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THE NATURE OF AGRICULTURAL INPUT SYSTEM TO FARMERS IN CENTRAL RIVER REGION OF THE GAMBIA

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ABSTRACT

This study on the nature of agricultural inputs was conducted in the Central River Region of the Gambia. The study examines the socio-economic background, nature of the input system to farmers and suggests strategies to improve farmers' access to inputs. Semi-structured questionnaires were administered through a cross-sectional survey of 384 randomly sampled farmers cultivating rice in the tidal ecologies during the 2016 cropping season. Pearson correlation was used to check the relationship between each of the input accessed and certain socio-economic characteristics with rice yield. The results obtained show that farmers obtained inputs from multiple sources such as those distributed to support rice growers by government, project or NGOs, seeds obtained from friends or relatives, seeds purchased in the local markets and those saved by farmers from their harvest. It also shows the supply of other inputs is very limited apart from the NERICA seeds variety meant for the upland rice production ecologies. It also shows that the distribution of agricultural inputs is inefficient for the fact that those poor and rural farmers do not easily receive adequate amounts and at the right time when needed. These indicate that inputs have major impact on rice yield and therefore, it is recommended that farmers' access to agricultural inputs should be improved in order to increase rice yields. This can be done by developing the input sector, provision of input subsidy and giving affordable credit to farmers.

INTRODUCTION

1 Backgroundof the Study

Rice scientifically referred to as *Oryza sativa* is a cereal crop consumed worldwide by most people around the globe than any other crop. In other words, it is the primary staple for more than half the world's population. The Food and Agricultural Organization of the United Nations (FAO) (2016) maintains that about 90% of the rice produced in any given year is consumed as food. Saka and Lawal (2009) described rice as the most important food depended upon by over 50 % of the World population for about 80 percent of their food need. Rice farming is the largest single use of land for food

production, (Global Rice Science Partnership), (GRiSP, 2013). The major producers and consumers of rice are in the Asia-Pacific region. It accounts for more than 40% of the calorie consumption of most Asians. The largest producers are China and India with more than 90% of world production. Other producers in Asia include Bangladesh, Thailand, Vietnam and the Philippines (GRiSP, 2013). According to the Rice Market Monitor, FAO (2016) trade volume for rice was 44.7 million metric tonnes while the annual production value was estimated at $150 billion.

In Africa, rice is a staple food in many countries. During the past years rice has witnessed a consistent increase in demand and its growing importance is evident in the strategic food security policies of many countries on the continent. The demand in most African countries generally exceeds production and large quantities of rice are imported to fill this gap. This contributes to the high import cost of recipient nations worth millions of Dollars. According to GRiSP (2013), the production of rice in East and Southern Africa increased by 57% from 1.19 million tonnes in 2000 to more than 1.87 million tonnes in 2010. During this period, the average yield increased by 17.5% from 1.52 t/ha to 1.78 t/ha and the area of production increased by 37% from 782,000 ha to 1.047 million ha. In Burundi, Kenya, Mozambique, Rwanda, Tanzania, and Uganda, total rice consumption in 2010 reached more than 3 million tones or 19 kg/person/year. Rice imports amounted to 1.2 million per year in paddy equivalent, or more than 40% of all rice consumed in the region.

In West Africa however, rice is said to be much more in deficit even though it is equally a very important staple. According to United State Department of Agriculture, (USDA) (2012), in three decades the crop has emerged as the most consumed cereal in the region (15.7 million tonnes), before millet (15.5 million tonnes), corn (15.2 million tonnes) and sorghum (11.1 million tonnes). Countries such as Senegal, Ghana, Benin and Côte d'Ivoire have a self-sufficiency rate lower than 40%. However, the self-sufficiency rate in Mali, Guinea, Nigeria, and Sierra Leone is higher than 60%. This supply deficit is covered by imports from the international market. The estimated import by the region is at around 7 and 8 million tonnes in 2011 and 2012, respectively. This represents about 20% of the world rice trade and nearly cost $3.5 to $4.0 billion. Nigeria, Senegal, Côte d'Ivoire, and Benin account for more than 50%t of the region's rice import International Food Policy Research Institute (IFPRI) (2014).

The establishment of the Africa Rice Centre (Africa Rice), formerly West Africa Rice Development Agency, (WARDA) in 1971 demonstrates the importance African countries attach to rice. This center is the leading pan-African rice research organization committed to improving livelihoods in Africa through strong science and effective partnerships with twenty-six member countries covering West, Central, East and North African regions. The New Rice for Africa commonly known as (NERICA) was specifically developed by the scientists of Africa Rice to address the problem of low productivity of upland rice in Sub-Saharan Africa. This created a big opportunity for Africa's rice farmers (Appa, Awoyemi, & Babayemi, 2016).

In the Gambia to rice is the number one staple crop. However, like many African countries, the domestic rice supply continues to be outpaced by growing population demand. MOA (2013) data from National Agricultural Sample Survey shows that the national consumption requirement for milled rice was estimated at 219, 960 metric tonnes while the current total national production was 41, 822 metric tonnes, representing 19% of domestic production. This exposes a significant gap of 178 138 metric tonnes. That is 81% deficit which has to be imported from other countries usually from Asia to make up for the gap.

