Smallholder Women's Perceptions on the Barriers to Promoting and Processing Local Rice in Gwagwalada Area Council, Abuja, Nigeria

Hafsat Aminu Anas[1*], Samson Olayemi Sennuga[1], Tena Mongalaku Barnabas[1], Funso Omolayo Alabuja[2] and Emeka Franklin Okpala[3]

[1]Department of Agricultural Extension and Rural Sociology, Faculty of Agriculture, University of Abuja, FCT, P.M.B. 117, Abuja, Nigeria
[2]Department of Agricultural Economics, Faculty of Agriculture, University of Abuja, FCT, Nigeria
[3]Department of Agriculture, Food and Environment, Royal Agricultural University, Stroud Road, Cirencester, Gloucestershire, United Kingdom, GL7 6JS

*Corresponding author

Abstract

The study examined Smallholder Women's Perceptions on the Barriers to Promoting and Processing Local Rice in Gwagwalada Area Council, Abuja, Nigeria. Two objectives guided the study. The study adopted a descriptive research design. Random sampling was employed to select the farming communities for the study. Descriptive statistics was used to analyzed data obtained and the study underscore the following; that the socio-economic variable; ages between 20-30 are those with high rate of consumption of local with percentage of 46.4% gender had female with 70%. The study revealed that those with tertiary qualification was 72.6% household income between N50,000 - N100,000 were seen to be high with 33.3%. The study shows that household size 1- 5 are majority in the consumption of local with percentage of 60.7%, working experience indicates those between 1 – 10 years with 52.4% 96.4% respondent in the study area accept they consume local with percentage consume it five days in a week. Preference for consumption of local rice had multiple entries with nutritional value as develop on the gain recorded in the rice sector through the ban on importation of foreign rice into the country by ensuring that policies are put in place to encourage more production and consumption of local rice in Nigeria.

Introduction

Agriculture plays a fundamental role in economic growth, enhancing food security, poverty reduction and rural development. It is the main source of income for about 2.5 billion people in the developing world (Ebisike *et al.,* 2021). Consequently, additional sustainable agricultural technologies such as the use of ICT and mechanized farming techniques remain an important part of the efforts to boost food availability, rice production and improve soil quality in a currently threatened human capability to access food in many developing countries today (Egbe *et al.,* 2021). Improved rice is a collection of principles for on-farm production and post –and healthy food rice products, while taking into account economic, social and environmental sustainability (FAO 2013; Sennuga *et al.,* 2020a). Processing to increase its productivity covers a range of areas including seeds,

crops protection, water modern irrigation, integrated pest management, integrated fertilizer management and conservation agriculture (FAO, 2013; Afolayan, *et al.,* 2022).

In addition, agricultural technologies that include all kinds of improved technologies and technologies which affect the growth of agricultural output (Lai-Solarin *et al.,* 2021). The most common areas of technology development and promotion for crops include new varieties and management regimes, soil as well as soil fertility management, weed and pest management, irrigation and water management. By virtue of improved input/output relationships, new technology tends to raise output and reduces the average cost of production which in turn results in substantial gains in farm income (Ojo *et al.,* 2021). An improved rice processing that enhances sustainable production of food and fibre has made the dynamics of technical change in rice processing, an area of intense research since the early part of twentieth century (Umunakwe *et al.,* 2015). These technologies are particularly relevant to smallholder farmers in developing countries because they are constrained in several ways, which makes them a priority for development efforts. These farmers for instance, live and farm in areas where rainfall is low and erratic, and soils tend to be infertile. In addition, infrastructure and institutions such as irrigation, input and product markets, and credit as well as extension services tend to be poorly developed (Ezike *et al.,* 2022; Sennuga *et al.,* 2020b).

Smallholder farmers rely on traditional methods of production and this has lowered the level of productivity. For instance, over 70% of the rice production in the majority of developing countries is from smallholders who use traditional methods of production (Ezike *et al.,* 2022). These farmers generally obtain very low crop yields because the local varieties used by farmers have low potential yields, most of the rice is grown under rain-fed conditions and irrigation is used only in limited areas, little or no fertilizer are used and pest control is not adequate (Ayoola and Makinde, 2014). This has triggered the much needed tendency to increase productivity and sustainability in agriculture globally but much less information is available on specific means to achieve this aim. Similarly, the process of adoption and impact of adopting new technology on smallholder farmers have been studied. However, improved agricultural technologies are often adopted slowly and several aspects of adoption remain poorly understood despite being seen as an important route out of poverty in most of the developing countries (Daoui, 2018)

