

TECHNO-ECONOMIC ASSESSMENT OF RICE AGRIBUSINESS IN SELECTED STATES OF SOUTHWESTERN NIGERIA

Ige¹, M. M., Baruwa^{*1}, O. I. And Akintelu², S. O.

ABSTRACT

¹Obafemi Awolowo University, Ile Ife, Osun State, Nigeria; ²Samuel Adegboyega University, Ogwa, Edo State, Nigeria.
E-mail: aragbon2005@yahoo.co.uk or ebaruwa@oauife.edu.ng. 8034668829

Rice milling enterprise is critical to agribusiness and is one of the food processing businesses that can serve as a means for conserving foreign exchange in Nigeria. The study assessed the agribusiness environment of the small scale rice-milling industry and the technology capacity of the paddy rice farmers. Multistage sampling procedure was used to select 50 respondents comprising 25 paddy rice farmers, and 25 rice millers. The result showed that men played dominant roles in paddy rice farming, 90% of the rice farmers had put in at least ten years and above. About 26% of respondents were illiterates, 36.6% of farmers practiced mixed farming. Most (76.4%) of them used their own seed, 47% of farmers employed "from the top" while the remaining 53% used "from the bottom" for harvesting. Many of the farmers employed different parboiling and drying methods which led to variation in the quality of the milled rice. The results also revealed that about 49% of the millers were above 50 years old, 96.2% were male, and 86.3% of the enterprises were owned by sole-proprietors. The implication of these findings as they relate to increase rice production and the economic well-being of the stakeholders is discussed.

INTRODUCTION

Agricultural development in Nigeria has been supply driven focusing primarily on the generation of technology and transfer. Agriculture remains a key component of the Nigerian economy contributing about 30.9% to the GDP and employs about 70% of the total labor force. Similarly, agriculture constitutes the single largest contributor to the well-being of the rural poor, sustaining 90% of the rural labor force (CARD, 2010). Rice is an important food crop and serves as a food security commodity in Nigeria (NCRI, 2009). Rice sector being a critical sub-sector of agricultural sector can serve as a means of conserving foreign exchange and improve the nation economy. Micro-enterprises, especially, those involving pre and post-harvest handling activities of agricultural materials have become major component of the economies of developing countries such as Nigeria (Osunbitan, et al., 2000). Based on this assertion, development of food processing industries in Nigeria will not only improve food supplies but also reduce imports. Such move will contribute to increase self-reliance by reducing food losses, adding value to the raw materials, increasing export earnings, raising employment levels and improving incomes (ODA, 1994). It will also ensure better market opportunities, stimulate production and rural development, reduce urban migration, improve nutrition standards and stimulate the allied sectors of the economy. Thus, the country can derive lots of benefits through the promotion of food processing industries, most especially the small-scale enterprises. One of such important and promising small-scale food processing industries in Nigeria is rice-milling enterprise.

Presently, market observation show that poor quality and unreliable supply of local rice are the two major problems faced by rice consumers in Nigeria, where rice consumption has increase at unprecedented rate (Ige, 2008). The quality levels that an organization can afford to either design or build into its product is dependent on extent to which it can conform to an 'agreed specification'. The degree to which the resultant product conforms to specifications will in turn be influenced by capability of the conversion process.

The usage of technology has revolutionized the activities and behavior of mankind. It is the know-how, physical things, and procedures used to produce products and services. Technology is also an important tool used to monitor the production and manufacturing process, thus improving quality management and ensuring compliance with environmental standards. In addition to the global market place, technological changes are very significant factors encouraging organization to be more competitive especially those for which technology is a key factor of success. Technology has unarguably become central to the industrialization process; hence, it should be understood thoroughly. One way of comprehending technology fully is to decompose it into its commonly identifiable components for conversion of inputs to marketable outputs.

All the components of technology interact dynamically and are required simultaneously for successful performance of an enterprise. Ogunfowora (2007) buttressed that improvement in all aspect of processing technologies and marketing is the key to move the Nigeria rice industry to higher levels of technical efficiency. Hence, the objective of this work is to provide some general information about agribusiness in rice production that

will be useful to project planners, government and other relevant agencies with the various components of technology in view.

MATERIALS AND METHODS

Area of study

This study was carried out in Ekiti and Osun States both in southwestern part of Nigeria. The two States were selected based on a prior knowledge that they were notable rice producing States among others (Fasola *et al.*, 2006). The climate and vegetation of the States are such that they enjoy a tropical climate with two distinct seasons. These are the rainy season (April – October) and the dry season (November – March). Temperature ranges are 21 °C and 28 °C with high humidity. The topography of the States is mainly an upland zone, rising about 250 meters above sea level. The land surface is generally undulating with a characteristic landscape that consists of old plains broken by steep-sided rocks that may occur singularly or in groups or ridges (Carim, 2002). Rice is one of the most important arable crops grown in the area.