Notwithstanding, the government of The Gambia has not been resting on its laurels. The country in

collaboration with Africa Rice first introduced the NERICA in the Gambia in 1998. Since then, giant strides have been made by the National Agricultural Research Institute (NARI) under the Ministry of Agriculture and non-governmental organizations in successfully spreading this upland variety across the entire country. At present, the NERICA varieties have spread across all agricultural regions of the country with fertilizer and irrigation schemes to support to farmers (Dibba, Fialor, Diagne, & Nimoh, 2012.)

Rice production in the Gambia is not without challenges. Although significant gains for the upland production has been made due to the introduction of the NEWRICA variety, efforts to provide improved varieties for the lowland has not been forthcoming. The rice sector continues to be affected by drought, poor soil fertility, environmental degradation, high production costs, low net returns as well as inadequate access to inputs by farmers such as improved seeds, fertilizer, pesticides and herbicides, labour and agricultural credit. This study was therefore undertaken to assess the impact of access to agricultural inputs by rice farmers.

Statement of the Research Problem

Each cropping season, rice farmers are faced with the daunting task of getting inputs at the right time and in the right quantities for rice production. Inadequate access to inputs such as improved seeds chemical fertilizer, pesticides and herbicides, credit and labour pose serious challenges to rice farmers in the Gambia.

Despite the fact that several researchers have broadly addressed the factors influencing rice productivity ranging from ecology, type of variety, agronomic practices and input use, they have not adequately looked into the supply and demand of the agricultural inputs. For example, Ceesay (2014) investigated the management of rice production systems to increase productivity in the Gambia and Dibba *et al.* (2012) looked into diffusion and adoption of new rice varieties for Africa (NERICA.)Therefore, to the best of my knowledge, there has been no previous research on the nature of the agricultural input system, the factors affecting farmers' access to inputs and how these impacts the yield of rice farmers. This study attempts to fill this gap. The objective of this study was therefore to examines the socio-economic background, nature of the input system to farmers and suggest strategies to improve farmers' access to inputs.

Significance of the Study

This work is important because it investigated the access to inputs and how this influences rice yield of farmers in The Gambia. The knowledge and understanding of the key factors which affect the yield of rice farmers, the main staple of the country is of great importance for designing agricultural policies, strategies and programs and their ultimate implementation on the food security agenda of the Gambia. If reliable empirical evidence on factors affecting input access and impact on yield unearthed, the study can provide a useful platform to evaluate the effectiveness of existing food security policies, programs and strategies. Findings from the study will put rice farmers in the spotlight as key actors and highlight assistance they need to increase their production and productivity in the quest to enhance national food security for the population.

Scope of the Study

The study was conducted in the Central River Region, the main rice-growing zone in the Gambia. The research used survey data from semi-structured questionnaires administered to respondents based on 2016 cropping season. It was centered on farmers growing rice in the tidal ecologies of the study area. The research looked into the impact of access to inputs such as seeds, chemical fertilizer, pesticides and herbicides, labour, credit and extension services.

2. AGRICULTURAL INPUTS

Broadly speaking, agricultural inputs are varied and depend on the type of output being produced. For example, inputs used for livestock production are different from those used in crop production. The United States Department of Agriculture (USDA) (2010) referred to agricultural inputs as all substances and materials used in the handling of organic agricultural products. House (2006) used the term inputs to refer to the resources that are used in farm products such as chemicals, equipment, feed and energy. This definition is more relevant in animal husbandry. In crop production however, the term input would generally point to seeds, fertilizer, pesticides, herbicides, machinery etc.

In the views of Baltzer and Hansen (2011) agricultural input is a common term for a range of materials that may be used to enhance agricultural productivity. This range of materials was put into two categories by Urgessa (2015) in his analysis of determinants of productivity in Ethiopia. This author classified inputs into technological inputs which include seeds, machinery, farm tools, and agro-chemicals (herbicides, pesticides, fungicides and fertilizer) and physical inputs such as labour, education, land, capital and other non-technological resources. The agricultural input system is meant to imply the chain of networks for the supply, demand, and distribution among dealers in seeds, fertilizer, labour, agrochemicals and agricultural credit.

3. THE NATURE OF AGRICULTURAL INPUT SYSTEM

Developed nations such as Europe, America, Japan and China have well developed, organized and formal inputs system that guarantees the availability, affordability and accessibility of high-quality inputs to farmers. The agro-dealers network is efficiently distributed and quality control of seeds, fertilizer and agrochemicals are effective. This is aided by good agricultural policies. Input suppliers are widespread and well supported. Farmers have access to inputs at affordable prices and private input business is generally flourishing and profitable.