Technology is a key factor of influence in rice production. Technology adoption refers to the acceptance of a group or an individual to use a new product or innovation. The process of adopting an idea or new innovation does not happen as a single unit act, but rather a mental process that consist of at least five stages namely, The awareness stage, the interest stage, the evaluation stage, trail stage and finally, the adoption stage (Ebisike *et al.,* 2021; Sennuga and Oyewole, 2020). At the awareness stage, an individual becomes aware of the idea but lacks detailed information about it. At the interest stage, an individual gets more information about it and wants to know more about how it works, what it is and its affordances. At the fourth mental stage, the stage, when the user has obtained more information from the previous stages. At fourth mental stage, the individual makes a small scale trial of the idea, and request for more specific information to answer questions. The last mental stage, adoption, is characterized by a large scale adoption of the idea and most importantly its continued use (Sennuga, 2021). Adoption of improved agricultural technologies has been associated with higher earnings and lower poverty, improved nutritional status, lower staple food prices, increased employment opportunities as well as earnings for landless laborers (Alarima, 2011; Nimzing *et al.,* 2022).

Adoption of improved agricultural technologies has been associated with higher earnings and lower poverty, improved nutritional status, lower staple food prices, increased employment opportunities as well as earnings for landless laborers (Nwalieji, 2014). Adoption of improved technologies is believed to be a major factor in the success of green revolution experienced by developed countries (Mwangi and Kariuki, 2015). Conversely, non-adopters can hardly maintain their marginal livelihood with socio-economic stagnation leading to deprivation (Hassan, 2014). Agricultural technology embodies a number of important characteristics that may influence adoption decisions. For instance, Toma *et al.,* 2018, have classified the determinants of adoption of agricultural technology into social, economic and physical factors.

Physical factors such as the farm size play a critical role in the adoption process of an improved technology. Many studies have reported a positive relation between agricultural technology (Simtowe, 2011 and Wandji *et al.,* 2012) owing to the farm size criteria. Small farm size provides an incentive to adopt a technology especially in the case of an input-intensive innovation such as a labor-

intensive or land-saving technology. Smallholder farmers with small plots of land adopt technologies that saves energy such as greenhouse technology, zero grazing among others as an alternative to increased agricultural production. (Obi, 2019).

In addition, a key determinant of the adoption of an improved technology is the net gain to the farmer from technology adoption, inclusive of all costs of using the improved technology. However, high cost of using the agricultural technology has been reported as hindrance to the adoption of these agricultural technology (Jegede *et al.,* 2021; Sennuga *et al.,* 2020). This is supported other previous studies such as Chi and Yamada (2002); Ezike *et al.,* 2022 on determinants of technology adoption. For instance, the elimination of subsidies on prices of seed ad fertilizers since the 1990s due to the World Bank - sponsored structural adjustment programs in sub-Saharan Africa has widened this constraint.

Acquisition of information about improved technology is another factor that determines adoption of technology (Montes *et al.,* 2021). It enables farmer to learn the existence as well as the effective use of technology and this facilitates its adoption. Smallholders farmers will only adopt the technology they are aware of or have heard about it. Therefore, access to agricultural information reduces the uncertainty about a technology's performance hence may change smallholder's assessment from purely subjective to objective over time (Sennuga *et al.,* 2020). Similarly, a study conducted by (Obisesan, 2014) in sub-Saharan Africa on the impact of technology adoption on smallholder rice production found out that the factors affecting technology adoption were assets, income, institutions, vulnerability, awareness, labour, and innovativeness by smallholder farmers. The authors also established that technologies that require few assets, have a lower risk premium, and are less expensive and have a higher chance of being adopted by smallholder farmers. However, previous studies on adoption of improved rice production agricultural technologies did not focus the influence of socio-economic characteristics on smallholder (female farmers) and sources of modern technologies on adoption. This study therefore will attempt to address the factors influencing the adoption of improved rice processing technologies among women smallholders in Abuja, Nigeria. Therefore, the purpose of this study is to find out the constraints associated with rice production among agricultural technologies among farmers in FCT.

The specific objectives of this study are to:

Describe the socio-economic characteristics of the farmers on adoption of technologies.

Identify improved agricultural technologies that are workable by female farmers through the sources of agricultural information on adoption of technologies by farmers.

