15,002.50
	Crop care (Mandays equivalent)	11.53	850.00	9,800.50
	Harvesting (Mandays equivalent)	2.48	850.00	2,108.00
	Threshing & winnowing (Mandays equivalent)	3.23	850.00	2,745.50
	Wood			5,713.66
	Water			1,910.65
	Milling			9,141.85
	Drying			1,645.53
	Destoning			3,047.89
	Polishing			1,523.03
	Size & Grading			4,570.93
	Packaging			2,559.72
	Working capital			4,275.20
	Land	1.00	10000	10,000.00
Output	Total Revenue (N/Ha)	1279.20	155.6	199,043.52
	Total Cost N/Ha			115,544.59
	Profit N/Ha			83,498.93

Appendix 2: Social Prices Budget

S-Budget	Item	Quantity	Unit of Price	Amount (N)
Tradables	Fertilizers	237.50	108.32	25,726.00
	Pesticides	5.23	965.75	5,050.87
	Seeds	80.64	165.40	13,337.86
Factors	Land Preparation	17.65	850.00	15,002.50
	Crop care	11.53	850.00	9,800.50
	Harvesting	2.48	850.00	2,108.00
	Threshing & winnowing	3.23	850.00	2,745.50
	Wood			5,713.66
	Water			1,910.65
	Milling			9,141.85
	Drying			1,645.53
	Destoning			3,047.89
	Polishing			1,523.03
	Size & Grading			4,570.93
	Packaging			2,559.72
	Working capital			6,480.32
	Land	1.00	0	0.00
Output	Total Revenue (N/Ha)	1279.20	101.75	130,158.60
	Total Cost N/Ha			110,364.81
	Profit N/Ha			19,793.79

Note: "that the Land price is 0. In the absence of clearly specified cropping alternatives, imputing social opportunity costs to fixed factors within a single commodity budgeting framework is arbitrary. Consequently, the land price, and thus cost, equals 0 and all returns to land are included in the Profits residual, i.e., Profits and Net Profits are the same. Social profits thus measure the returns to land and management when all commodities are priced at their efficiency prices". (Gotsch, 2003).

Appendix 3: International Parity Price of Rice[†] (N/MT) and Estimated Price of Rice (N/MT) Landed in Kaduna

Table A1: International Parity Rice (N/MT) for Kaduna

Parameter	**US$**[††]	**N**
CIF Lagos, Nigeria[†]	585.00	93600.00
Clearing	3.00	480.00
Transportation (LG-KD)		7666.67
IPP per MT		101746.67
IPP per kg		101.75

Table A2: Estimated Price of Rice Landed in Kaduna

Parameter	**US$**[††]	**NGN**
Cif Lagos, Nigeria[*]	690	110400
Levy (100%)**	690	110400
Duty (10%)**	69	11040
Clearing charges	3	480
Transportation (LAG-KD)		7666.67
Other Costs***		766.67
Total		240753.3
Price per kg		240.7533

[†]**Note:** Parboiled rice with the following qualities: Moisture: 14%, Broken: 5% max, Size: 6mm and above. Cif US$ 585/MT Apapa Port Lagos. Source: Riceauthority.com

[† †]**Note**: Exchange rate N/US$ = 160.00

***Note**: "Periodically, the GON reviews the benchmark price for all types of imported rice and from all origins. The current benchmark price is $690 per ton. Import duty is calculated based on the benchmark price, regardless of the actual FOB price"(USDA,2013).

**Note: The 110% tariff on rice import (duty: 10%; levy:100%) was reduced to 70% (duty: 10%; levy:60%) this year, 2015. This development was after the field survey. For details see the Business section of the Daily Independent of June 8th 2015, accessed online at http://www.dailyindependentnig.com

***Note**: Estimated at 10% of transport costs. This includes bribery to police and other miscellaneous expenses incurred during transportation.

Appendix 4: Rice Farmers' Questionnaire

Questionnaire N0_____ **Date _____**

Department of Agricultural Economics & Rural Sociology

Ahmadu Bello University, Zaria

Rice Farmers' Questionnaire

Instructions: This questionnaire is one of several designed for a PhD study aimed at evaluating the impact of government policies on rice production in Kaduna State. Kindly record answers to the questions below by filling in the blank spaces or ticking where appropriate.