However, in many African countries the story is completely different. Despite Africa's rich agricultural resource endowment, the continent remains the only region of the developing world where agricultural input business is not well-developed, Economic Commission for Africa (ECA, 2010). Over the years, the input system in Africa has been facing numerous challenges. (Gerstenmier & AGRA (2015:14-15). stated that :

> "agricultural input supply systems in Africa suffered a further blow following the structural adjustments programs (SAPs) that most countries in Africa implemented between the mid-1980s to late 1990s. Both seed and fertilizer access were seriously affected, as were agricultural extension services. Deprived of public funding, few public seed enterprises survived during this period, leaving farmers with no access to quality seeds. Private sector investment in seed supply was slow to take off. In many countries, farmers were left with no alternatives in either the public or the private formal seed sector, creating a vacuum for NGOs to initiate local solutions mostly centered on the recycling and exchange of farmers' traditional varieties. The historic dominance of the state in seed markets had either excluded or left the local private sector weak and inexperienced in the basics of seed supply"

In its report on the agricultural input business development in Africa, ECA (2010) maintains that improved seed is an important yield-enhancing input because it is the delivery vehicle for modern plant varieties. The development and spread of modern plant varieties was the technological force behind the green revolutions that occurred in China, India, Southwest Asia, and many parts of Latin America. In Africa, the growth in demand, for improved seeds is only about 5–10% of the potential

demand currently being met. Most farmers continue to plant unimproved seed obtained from local sources, including seed saved from the farmers' own crops, seed obtained from neighbors or relatives, or seed purchased in local markets. This is primarily triggered by the lack of seed sector development across the continent (ECA, 2010;Per Pervez et al. 2019).

In their findings on the analysis of the seed system in Ghana, Etire *et al.* (2013) reported that the agricultural input sector in some developing countries is characterized as informal and underdeveloped and this informal nature highly affects the seeds and fertilizer sectors. According to these authors, it is observed that the informal seed system is unstructured and unregulated hence its activities are not monitored or supervised by any public institution. The sales of seeds are not really common as farmers tend to keep seeds from their previous harvest (Etire, *et al.* (2013). These practices of obtaining seeds from informal sources often lead to accessing those with poor qualities. Ayieko and Tschirley (2006) argued that the seeds are obtained from informal dealers, neighbours and the local markets which mainly comprise local varieties that are often poor in quality.

A joint report on agricultural input market in Nigeria: an assessment and strategy for development by the International Fertilizer Development Centre (IFDC), International Institute for Tropical Agriculture (IITA) and the West Rice Development Agency (WARDA) now Africa Rice, identified the following fertilizer market constraints:

i. The instability of the policy environment leading to inadequate investments in the establishment of distribution channels, capacity building, and promotional activities.
ii. Weak legal and regulatory framework supporting the liberalization of the fertilizer market leading to the flooding of the market by dubious quality products. Instability of the macroeconomic variables (interest rates, foreign exchange, tariffs, etc.). This has increased the risk of investments in fertilizer market development.
iii. Inadequate financial services including the high cost of procurement and distribution credit.
iv. Lack of market information on prices, availability, supply sources and overall market conditions. Poorly developed rural infrastructure leading to high transportation and high costs of fertilizer at the farm gate.
v. Inadequate and sometimes obsolete port facilities and inefficient custom clearing bureaucracy that increase the landed cost of fertilizer.
vi. The low demand for fertilizer arising from the weak purchasing power of farmers.

Input prices are usually high as the inputs especially fertilizer is not adequate and being marketed by few dominant dealers. High transaction and marketing costs are common in Africa and can eat into suppliers' profit margins (Kherallah, Delgado, Gabre-Madhin, Minot, & Johnson 2002). In their views these high intermediate costs are then transferred to farmers in the form of high prices. Due to poor distribution networks, farmers have to travel far to get to the selling and distribution points. The seasonal nature of fertilizer provision creates a wide gap and market disruption between demand meeting supply as the later frequently fails to match the former (Kherallah *et al*., 2002).

In Ethiopia, deficiencies that characterized the input sector include insufficient availability and supply of agricultural inputs mainly seeds and pesticides; the absence of internal quarantine regulation to curtail the movement of seeds from contaminated areas to other areas (Seko, 2009).

Many input systems in Africa lack the organization and legal framework to effectively meet the forces of demand and supply, standard and certification processes. Venkatesan (1994) provided what a sound input system should involve. This scholar identified that an effective seed system has basic characteristics which include: strategies that guarantee quality, timeliness, access and affordability;

covers all crops that most of the farmers grow; developed with a stable political and legal environment that ensures the release of new varieties of high-quality seeds of appropriate critical characteristics to farmers in a sustainable manner; consistent with the policies generally followed in the agricultural sector; well supported by effective research and extension and other services such as fertilizer and pesticide supply system, seasonal credit and output market systems.

In most developed countries, commercial banks are able to provide lending for personal and business loans. However, in a number of developing countries, much of the demand for personal and business loans stems from the agriculture sector. Given the nature of agricultural risk to exogenous factors for example weather, pests, diseases, and commodity price fluctuations and their long-term seasonal nature, many banks perceive lending to farmers as too risky, (Hong & Hanson, 2016). Though local bank lending should be the main point of access, the financial sector meets less than 3 % of total smallholder demand for financing, estimated at $450 billion, (Hong & Hanson, 2016). In sub-Saharan Africa, only 95 out of 900 banks surveyed provide financing to smallholder farmers. While the number of adults living in rural areas who have access to bank accounts has increased in recent years due to mobile money expansion, the share in sub-Saharan Africa still hovers at a mere 34% (Hong & Hanson, 2016).

Although the literature on nature of the input system in the Gambia is hard to find and probably not yet to be comprehensively studied, the prevailing circumstance however, is not different from what exists in many African countries. That is, the input system remains informal. Supply networks are unregulated and poorly coordinated. It means there is little regulation in terms of the supply, price and quality of the inputs available to be accessed by farmers. There are dealers in seeds mostly located in the greater Banjul area which is far away from rural farmers. This small scale and medium enterprises are generally specialized in the supply of horticultural seeds rather than rice seeds. For rice, aside from the NERICA variety which is meant for the upland cultivation and mostly supplied by the National Agricultural Research Institute, (NARI), there are no certified seed suppliers and no seeds companies specializing in the production, sale and distribution of improved seed varieties. In order words, there is no organized seed market for rice.