Method of Processing Local Rice

Traditional Method of processing Local Rice and Drying

The traditional process of parboiling rice uses small and large pots made of thicker materials with a capacity of 15-30kg. This also involves drying on cemented floors and using the hands, legs, plates to stir the rice to dry. This method has no specific kits set aside for parboiling in the traditional method there is no any destoning of the rice so the method exposes parboiled paddy to the sun for more than 5 hours which leads to over drying and breakage of rice. The process is rudimentary and involves hard laborious work and poor handling of rice resulting in rice breakage. Ninety percent (90%) of rice processing by the women is bought from the market in addition to the harvesting and threshing of rice. In the study area is also, rice processor carry-out traditional methods of rice processing using and beating against the drum.

Rice is normally parboiled for consumption or for sale (pre and post processing). Local market of processing and parboiling subjecting the rice paddy to moisture and heat treatment to achieve desirable qualities in the final products. Parboiling makes rice easier to process by hand, which in a way adds value to paddy rice. It produces physical, chemical and sensory changes that retain nutrients yield, and reduce grain breakage. When rice is parboiled, it has a more qualities appalling, better looking appearance, grade, which far easy digested.

Modern Methods of Processing Local Rice

In recent times, rice processing have been discovered to have improved in rice processing in Nigeria compared to the 1990s. In view of the used of modern methods, the rough rice or paddy is first cleaned to remove contaminants and husk are then removed by the equipment called shellers. The rice and husk are separated by the aspiration and any paddy remaining with the rice is removed in a paddy separator. It is discovered that the main problem of Nigerian rice is the

presence of stone and breakage in the rice grains. Survey conducted by Indahgiju *et al.,* (2022) shows that there has been locally made fabricated destoning machine in Kano, Nigeria that cost N65,000 made of angle iron and sheet metal. Another improvement in rice processing in Nigeria reported by propcon is the drying process. The traditional sun drying has now been replaced by mechanical dryer or improved sun drying method, which is much more-easier and faster.

A typical example of mechanical dryer in figure2. This type of dryer is found all over the country. It can process about 3000kg and remove 50% moisture if rice ub 6 hours. Apart from this mechanical dryer which uses diesel or electricity. Other dryer has been developed such as solar dryer for drying rice paddy. National centre solar energy research, Sokoto, Nigeria. The development of this dryer result from the incessant power outage experienced all over the country. This type of solar dryer is equipped with fan to enhance hot air distribution over the rice paddy.

Materials and Methods

Population of the study and research design

The study was carried out among smallholder women in Gwagwalada Area Council in Abuja. Gwagwalada was selected because the community have in common agro-climatic, ethnic group, religion and cultural settings. Gwagwalada is also the name of the main city in the Area Council, which has an area of 1,043 km2 and a population of 157,770 at the 2006 census. It is projected to have a 6.26% growth between 2020 and 2025 and adjudged the largest increase on the African continent. The respondents were interviewed using structured questionnaires which was distributed among farmers in the study area. Data was analysed using descriptive statistic.

Sample Size and Sampling Techniques

A well-structured questionnaire was used by the researcher to acquired primary data. The questionnaires were distributed among respondent who were randomly selected in the study area. Women participation was encouraged in order to ensure coverage of gender and other cross cutting issues of asymmetric information occurrence and incidences. Random sampling technique was employed in the choice of the study area and simple random sampling of 84 small rice farmers. The gender

profile of the sample population indicated that 45.2% male and 54.8% female were interviewed.

Data Collection

Primary data were collected using Greenwich schedule, interview from both rural dwellers. Structured questionnaires were administered to collect data and the survey took about 1 hour 10 minutes. The key themes in the survey included socio-economic characteristics of smallholder farmers, household assets, extension advice level of awareness of constraints of processing of local rice sources of agricultural information in the area, in order to ascertain the appropriateness and reliability of the questions set for the survey among three smallholder farmers working with to correct aspect related to verbal understanding and to ensure the interviewees' performance, and some minor corrections were affected before administering the question study participants. In few cases, additional visits were made when it was compulsory to clarify and review incomplete information.

Data Analysis

The data collected for the study were analyzed using descriptive statistics such as frequency and percentages. Spearman rank influence technique was used to test the significant relationship between processing, promoting of local rice and socio-demographic variables of Science (SPSS) version 24 the data were analyzed and the descriptive statistic were used to present the results.