1. Name of farmer_____ 2. Tel No _____
3. Age_____
4. Sex_____
5. LGA_____
6. District_____
7. Village_____
8. Number of Rice farmers in your community _____
9. Marital Status: Married [ ] Single [ ]
10. Number of wife or wives_____
11. Number of children/dependents in your household under 18 years of age: _____
12. Number of children/dependents in your household above 18 years of age: _____
13. What is the highest level of formal education attained by household head?
    a. Primary school [ ]
    b. Secondary school [ ]
    c. Higher/Tertiary [ ]
    d. None [ ]
14. What is your main occupation? _____
15. If not farming, what other things do you do?

    (i) Trading [ ] (ii) Fishing [ ] (iii) Tailoring [ ]

(iv) Blacksmithing [ ] (v) Others (please specify)……..

16. How long have you been growing rice? _____
17. What is your total land holding? _____Ha
18. How much land is devoted to rice cultivation in the last growing season _____Ha
19. How did you acquire the rice farm land?
    (i) Through inheritance [ ] (ii) Outright purchase [ ]
    (iii) Borrowed (if no payment) [ ] (iv) Rent/ lease/ hire [ ]
    (v) Gift [ ]
20. Are you a member of any rice farmers association? Yes [ ] No [ ].
21. If yes, give name of association _____
22. For how many years have you been a member? _____
23. How much bags of fertilizer did you use on your rice farm last year? Urea _____ NPK_____
24. How much did a bag of fertilizer cost in Naira? Urea _____ NPK _____ Other _____
25. How many litres or kilograms of herbicides did you use on your rice farm last year? _____
26. How much did a litre or kilogram of the herbicide cost in Naira? _____
27. How many litres or kilograms of pesticides did you use on your rice farm last year? _____
28. How much did a litre or kilogram of the pesticide cost in Naira? _____
29. How many kilograms of seeds did you used on your rice farm last year? _____
30. How much did a kilogram of rice seeds cost in Naira? _____

31. Kindly indicate the amount of labour (in man-days) you used in carrying out each of the following farm operations last year

S/No	Farm Operation	Labour use by type		Total Mandays
		Family Labour (mandays)	Hired Labour (mandays)	
a	Land preparation			
b	Planting			
c	Weeding			
d	Harvesting			
e	Threshing			
f	Drying and Bagging			
g	Transportation			
	Total			

32. How much did you pay for a manday of labour in naira? _____
33. Did you provide non-monetary incentives such as meals and drinks to your labourers? Yes [ ] No [ ]
34. Apart from human labour, did you also hire tractor services for preparing your land? Yes [ ] No [ ]
35. If yes, how much did you pay for the land preparation? _____
36. What is your total paddy harvest last year? _____ (paddy bags)
37. How much did you sell a bag of paddy last year? _____
38. Did you normally take your paddy for processing? Yes [ ] No [ ]
39. If yes, how much does it cost to parboil a bag of paddy? _____
40. How much does it cost to mill a parboiled bag of paddy? _____
41. How many bags of paddy rice do you require to produce 1 bag of milled rice? _____
42. How much did you sell a bag of parboiled milled rice last year? _____
43. What are the major constraints you faced in rice production?

Appendix 5: Parboilers' Questionnaire

Questionnaire N0_____ **Date _____**

Department of Agricultural Economics & Rural Sociology

Ahmadu Bello University, Zaria

Parboilers' Questionnaire

Instructions: This questionnaire is one of several designed for a PhD study aimed at evaluating the impact of government policies on rice production in Kaduna State. Kindly record answers to the questions below by filling in the blank spaces or ticking where appropriate.