Notwithstanding, the good news is that a national seed secretariat has been established by an act of parliament to support farmers to the production and supply of breeder, foundation and certified seeds.

Unlike rice seeds the market for chemical fertilizer is far more visible. The product is mostly marketed by the government after importation from other countries usually shortly before the rainy season begins. The government dominates the fertilizer sector. There are private dealers too but greatest importer remains to be government through the National Food Security and Marketing Cooperation. There are numerous outlets (both private and public) across the country where fertilizer is supplied and put on sale through appointed agents in villages and urban centers. The demand for fertilizer is far more than its supply and thus a shortage is a common occurrence.

By contrast, the main suppliers of agrochemicals are private dealers. According to the West Africa Agricultural Productivity Programme (WAAPP, 2010) report on Pests and Pesticides Management Plan, the Ministry of Agriculture (MOA) has been the major importer and user of pesticides but it has not imported pesticides or received donations since the 2002 KR2 Japanese Grant and the Locust Control Campaign in 2004.

Most of the suppliers of agrochemicals are located in the Greater Banjul area and these are usually registered suppliers. However, the sale and distribution outlets for agro chemicals are spread across the country. Agro-chemicals can be purchased from local dealer's frequenting weekly organized markets

locally known as *Lumos.* Some of these dealers though do not only sell their products without proper labels but also without legal registration. This risk associated with this is that there is a high possibility of supplying low quality, adulterated, expired, fake products by sellers which are likely to have negative impact on farmers' yields who may have no idea whether or not the product is of good quality.

In terms of agricultural credit, Gambia's financial sector has experienced significant and rapid growth over the past few years, as a result of an increase in the number of banks and micro-financial institutions. There are nine commercial banks with regional branches operating across the country. This growth has helped increased availability of financial services. According to the Central Bank of the Gambia, (CBG) (2016) the public and private sectors have enjoyed credit provision which has grown by about 4.5% a year over the last 10 years to reach 17% of GDP. Banks are adequately capitalized and liquid, with the average risk-weighted capital adequacy ratio reaching 27.1% in 2011, well above the 8% minimum threshold stipulated by the 2003 Financial Institutions Act.

The Central Bank of Gambia has been actively pursuing a series of financial and banking sector reforms to preserve solvency and increase stability. These measures include the establishment of the Credit Reference Bureau (CRB) in 2009, a tripling of capital requirements over the 2010-2012 periods, the revision of supervisory processes with an emphasis on on-site, and the introduction of a new payments-system (CBG 2016).

The microfinance sector has seen significant growth in the past few years. By 2008, Village Savings and Credit Associations (VISACAs) and microfinance institutions (MFIs) reached about 82% of households, up from 42% in 2003. Total registered deposits increased by an average of 46 percent a year between 2001 and 2008. However, outstanding loans remain limited, representing less than 6.7 % of the volume of outstanding loans from commercial banks. The sector remains largely unregulated, although the Central Bank has recently established guidelines that aim at reducing barriers to the entry of new non-bank institutions into the sector, (CBG, 2016).

Despite this progress, no agricultural bank has been established yet in The Gambia. Such a bank is critical in strengthening the financial muscles of farmers by giving low-interest loans with much-relaxed eligibility criteria unlike Banks and microfinance institutions that are more or less driven by profit motives. Agricultural banks are also important in facilitating output and input transactions for farmers.

4. METHODOLOGY

a. Research Setting

This study was conducted in the Central River Region of The Gambia. It is located between latitude 13°13´22.52"N and longitude 16°34´55.13"W. This region has five districts covering a total land area of about 2, 894 km² and a population of 226, 018 the Gambia Bureau of Statistics (GBoS) (2013.) The main inhabitants are Mandinkas, Wolofs, Fulas and Sarahules. Split in the middle by The River Gambia into Central River North and South, it boasts of a large area of arable land with rich alluvial soils and freshwater suitable for both dry and wet season rice production. In other words, it holds the comparative advantage for rice production in the country and therefore often regarded as the potential food basket of the nation. Janjangbureh is the administrative headquarters of the region and houses the office of the Regional Governor.

The economic activities in this area include rice production, livestock rearing, artisanal fishing and trading. The region hosts at least eight regular weekly markets spread across north and south. These

markets are very popular and draw people from different kinds of businesses both from the region and across the borders from Senegal.

In spite of its potential for income generation, the central River Region has a startling poverty prevalence rate. Findings by the World Food Programme (WFP) (2011) in a survey on food security and vulnerability analysis, Central River Region North and South showed 82. 8% and 74.1% poverty rate respectively. A map of the study area is shown in figure 1.