Results and Discussion

Socio-economic characteristic of the respondents in the study area

The result of socio-economic characteristics of the respondents were presented in the Table 1. The variable investigated in the study included: age, sex, marital status, household size, level of education, major crops cultivated, household assets and income level. The age of the farmers in the households ranged from 20 to 60 years. per cent of them fell within the middle age of 31-50 years in community. This suggests that the majority of the respondents were within their economic active age and this enhances their productivity in order to ensure food security (Table 1). The old age group (51-60) had the lowest impact in farm work with 10.7 contributing to active farming among the sampled 50 per cent population. This result reveals that the majority of

farmers who participated in the survey belong to the active age group and still have strength to cultivate more farmland and explore new agricultural innovations. However, it is generally assumed that of their older counterparts. In the respondents were males; this is because the cultural traditions of the study area do not allow females to be actively involved in farming activities (Sennuga and Fadiji, 2020).

In terms of the marital status of the respondents, overwhelming majorities (96.7%) of the respondents were married with half of these households having 10 or more members, the remainder had larger families of more than 21 members reflecting polygamy within the community. The result is not surprising because large family sizes are the norm in the Northern Nigeria and large families provide accessible workforces. Furthermore, the cultural tradition and religion allows the men to marry at most four women. The use of household labour for several activities was very common in the study area with activities such as ploughing, harrowing, planting, weeding, chasing away straying domestic animals, irrigation activities and harvesting. In the same vein, large household may also help to access more agricultural information.

Educationally, 72.1 per cent tertiary of the respondents had acquired education, while 17 per cent had secondary education. Only 34per cent of the respondents possessed (Table1). This suggests that the respondents in the study area obtained the basic education required for better understanding and ability to embrace new technologies. In addition, it is generally thought that the level of education enhances the ability to comprehend and adopt relevant agricultural information which is in conformity in term of household asset, 58 per cent of the household keep poultry, a greater proportion (61.7%) keep sheep and goats. A sizeable proportion of the respondents (42%) also indicated that they rear cattle and only 6.5 per cent specified that they keep other livestock such as camel, duck, turkey, etc. The baseline livelihood survey keeps pigs in the study shows that no single household keeps pigs in the study area. This was attributed to the religion (Muslims) of the respondents.

Consumption Level of Local Rice

Table 2, revealed the level of consumption of local rice in Abuja, it indicates that majority of the people prefer eating Nigeria cultivated local rice, the percentage representing this category of people is 96.4% which is the core of this study, rice are very insignificant in

number, representing 3.4% of the total population. Fig 1: Spearman rank influence of factors influencing adoption of improved agricultural technologies among smallholder farmers.

Impact of Age on Promoting and Processing of Local Rice

The findings reveal a positive statistically significant relationship between age (0.001) (fig 1). Age has been considered to be a major underlying characteristic in the decisions made by smallholders (Parvan, 2011). Age was also found to positively integrated Pest Management (IPM) on peanuts in Georgia (Omonona *et al.,* 2016) and sorghum in Burkina Faso (Udoh and Omonona, 2018) among older farmers. However, there is a debate on the direction of the effect of age in adoption, the older farmers find it extremely difficult to take the risk which may result in production of rice (Adesiyan, 2015).

The results of this study are supported by Mwangi and Kariuki (2015) who found that the active age group are characteristically less risk-averse and are keener to try younger farmers still have the potency to take a risk, grow more local rice and search for new agricultural innovations.

The role of Gender in the Promoting and Processing of Local Rice

The study results revealed that the gender of the respondents had positive impact of promoting and processing of local rice. This implies that male farmers are more likely to promoting and processing of local rice than their female counterparts. The reason for this is that men are the people in the study area who make the production decisions and also control the productive resources such as land, labour and capital which are critical for the production of local rice. However, gender issues in production of local rice have been investigated for a long time and most studies have reported mixed evidence regarding the different roles men and women play in (Fawehinmi and Adeniyi, 2014).

Impact of Culture on Promoting and Processing Local Rice

The results of spearman rank influence revealed in fig 1 shows significant constraints of culture in the study area. Cultural norms, value, and tribal background to constraints of promoting and processing of local rice. The belief, habits and rituals attached to culture are so

deeply rooted and many constraints promoting and processing of local rice.

Financial Factors and Insecurity on Promoting and Processing of Local Rice

The study results presented in fig 1 illustrate a significant relationship between financial factors and insecurity is the major constraints affecting the promotion and processing of local rice. It is believed that more farmers that participate in production of local rice are facing both financial and insecurity challenges due to poor funding and bandits.