1. Name of Parboiler_____ Tel No_____
2. Age_____
3. Sex_____
4. LGA_____
5. District_____
6. Village_____
7. No of rice parboilers in your community _____
8. What parboiling method do you use?
   a. Traditional (boiled water) [ ]
   b. Modern (steamed parboiling) [ ]
   c. Others [ ]
9. What type of building or structure do you use in parboiling?
   a. Temporary/makeshift [ ]
   b. Permanent [ ]
10. Where did you source the paddy you parboil from?
    a. Own farm [ ]
    b. Market [ ]
    c. Farmer-clients [ ]
    d. Other clients [ ]
11. How many bags of paddy can you effectively parboil in a day? _____
12. How much did you charge to parboil an average bag of paddy? _____

13. How many bags of paddy did you parboil in a day? _____
14. Is there shrinkage in paddy quantity after perboiling? Yes[ ] No [ ]
15. If yes, how many bags of paddy rice do you require to produce 1 bag of parboiled non milled rice? _____
16. How many boiling drums did you use in parboiling? _____
17. How much does a drum cost? _____
18. How many years did you use a drum before it becomes un-usable? _____
19. Where did you source the water you use in parboiling? _____
20. If you buy water, how much did a unit (e.g. a 25 ltr Jerrycan) costs? _____
21. How much water did you use in parboiling in a day? _____
22. How much firewood (bundles) did you use in parboiling in a day? _____
23. How much did a bundle of firewood costs? _____
24. Did you hire the services of labourers? Yes[ ] No [ ]
25. If yes, how much did you pay labourers in a day? _____
26. What are the major constraints you faced in the parboiling of paddy?

_____

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Appendix 6: Millers' Questionnaire

Questionnaire N0_____ **Date _____**

Department of Agricultural Economics & Rural Sociology

Ahmadu Bello University, Zaria

Millers' Questionnaire

Instructions: This questionnaire is one of several designed for a PhD study aimed at evaluating the impact of government policies on rice production in Kaduna State. Kindly record answers to the questions below by filling in the blank spaces or ticking where appropriate.

1. Name of Miller_____ Tel No_____
2. Age_____
3. Sex_____
4. LGA_____
5. District_____
6. Village_____
7. No of rice millers in your community _____
8. No of milled rice marketers in your market _____
9. What type of building or structure did you use in milling?
   a. Temporary [ ]
   b. Permanent [ ]
10. Where did you source the paddy you milled from?
    a. Own farm [ ]
    b. Market [ ]
    c. Farmer-clients [ ]
    d. Other clients [ ]
11. How many bags of paddy can you effectively milled in a day? _____
12. How much did you charge to mill an average bag of parboiled paddy? _____
13. How many bags of parboiled paddy did you mill in a day? _____
14. Is there shrinkage in the quantity of parboiled paddy after milling? Yes[ ] No [ ]

15. If yes, how many bags of parboiled paddy did you require to produce 1 bag of milled rice? _____
16. How many bags of bran did you normally get in a day? _____
17. How much do you sell a bag of bran?
18. Did you store paddy in the mill house / warehouse before milling? Yes[ ] No [ ]
19. Did you store milled rice in the mill house/warehouse before sale? Yes[ ] No [ ]
20. What type of rice milling machine are you using?
    a. Imported [ ]
    b. Locally fabricated [ ]
21. If imported, what is the model/type? _____
22. If locally fabricated, where did you purchase it from? _____
23. How much does the complete milling machine cost? _____
24. How many years do you expect to use it before it becomes un-usable?
    _____
25. What is the source of power for the machine?

a. Fuel [ ]
b. Electricity [ ]

26. Did you hire the services of labourers? Yes[ ] No [ ]
27. If yes, how many labourers do you hire on a normal day? _____
28. How much do you pay labourers in a day? _____
29. What are the major constraints you faced in the milling of rice?

    _____

    _____

    _____

    _____

Appendix 7: Paddy Marketers' Questionnaire

Questionnaire N0_____ **Date _____**

Department of Agricultural Economics & Rural Sociology

Ahmadu Bello University, Zaria

Paddy Marketers' Questionnaire

Instructions: This questionnaire is one of several designed for a PhD study aimed at evaluating the impact of government policies on rice production in Kaduna State. Kindly record answers to the questions below by filling in the blank spaces or ticking where appropriate.