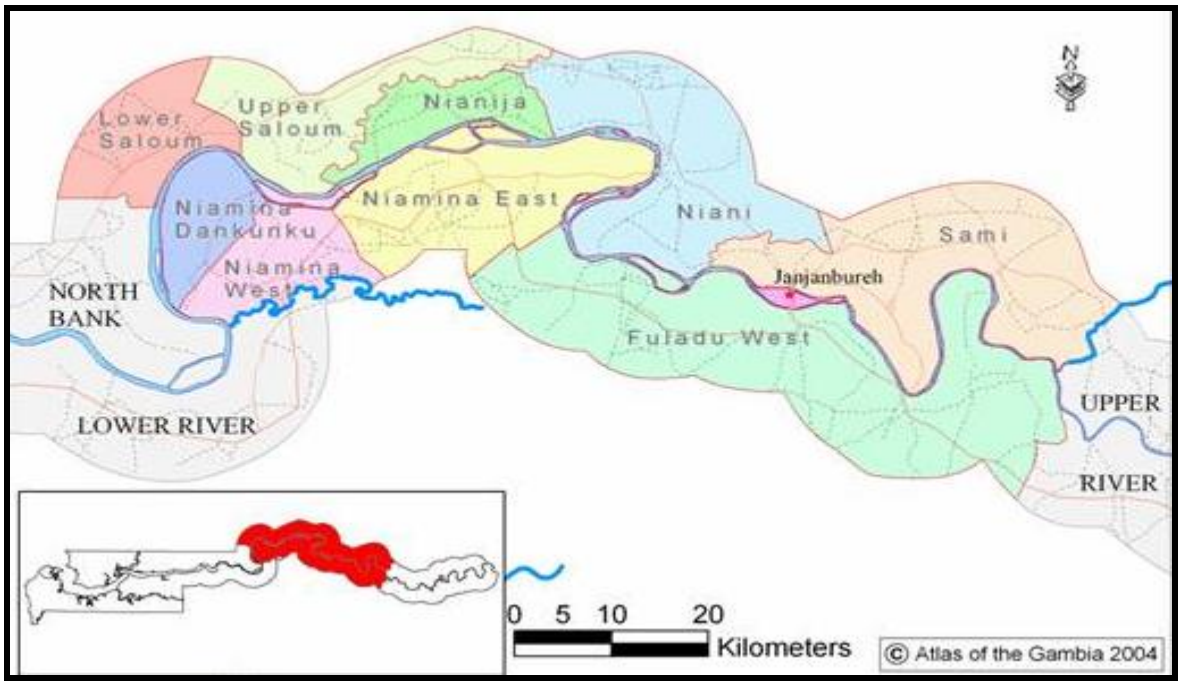

Fig 1. Map of the Central River Region of the Gambia**,** **(**Source: http://www.columbia.edu/~msj42/CentralRiver.htm)

b. Research Design

The study adopted a cross-sectional survey method that allows data to be collected at a single point at a time through farmer-to-farmer administered questionnaires. This design is chosen because the study uses nonexperimental approach. In other words, no field trial was needed to make the assessment. Instead survey is reliable enough to give respondents the opportunity shares their views on input access and rice production.

c. The population of the Study

This region has a total population of 226, 018 consisting of 20, 559 households (GBoS, 2013. The population of the study comprises all the rice farmers in the Central River Region of the Gambia. However, data obtained from the registry of the Agribusiness Service of the Department of Agriculture puts the population of registered farmers in the study area at 9217.

d. Sample Size Determination

The sample size was calculated by using Yamane Taro's (1967) formula with 5% margin of error and a 95% confidence level. Therefore, 384 respondents were used as the sample size. This was used to further calculate the number of respondents in each of the selected villages for Central River Region north and south.

Table 1 Number of respondents across selected villages in the study area

Region	District	Communities	No. of respondents p/qxr	Survey date
		Brikama Ba	192/384 x 112 = 56	8/09/2017
Central River Region North	Lower Fulladu West	Saruja	192/384 x100 = 50	11/09/2017
		Jahaly	192/384 x 80 = 40	14/09/2017
		Pacharr	192/384 x92 = 46	17/092017
Sub-total			**192**	
		Jarumeh Koto	192/384 x82 = 41	21/09/2017
		Kuntaur	192/384 x 100 = 50	24/09/2017
Central River Region South	Niani	Wassu	192/384 x 110 = 55	27/09/2017
		Sukuta	192/384 x92 = 46	31/09/2017
	Sub-total		**192**	
TOTAL			**384**	

Source: Field Survey, 2017

e. Sampling Procedure

The Central River Region was purposively selected for this study due to its comparative advantage in rice production especially for the lowland ecology. This production zone mainly lies in two districts of Lower Fulladu West in the South and Niani in the North. A total of 8 villages were selected using simple random sampling. A list of villages were obtained from the Population and Housing Census report by GBoS in 2013. Then the village was allocated numbers and four villages drawn out for each of the north and south.

The district extension officer and the researcher conducted a visit to each of the selected villages and made arrangements with the village head and the village development committees. After agreeing on a date, arrangements were made to gather all the rice producers in that community either at the compound of the village head or at the village square. Upon arrival by the team of data collectors, rice farmers were registered on the spot and each was allocated a number whose cut-outs were selected randomly and then the extension agents and researcher administered the questionnaires to the rice farmers allocated with that numbers. A total of 384 respondents were surveyed.

f. Method of Data Collection

The primary data was collected by administering semi-structured questionnaires. In addition to this, a separate set of questionnaires were administered to key informants to gather their opinion on the issue. These included the Director-General, Regional Directors, Deputy Directors and extension agents.