The findings for the distribution of respondents according to preference for consumption of local rice as indicated in table 3 revealed multiple reasons why many people within Abuja consume local rice, it has the percentage of 35.7% followed by nutritional value of the local rice is utmost accepted because of many factors as stated on the table. Normally the desire to eat tasty and nutritional food is what drive, our daily struggle also as the saying goes "one good turn deserves another" consuming a delicious recipe of invitation for another.

The Role of Farming Experience on Promoting and Processing of Local Rice

As reported I Table 3, the level of farming experience is a significant factor in the constraints of processing local rice in the study area. According to (Adam *et al.,* 2018), longer farming experience implies accumulating farming knowledge and technical know-how and skills, all of which contribute on promoting and processing of local rice.

Impact of Household Size on the Promotion and Processing of Local Rice

The findings reveal a positive and significant relationship between Household size and constraints on the promotion and processing of local rice simply used as a measure of labour availability for farmers with large families (Aluko *et al.,* 2021). It determines the constraints and process process in that, larger households have the capacity to relax labour constraints during the introduction of new technologies. This implies that farmers with large families will certainly generate more

income through large-scale production of improved technologies using family labour, However, the bigger the family size, the more economically stable the family (Mwangi and Kariuku, 2015).

Impact of Farm Size on the Promotion and Processing of Local Rice

The farm size had a negative significant constraint on promoting and processing of local rice. These results show that farm size does not have an effect on the constraints of promoting and processing local rice. This is because the respondents are small scale farmers who operate on small farmlands. A similar finding was by Aluko *et al.,* (2021) who established that farm size does not always affect the processing of local rice; rather the literature finds that the effect of farm size varies depending on the type of the rural community. However, in a study undertaken by Nwalieji *et al.,* 2014). This presents a serious challenge to policy makers and the government of Nigeria in promoting and processing local rice in the study area. This is because an overwhelming majority of farmers in FCT and Nigeria as a whole operate on a small scale with the average farm sizes hardly exceeding three hectares.

The essence of this study is to dig into various factors affecting the adoption of improved agricultural technologies by smallholder farmers in Nigeria rural communities. The study had revealed factors affecting smallholder farmers' decision to adopt agricultural technologies. Findings from this study had shown that constraints of Promoting and Processing local rice depends on a range of factors which include among others; human factors, social factor, cultural/religious factor, economic factor, education levels, household size, across to information, utilization of social networks and so on. The study evaluated the constraint associated with promoting and processing of local rice among women in Abuja.

The result of the study revealed that there is significant of women in farms of rice women that socio-economic characteristic is low-income earners the result also revealed that there is a low level of acceptance of local produce rice which is associated to its processing and packaging as revealed from the questionnaire.

Table.1 Socio-Economic Characteristics of Respondents (n=84)

| Variables	Frequency	Percentage %
AGE (Years)		
20-30	39	46.4%
31-40	28	33.3%
41-50	9	10.7%
51-60	5	5.9
Above 60	3	3.6
GENDER		
Male	38	45.2%
Female	46	54.8%
MARITAL STATUS		
Single	42	50%
Married	39	46.4%
Widowed	3	3.6%
ACADEMIC QUALIFICATION		
None	8	16
Primary	4	4.8%
Secondary	19	22.6%
Tertiary	61	72%
HOUSE HOLD SIZE		
1 - 5	14	28%
6 - 10	18	36%
11- 15	7	14%
16 - 20	3	6%
FARM SIZE		
1 Hectare	48	48%
2 – 3 Hectares	45	45%
4 – 5 Hectares	14	14%
MAJOR OCCUPATION		
Farming	75	75%
Cattle Rearing	50	50%
Trading	3	13%
DO YOU BELONG TO A COPERATIVE SOCIETY?		
Yes		40%
No		30%
No Response		14%
ANNUAL INCOME		
<50,000	11	11%
60,000 – 100,000	26	26%
150,000 >	32	32%

Source: field survey 2022

Table.2 Improved Promoting and Processing of Local Rice

Variables	Frequency	Percentage %
I consume Local Rice	81	96.4%
I do not consume Local Rice	3	3.6%
NUMBER OF DAYS IN A WEEK		
< 5 Days	59	70.2%
> 5 Days	22	26.2%
No consumption	3	3.6%