1. Name of marketer_____ Tel No _____
2. Age_____
3. Sex_____
4. LGA_____
5. District_____
6. Village_____
7. No of paddy marketers in your market _____
8. Did you own or rent the place in which you sell? Yes[ ] No [ ]
9. If rent, how much do you pay per month? _____
10. What is the average number of traders in the market that sell paddy during a normal market day? _____
11. Is paddy the principal item that you sell? Yes[ ] No [ ]
12. Where do you source your paddy from?
    a. Farm gate [ ]
    b. Rural Assemblers [ ]
    c. Wholesalers [ ]
    d. Middlemen [ ]
13. How far is it from your place of business (average distance)? _____
14. How much did you buy a bag of paddy? _____
15. How much did you sell a bag of paddy? _____

16. How much did it cost, on the average, to transport a bag of paddy from the point of purchase to your place of business? _____
17. If you have your own means of transportation, how much would you charge to transport a bag of paddy from the point of purchase to your place of business? _____
18. How much did you pay labourers to load a bag of paddy at the place of purchase? _____
19. How much did you pay labourers to unload a bag of paddy at your place of business? _____
20. Did you store paddy before selling? Yes[ ] No [ ]
21. If yes, for how many months? _____
22. Where did you store your paddy? _____
23. How many paddy bags can be conveniently kept in the store? _____
24. If the store is rented (or is to be rented) how much will it cost per annum? _____
25. How much does an empty sack used in the packaging of paddy cost? _____
26. Did you normally take your paddy for processing? Yes [ ] No [ ]
27. If yes, how much did it cost to parboil a bag of paddy? _____
28. How much did it cost to mill a parboiled bag of paddy? _____
29. How many bags of paddy rice do you require to produce 1 bag of milled rice? _____
30. How much did you sell a bag of milled rice last year? _____
31. What are the major constraints you faced in paddy marketing?

Appendix 8: Milled Rice Marketers' Questionnaire

Questionnaire N0_____ **Date _____**

Department of Agricultural Economics & Rural Sociology

Ahmadu Bello University, Zaria

Milled Rice Marketers' Questionnaire

Instructions: This questionnaire is one of several designed for a PhD study aimed at evaluating the impact of government policies on rice production in Kaduna State. Kindly record answers to the questions below by filling in the blank spaces or ticking where appropriate.

1. Name of marketer_____ Tel No_____
2. Age_____
3. Sex_____
4. LGA_____
5. District_____
6. Village_____
7. No of milled rice marketers in your market _____
8. Did you own or rent the place in which you sell? Yes[ ] No [ ]
9. If rent, how much did you pay per month? _____
10. What is the average number of traders in the market that sell rice during a normal market day? _____
11. Is rice the principal food crop that you sell? Yes[ ] No [ ]
12. Where did you source your milled rice from?
    (a) Farm gate [ ]
    (b) Rural Assemblers [ ]
    (c) Wholesalers [ ]
    (d) Middlemen [ ]
13. How far is it from your place of business (average distance)? _____ km
14. How much did you buy a bag of milled rice? _____
15. How much did you sell a bag of milled rice? _____

16. How much did it cost, on the average, to transport a bag of milled rice from the point of purchase to your place of business? _____
17. If you have your own means of transportation, how much would you charge to transport a bag of milled rice from the point of purchase to your place of business? _____
18. How much did you pay labourers to load a bag of milled rice at the place of purchase? _____
19. How much did you pay labourers to unload a bag of milled rice at your place of business? _____
20. Did you store parboiled milled rice before selling? Yes[ ] No [ ]
21. If yes, for how many months? _____
22. Where did you store your milled rice? _____
23. How many bags of milled rice can be conveniently kept in the store? _____
24. If the store is rented (or is to be rented) how much will it cost per annum? _____
25. How much did an empty sack used in the packaging of milled cost? _____
26. Do you normally take your paddy for processing? Yes [ ] No [ ]
27. If yes, how much did it cost to parboil a bag of paddy? _____
28. How much does it cost to mill a parboiled bag of paddy? _____
29. How many bags of paddy rice do you require to produce 1 bag of milled rice? _____
30. How much did you sell a bag of milled rice last year? _____
31. What are the major constraints you faced in the marketing of milled rice? _____