First, the questionnaires were pilot tested to check for any ambiguity and necessary corrections were made. After this, field extension agents in the region who have years of experience in survey data collection and directly stationed in these communities were involved in administering the questionnaires to respondents in the local language. This was facilitated with a cover letter from the Director of administration, Department of Agriculture to the Regional Agricultural Directors (RAD) urging them to accord the researcher with all the necessary support.

g. Techniques of Data Analysis

Data were analyzed by computing all responses from the survey into the statistical package for social science (SPSS) software, version 23 and then run the analysis. Descriptive statistics were first

analyzed to show the frequencies, percentages, mean, median, mode, standard deviation, maximum and minimum values.

5. RESULTS AND DISCUSSIONS

The results present the socio-economic characteristics of respondents, the nature of the input system, factors affecting farmers' access to inputs and the impact of inputs and some socio-economic characteristics on rice yield.

1. Socio-Economic Characteristics of the Respondents

Table 2 Socio-economic characteristics of respondents

Description	Frequency N=384	Percentage %=100	Mean
Gender			
Male	132	34	
Female	252	66	
Marital Status			
Single	18	5	
Married	357	93	
Widowed	9	2	
Age			45.4
20-30	49	13	
31-41	127	33	
42-52	106	28	
53-63	66	17	
64 above	36	9	
Household size			9.6
1-5	62	16	
6-10	196	51	
11-15	90	23	
16 above	36	9	
Level of Formal Education			
Primary	40	10	
Secondary	46	12	
Tertiary	0	0	
Non-formal education	298	78	
Farmers Organizations			
Member	285	74	
Non-Member	99	26	
Annual Income	-	-	13, 382.00
Land ownership			
Self-owned	367	96	
Rented	17	4	
Area Cultivated	-	-	
			1.25

Source: Field Survey, 2017

Table 2 shows the socio-economic characteristics of the 384 respondents. The gender composition shows that the population of female respondents was higher than that of the males. The females constituted 66% compared to 34% for the males. This shows that female folk is more active in the rice sector than their male counterparts.

Table 2 shows the respondents' marital status. The majority of the farmers (93%) surveyed were married. The rest, 5% and 2% were single and widowed respectively. This implies that farmers are responsible people with families working to provide for the livelihood of their members. It shows that being married is an integral part of adult people living in rural society and rice being the main staple is critical for the survival and well being of the family in the Gambia.

The mean age of the respondents surveyed was 45.4% as shown in Table 4.1. In fact about 60% of them fall between the ages of 41-52 years. Only 13% were aged between 20-30 years. This suggests that most of the rice farmers are in their middle ages. It is an indication that there is a low level of youth participation in agriculture as well. The result on the age composition is consistent with the findings of Dibba *et al*. (2012) who also found out that mean age of respondents in Central River Region North and South were 40 and 44 years respectively while Sanyang (2010) showed that the age range of most of the rice growers he surveyed was 41-50 years old.

The low activities of youths in agriculture have been a concern to government and development partners in the Gambia. The youths who constitute the majority (60%) of the country's population are either unwilling or do not have the necessary motivation to venture into agriculture. They prefer to migrate to cities in search of better jobs and more recently to Europe through perilous journeys across the Mediterranean Sea commonly called the "back way" in pursuit of greener pastures. This is where they expect to get high paying jobs and better livelihoods. The apparent lack of prospects in farming, low returns, poor infrastructure, lack of market and inadequate support to farmers is obvious push factors to the youths.

In table 2, the average household size is 9.6, a score slightly above the national average of 8.6. The Gambia has a high fertility rate like most African countries, 5.8% according to the United Nations Development Programme, ((UNDP) (2015). Marriages are usually polygamous especially among the Muslims who form the bulk of the population (almost 90%) and there is general perception that more children are a blessing from Allah. Therefore, household sizes are usually large especially in the rural settlement where people live in extended family systems.

Table 2 shows the educational level of the respondents. It reveals that 78% of them have no formal education while only 10% and 12.0% received primary and secondary education respectively. No single farmer has acquired tertiary education. That is to say none has attended or obtained a college diploma or university degree. Thus, with regard to Western education, illiteracy among farmers is very high. It also implies that those who are educated are not active in rice production but probable are engage in other occupations such as civil service and manufacturing and service industries.

In terms of belonging to an organization, 74% of the respondents in Table 2 have acknowledged being a member of a farmer group, an association, or a cooperative society while 26 % reported being non-members. It suggests that there are indeed organizations existing in the rice production zones. This is not surprising because historically, rice growers have generally been organized into groups, mostly cooperative societies or associations to facilitate government and non-governmental support.

Table 2 shows that 96% own their land through the traditional customary system where the land is allocated for free by the village head, family head, or head of the clan. On the other hand, 4% claimed to have rented the land during the 2016 cropping season. This shows that most rice growers own their

land and the traditional land tenure system is quite prevalent.

Table 2 shows the cultivated land size of respondents in hectares. The average area of land cultivated with rice was 1.25 hectares. This is typical in the Gambia. Rice growers often cultivate in small fields or plots which mostly ranges between 0.5 hectares to 1.0 hectares. This implies that majority of rice growers are subsistent small-scale farmers growing rice mainly to feed their families rather than commercial purposes.