Source: field survey 2022

Fig.1 Barriers of Promoting and Processing of Local Rice among Women
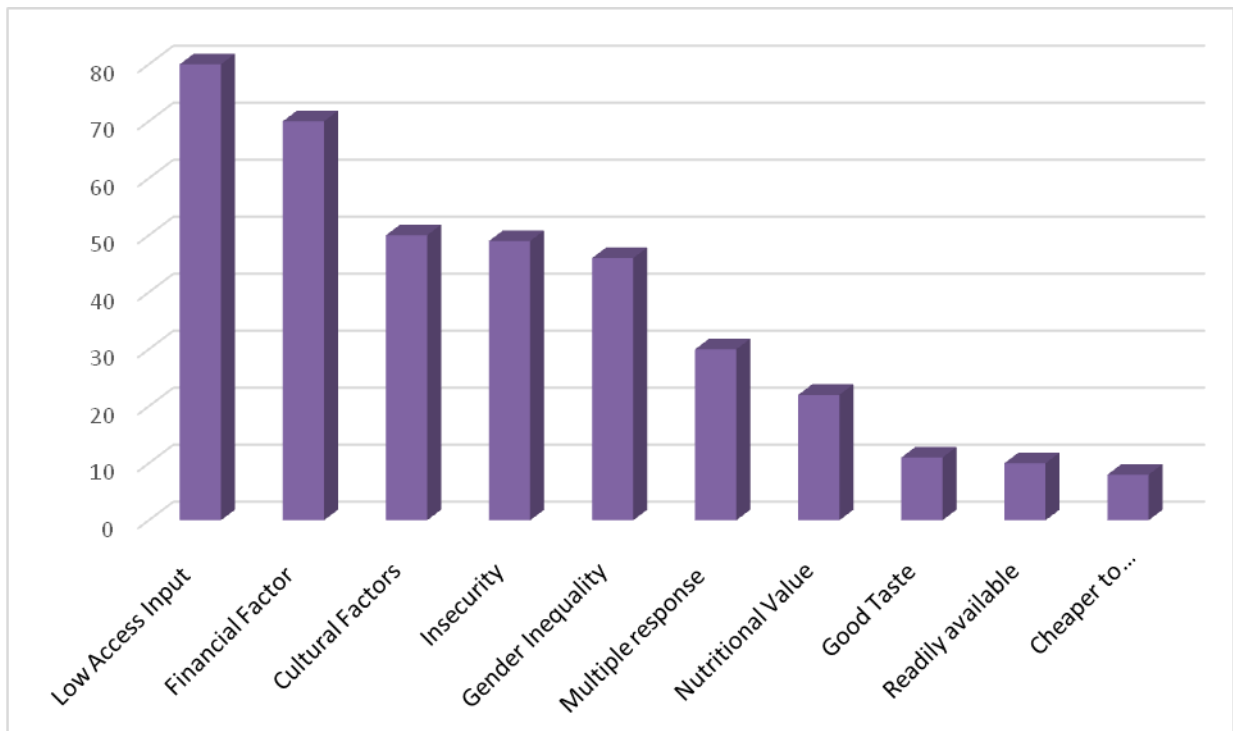
Source: Field survey 2022

This is negative remark as there is need for government now and individual investors to leverage on the promoting and processing of local rice. This will boost the production and will promote the status of the rice as well as the socio-economic status of the women farmers. Not only so, but initially policies and programmes in the rice value chain and ensuring that such programme are well funded and implemented to achieve a greater Nigeria.

Recommendations

The following recommendations were made based on the findings and the conclusions of the study;

There is a need for Government to increase farmers' capital and credit facilities and make these services accessible to the farmers.

There is need for farmers to be trained on yield-raising technologies and other technologies that can positively contribute to high productivity among farmers. This will increase awareness on the availability and usefulness of promoting and processing local rice.

More Youth under the age of 25-30 should be encouraged to go into rice processing because the elderly farmers may not be able to in the farm due to old age or may not be strong enough to be in the farm.

For the successful agricultural programme Government, non-governmental organization and other stakeholder should have organized sensitization and awareness campaigned through the extension agencies, media and mass media to disseminate the information rice processing and production to farmers and co-operatives groups.

Professional extension agent should be train the female processors on how to use the available processing machine in other to reduce a lot of stress and to increase the readiness of the processor to continue processing and to assist produce more rice with better, desirable and palatable quality.

Government, non-governmental organization and politician should carry their constituency project by providing farm tractors, harvesters and other farm facilities to their rice processor farmers in their communities.