The farm size is mostly used to categorize such types of farmers. For example, the Food and Agricultural Organization characterizes smallholder farmers as those who often farm less than a threshold size of 2 hectares. Today, the smallholder sector is known for its small farms that are labor-intensive, uses traditional production techniques and often lacks institutional capacity and support (Pienaar & Traub, 2015; Pervez et al. 2017).

Table 2 shows the respondents' annual income. The average farm income is D 13 382.00 about USD$ 282.31 at today's exchange rate of D47.40 to $1. This income level is less $1 a day and reflects the typical scenario of the poverty level of the majority of the Gambia's population who are mostly farmers. Such low-income level confirms the World Bank's characterization of low-income countries whose citizens leave below the poverty line of less than $2 a day. The Gambia is among the poorest countries in sub-Saharan Africa. UNDP and GBoS (2011) in their joint report on Integrated Household Survey reported mean per capita household income of D15, 930.00.

2. The Nature of the Agricultural Input System

This section focuses on the supply, distribution and access of farmers to rice seeds, chemical fertilizer, pesticides and herbicides, credit and labour as well as extension service provision.

Table 3 Distribution of Respondents According to Sources of Seeds

Seed Sources	Frequency N=384	Percentage %=100
Distributed by government/ Project	29	8
Farmers organizations	42	11
Relatives/friends	53	14
Purchase from open market	6	2
Saved from the previous harvest	254	66

Source: Field Survey, 2017

Table 3 shows the distribution of respondents according to sources of seeds. The results show that during the 2016 cropping season, 66% of the respondents obtained seeds from harvested rice, 8% received seeds through government, project or NGO, 11% from farmer organization, 14% obtained from relatives/friends and 2% bought seeds from the local markets at cost of D700 per 50 kg bag of local rice seeds. This indicates that farmers have multiple seed sources and the majority of rice farmers keep seeds from previous harvest. The seeds acquired from relatives, friends or purchased in the open market are local varieties with poor qualities whereas those distributed by government or projects or NGO such as FAO are usually good quality seeds given to some farmers for free in the form of assistance.

For rice, the seed system is undeveloped. Although the government has set up a National Seed Secretariat since 2015 to promote the development of high-quality improved seeds but production of certified seeds has not yet begun. At present there are no certified seed suppliers and no seeds companies specializing in the production, sale and distribution of improved rice seed varieties. In order words, there is no organized rice seed market.

Consequently, farmers obtain seeds from multiple sources which include those distributed to support rice growers by government, project or NGOs, seeds obtained from friends or relatives, seeds purchased in the local markets and those saved by farmers from their harvest. The supply of improved seeds is very limited apart from the NERICA variety meant for the upland rice production ecologies. This variety is mostly obtained from one main source, the National Agricultural Research Institute (NARI.)

The implication for unreliable seed sources is the risk of obtaining poor seeds due to adulteration as farmers do experience poor germination of such seeds. So seed viability is a challenge because of the lack of regulation in the seed sector. Formal seed sector and organized seed system that would ensure regular availability of seeds for production. In a similar study, Ayieko and Tschirley (2006) reported that the seed system in some developing countries is highly informal as most rice farmers usually obtain their seeds from friends, relatives or from their previous harvest.

Table 4 Distribution of Respondents on Quantity of Fertilizer Accessed

Quantity (kg)	**Frequency N=384**	**Percentage %=100**
0	84	22
1-25	3	1
26-50	50	13
51-100	145	38
101-150	29	8
151-200	56	15
201-250	3	1
251-300	9	2.3
300-350	4	1
351--400	1	0.3
Mean	99.28	
Median	100.00	
Mode	100	
Standard Deviation	81.18	

Source: Field Survey, 2017

Table 4 shows the quantity of fertilized accessed during the 2016 cropping season. This result shows that 22%, representing (84) farmers reported having no access to any quantity of chemical fertilizer. The majority of the farmers constituting 38% were able to access between 50- 100 kg of chemical fertilizer. Less than 5% of the farmers access more than 200 kg of chemical fertilizer. This depicts the low affordability and accessibility of chemical fertilizer among rice farmers. Most of the farmers are poor people, living in less than a dollar a day. Despite the fact that the fertilizer prizes were subsidized by the government, the price which was sold at D950.00 per 50kg bag during this period was still beyond the reach of most rice farmers. This problem of high cost was reported by Gregory and Bumb (2006) who posited that, high fertilizer prices are mostly attributed to high transaction costs of fertilizer trade arising from high transportation costs, high-interest rates on loans and low volume of purchases.

The main challenge in the fertilizer business is that the input is not manufactured domestically in the Gambia and it's not available all year round to be accessed by farmers. It is rather imported predominantly by the government through its agency, National Food Security, Processing and

Marketing Cooperation usually shortly before the commencements of the cropping season. In other words, the supply of fertilizer is limited during the off-season. The main importer of fertilizer is to be government which has a stranglehold or monopoly of the sector.

The national requirement of fertilizer according to the Gambia Investment and Export Promotion Agency (GIEPA) is about 20 000 metric tonnes annually. However, if this is compared with data from FAOSTAT (2014) which shows the average annual import from 2005-2014 at 2266 metric tonnes, it does suggest that in the last 10 years fertilizer imports have been grossly inadequate. That is, the Gambia has been importing only 11% of its fertilizer needs during this period.

The implication for demand exceeding supply is scarcity which surges prices up thus making it much more difficult to afford by farmers. Even if the government subsidizes the price, the imported quantity is still insufficient for farmers.

Private dealers are important players in the fertilizer market. These dealers include but not limited to Agro-Input Ltd, Asia-Gambia Development Enterprise, Garden Seed Stock Ltd, Nyambai Agricultural Inputs, Sangol Firms Ltd and Gambia Horticultural Enterprise. These are small and medium-sized enterprises that deal with fertilizer. They are located in Kanifing, Serekunda and Brikama, the three largest urban settlements in the country. There is no private-public partnership in this sector. The private sector continues to exhibit many weaknesses. These include inadequate financing (lack of loans and tax incentives), inability to market inputs when and where farmers are most likely to buy them probably due to long-distance from them. This situation was also reported in the works of (Sheahan, Black, & Jayne, 2013) who pointed out that input dealers tend to concentrate in cities and other big towns that are far away from the farmers, hence making fertilizers and other essential inputs inaccessible to farmers.

Table 5 Distribution of Respondents According to Agro-Chemicals Accessed

Agro-Chemical	Frequency N=384	Percentage %=100	Price (D/liter)	Quantity (liter)	Total Cost (D)
Herbicides	11	3	650.00	13.0	8 450.00
Pesticides	15	4	1000.00	18.0	18 000.00
None	358	93			
Total					26 450.00

Source: Field Survey, 2017

Table 5 shows the distribution of respondents according to agro-chemical accessed. This was limited to pesticides and herbicides only. It shows that over 93% of the respondents reported having no access to these inputs very much needed to mitigate the effects of pest and diseases on crops which invariably would also impact yield. Out of those who accessed, 3% used pesticides and 4% reported using herbicides. The total expenditure on Agrochemicals by 7 % (26) farmers was D 26,450.00. In the market herbicides were being sold at D 650.00 per litre and pesticide was sold at D 1000.00 per litre.

The fact that only 6.8% of the respondents reported access to these agrochemicals is indicative of the low use of agrochemicals among farmers. This problem of low pesticide use was reported in the work of (Zhang, Jiang, & Ou, 2011). In their analysis of global pesticide consumption and pollution they reported that only 3% of global pesticide consumption came from Africa while 2% of all pesticide consumption came from South Africa alone, leaving only 1% for the remainder of the continent.

In addition to the relevant opinion of these scholars, another reason is that the relative price for the pesticide/herbicide is considered high as complained by some of the farmers; the price is within the

range of the cost of fertilizer which the poor farmers generally prioritized first due to their low purchasing power. Therefore, they are faced with a choice of preference and of course they would rather have fertilizer first.

The supply of pesticides entirely rests on private dealers unlike fertilizer which is dominated by government. Most of the registered suppliers are located in the Greater Banjul area which is very far from the farmers. Dealers may also be found in weekly organized markets locally called *Lumos*. Some of these dealers do not only sell their products without proper labels but also without legal registration even though there is legal framework for the control and use of pesticides through the Hazardous Chemicals and Pesticides Control and Management Act (HCPCMA) established since 1994 and is enforced by National Environment Agency (NEA).

6. CONCLUSION

This research on the impact of access to agricultural inputs on rice yield in the Gambia was carried out in the Central River Region. The study surveyed 384 respondents. Findings revealed that the majority of the rice growers were women constituting 66%. The average household size was 9.6. Most of the farmers (60%) were in their middle ages and less than 15% were aged between 18-31 years old. Furthermore, 78% of the respondents reported no formal education, 10% attended primary education and 12. % attended secondary education but none attained a college or university. The mean income of respondents was D 13 381.70.

Therefore, inputs play a significant impact on the yield of rice farmers. This conforms to our assumption that agricultural inputs are the major determinants of rice yield. Although socioeconomic characteristics played a role but with the exception of income which was found to have a major impact, age, education and household size had no significant impact on yield.

Therefore, the agricultural output cannot be increased without increase in access to improved seeds, chemical fertilizer, labour and credit. It is vital to think along this line to develop and formalize the input sector that will guarantee the adequacy, availability and affordability of inputs in order to assist farmers to improve their level of input access and by doing so enhance yields. Domestic input supply should be promoted to minimize cost of foreign imports.

Recommendations

This study has unearthed major issues of concern in the agricultural inputs sector. Therefore, in order to improve rice yield and national food self-sufficiency and food security, the following recommendations are critical:

1. Government and development partnership through the Ministry of Agriculture (MOA) should work hand in glove to establish a vibrant seed system to promote the production and supply of high-quality certified rice seeds at affordable prices for farmers. This can be done by increasing funding to the National Research Institute (NARI) to develop breeder, foundation and certified seeds.
2. The government should formulate an efficient and effective fertilizer subsidy program in order to enhance the affordability of fertilizer by rice growers. An increase in the budget allocation for agriculture from below 10% to 25-30% would avail more funds to purchase and subsidize fertilizer.
3. Government and private investors should improve farmers' access to affordable credit (loans) through the establishment of agricultural banks or strong cooperative societies to give "green loans" to farmers to enhance their capacity to purchase agricultural inputs.
4. The government should develop and effectively enforce regulation to control the supply into the input system of fake, adulterated and poor-quality seeds, fertilizer, pesticides and herbicides.

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