References

Adam, A. G., Bidoli, T. D., Ammani, A. A. and Oduehie, T. C. (2018). Gender Participation in Rice Processing Value Chain in kebbi and Sokoto States, Nigeria. Global Journal of Science Frontier Research, Agriculture and Veterinary, 18 (2).

Adesiyan, O. F. (2015). Economic analysis of maize production in Osun State: A case study of Ilesa East and West of Osun State. Journal of Economics and Sustainable Development, 6(9), 268–272.

Afolayan, O. A., Sennuga, S. O., Ezike D. N. andWilberforce, A. G. (2022). Assessment of Inputs Accessibility to Smallholder Farmers in Nigeria: A Case Study of Kuje Area Council, Abuja, International Journal of Advanced Multidisciplinary Research and Studies, 2(2): 322-326

Aluko K. J., Sennuga, S. O. and Emeana, E. M. (2021) Exploring Smallholder Farmers' Perception on the Uptake of Agricultural Innovations in Kuje Area Council, Abuja International Journal of Agricultural Economics.6 (6), 315-323.doi:10.11648/j.ijae.20210606.19

Ayoola, O. T and Makinde, E. A (2014) Fertilizer treatment effects on performance of cassava under two planting patterns in a cassava passed cropping system in south west Nig. Research Journal of Agriculture and Biological Science 3(1): 13-20

Daoui, A. (2018). Which country is the largest producer of Rice in Africa? Retrieved from www.waystocap.com

Ebisike, C., Fadiji, T. O. and Sennuga, S. O. (2021). Awareness and Usage of Information and Communication Technologies (ICTs) among Farmers in Federal Capital Territory, Nigeria. Journal of Current Trend Agriculture Environment Sustainability, 2(1): 1-4.

Egbe, G. D., Sennuga, S. O., Lai-Solarin, W. I. and Adeoye, W. A. (2021). Crop farmers' perceptions on climate change's impact on farm produce in Gwagwalada area Council, Abuja. International Journal of Agriculture Extension and Social Development, 5(1): 15-20

Ezike, D. N., Sennuga, S. O. and Afolayan, O. A. (2022). "Factors Affecting Farmers Adoption of Improved Agricultural Technologies in Cassava Production and Processing in Kuje Area Council, Abuja. Journal of Agricultural Research Pesticides and Biofertilizers, 3(4)

FAO, "Rice Market Monitor. Volume XVI—Issue No. 1," 2013, http://www.fao.org/economic/est/publications/rice-publications/ rice-market-monitor-rmm/en/

Fawehinmi, O. A., and Adeniyi, O. R. (2014). Gender dimensions of food security status of households in Oyo State, Nigeria. Global Journal of Human Social Science 14(1).23-31.

Hadush H. (2015). Production of Upland Rice and Constraints Faced by the Farmers in Tselemti District, Northern Ethiopia. Journal of Poverty, Investment and Development.19

Hassan, S. M. (2014). Pattern and Trend of Rice Production in the Federal Capital territory, Abuja Nigeria Confluence Journal of Environmental Studies, 29 (1): 12-23.

Indahgiju W. D, Sennuga S. O., Bako, H. & Maisule, S. A. (2022). Exploring the Utilization of Cowpea Storage Mechanisms for Post-Harvest Loss Avoidance in Kuje Area Council, Abuja, Nigeria. International Journal of Agricultural Research Pesticides and Biofertilizers, 3(5): 1-6

Jegede, M. E, Sennuga, S. O. & Olorunniyi, A. A. (2021): Factors Influencing the Effectiveness of Improved Soil Management Practices among Rice Farmers in Abuja. Journal Food Science & Nutrition: 1-6 JFSN-117.DOI: 10.46715/jfsn2021.07.1000117

Lai-Solarin W. I., Adeoye, W. A. and Sennuga, S. O. (2021). Technology Adoption Capabilities of Small Farm Dairy Cattle Holders in Gwagwalada, Abuja: Effects of Asymmetric Information and Extension Approaches, International Journal of Agricultural Economics.6 (6): 315-323.doi:10.11648/j.ijae.20210606.19

Matchaya, G., and Chilonda, P. (2012). Estimating effects of constraints on food security in Malawi: policy lessons from regressions quantiles. Applied Econometrics and International Development, 12(2), 165–191.

Montes de O., Munguia, O, Pannell, D. J. and Llewellyn, R. (2021). Understanding the Adoption of Innovations in Agriculture: A Review of Selected Conceptual Models. Agronomy, 11, 139.

Mwangi, M. and Kariuki, S. (2015). Factors Determining Adoption of New Agricultural Technology by Smallholder Farmers in Developing Countries. Journal

of Economics and Sustainable Development, 5 (6): 208- 216

Nimzing, M. M., Sennuga, S. O. and Emeana, E. M. (2022). Analysis of women empowerment in cassava production and processing as a means of household poverty status in Kuje area Council, Abuja. International Journal of Agriculture Extension and Social Development, 5(1): 10-14

Nwalieji, H. U., Madukwe, M.C, Agwu, A.E and Umerah, M. I (2014). Adoption of Rice Technologies Introduced by the United States Agency for International Development in Anambra and Ebonyi States, Nigeria: Journal of Agricultural Extension. 18(1): 158-169.

Obi, G. (2019) Rice Industry Review, consumer and industrial markets KPMG, Nigeria. www.googleweblight.com

Obisesan A. (2014). Gender Differences in Technology Adoption and Welfare Impact among Nigerian Farming Households, MPRA Paper No. 58920.

Ojo, I. H., Sennuga, S.O., Kagbu, J. H. and Omokore, D. F. (2021). Assessment of Women Farmers' Sources of Information on Adoption of Improve Cassava Production Technology in Mopamuro Local Government Area, Kogi State, Nigeria. Journal of Agricultural Economics, Extension & Social Sciences, 4(1): 78 – 85.

Omonona, B. T., Oni, O. A. and Uwagboe, A. O. (2016). Adoption of improved cassava varieties and its welfare impact on rural farming households in Edo State, Nigeria, Journal of Agricultural & Food Information 7(1), 39-55

Oyewole, S. O. and Sennuga, S. O. (2021). Factors Influencing Sustainable Agricultural Practices among Smallholder Farmers in Ogun State of Nigeria. Asian Journal of Advances in Agricultural Research 14(1): 17-24

Parvan, A. (2011). Agricultural Technology Adoption: Issues for Consideration When Scaling-Up. The Cornell Policy Review, 1(1): 1-12

Sennuga, S. O. (2021). Constraints Facing Smallholder Farmers' access to Market: The Case Study of Kaduna State, Nigeria. African Journal of Agriculture and Allied Sciences 1 (1):

Sennuga, S. O., Angba, A. O. and Fadiji T. O. (2020): Adoption of Appropriate Good Agricultural Practices (GAPs) Technologies among Smallholder Farmers in Nigeria, International Journal of Agricultural Research, Sustainability, and Food Sufficiency,03(9): 01-13.

Sennuga, S. O., Baines, R. N., Conway, J. S and Angba, C. W. (2020). Awareness and Adoption of Improved Agricultural Technologies among Smallholder Farmers in relation to the Adopted Villages programme: The Case Study of Northern Nigeria, International Journal of Biology, Agriculture and Healthcare, 10 (6): 34-49.

Sennuga, S. O., Fadiji, T. O. and Thaddeus, H. (2020). Factors Influencing Adoption of Improved Agricultural Technologies (IATs) among Smallholder Farmers in Kaduna State, Nigeria. International Journal of Agricultural Education and Extension, 6(2):382-391

Simtowe F. (2011). Determinants of Agricultural Technology adoption: The Case of Improved Pigeon pea Varieties in Tanzania, Food Policy, 37: 283–295

Toma, L., Barnes, A. P., Sutherland, L. A., Thomson, S., Burnett, F. and Mathews, K. (2018). Impact of information transfer on farmers' uptake of innovative crop technologies: a structural equation model applied to survey data. The Journal of Technology Transfer. (43) 15, 864-881.

Udoh, E. J. and Omonona, B. T. (2018). Improved rice variety adoption and its welfare impact on rural farming households in AkwaIbom State of Nigeria. Journal of New seeds, 9(2), 156- 169.

Umunakwe, P. C., Nwakwasi, R. N., Ani, A. O. Ejiogu-Okereke, E. N. and Nnadi, F. N. (2015). Constraints to the Adoption of Improved Cassava Varieties among Rural Farmers in Imo State, Nigeria. Asian Journal of Agricultural Extension, Economics & Sociology. 6(1):56-63

Wandji D. N., Pouomogne, V., Binam, J. N. and Nouaga, R. Y. (2012). Farmer's Perception and Adoption of New Aquaculture Technologies in the Western Highlands of Cameroon. Tropicultural 3 (3), 180-184