Sampling procedure

A two-stage sampling technique was employed in this study, with elements of purposiveness and random selection. Twenty five paddy rice farmers were selected from each of the States using purposive sampling techniques with the assistance of the extension service workers of the Agricultural Development Programme (ADP) based on the prominence. Twenty five rice mill managers that were getting their raw material supplies from the paddy rice farmers in each of the States were identified and randomly selected for the second stage.

Data collection and analysis

Two types of questionnaire were designed according to functions performed by the paddy rice farmers and rice millers. The questionnaire for the paddy rice farmers was designed to elicit information on socio-economic characteristics of the farmers, variety of rice planted and other agronomic and rice processing practices. The second questionnaire schedule were administered on the rice millers to elicit information on socio-demographic characteristics of the mill managers, varieties processed, quality problems during processing, current different processing and techniques, quality management practices. Descriptive statistics was used to analyze the data generated from the study.

RESULTS AND DISCUSSION

Socio economic characteristics of the paddy rice farmers

Age distribution of the paddy rice farmers

Majority (69%) of the paddy rice farmers were adults between 45 and 59 years of age (Table 1). About 13% of them were middle aged, that is, between 35 and 39 years of age. A few (7.4%) of the total respondents were under 20 years of age. Some of them probably employed as helping hands to assist parents after completion of their primary or secondary school education. These results have implications for productivity. Age is a very important parameter used in measuring the productivity and efficiency of farmers. It is assumed that young, active and virile farmers will be more productive than older farmers. Agwu (2009) and Ibitoye *et al.* (2014) showed that the enterprise is dominated by the younger ones who are more active and stronger. Fiamohe *et al.* (2014) also showed that farmers above 40 years constituted 94% and 70% of the farming population in the rain forest and savanna agro ecological zone of Nigeria respectively. According to them, older farmers controlled larger farm holdings but cultivated about the same as or less farm size than younger farmers. The results also indicated that farming business was not attractive to the young school leavers.

Table 1: Age distribution of paddy rice farmers

Age (Years)	Igbemo Frequency (%)	Ikole Frequency (%)	Osun Frequency (%)	All Respondents Frequency (%)
Under 20	4 (28.57)	-	-	4(7.41)
20 – 24	2 (14.29)	-	-	2 (3.70)
25 – 29	1 (7.14)	-	-	1 (1.85)
30- 34	-	1 (16.67)	2 (5.88)	3 (5.56)
35 – 39	1 (7.14)	1 (16.67)	5 (14.71)	7 (12.96)
40 – 44	-	-	-	-
45 – 49	1 (7.14)	1 (16.67)	22 (64.71)	24 (44.44)
50 – 54	5(35.71)	3 (5.0)	5 (14.71)	13 (24.07)
Above 55	-	-	-	-
Total	14 (100)	6 (100)	34 (100)	54 (100)

Source: Field survey, 2015

Sex distribution of paddy rice farmers

About 69% of paddy rice farmers (both from Ekiti and Osun States) were male while 31% were female (Table 2). No female paddy rice farmer was recorded in Ikole, a processing center in Ekiti State. However, female constituted majority (64%) of the paddy farmers at Igbemo and in Ekiti State compared to 36% male paddy rice farmers. These results showed that men still played dominant roles in paddy rice farming enterprises in the study areas. However, previous studies on contributions of Nigerian women to agriculture showed that rural women had made considerable contribution to food production (Usman 2009; Ibitoye *et al.*, 2014 and Nasiru, 2014). Ibitoye *et al.*, (2014) also affirmed that females constitute majority of rice processors, having 84.4% while males involved in the enterprise were 15.6%. Ekwumankama, (2000) reiterates that women play active roles in the processing of agricultural produce. Usman (2009) and Basorun (2013) in their separate studies also confirmed that more females are in rice processing and marketing.

Table 2: Sex distribution of Paddy rice Farmers

Farmers' locations	Male Frequency (%)	Female Frequency (%)	All Respondents Frequency (%)
Igbemo	5(13.16)	9(52.94)	14(25.45)
Ikole	6(15.29)	-	6(10.91)
Osu	27(71.05)	8(47.06)	35(63.64)
Total	38 (100)	17(100)	55(100)

Source: Field survey, 2015

Experience of the respondents in paddy rice farming

The results on years of experience of farmers on paddy rice farming showed that about 90% of them had been in rice farming business for ten years and above (Table 3). About 33% of them had put in more than 20 years. The results implied that most paddy rice farmers in the study areas were highly experienced in paddy rice farming activities. Skill acquisition and competence are expected to increase with the year of experience. However, rice quality and years of experience of the processors were weakly correlated ($r = 0.02$). This shows that the years of experience of the processors has no effect on the quality management practices adopted by the farmers.

Table 3: Years of experience of the respondents in paddy rice farming

Experience (Years)	Igbemo Frequency (%)	Ikole Frequency (%)	Osu Frequency (%)	All Respondents Frequency (%)
< 1 year	-	-	-	-
5 – 9	3(21.43)	-	2(6.25)	5(9.62)
10 – 14	1(7.14)	3(50)	10(31.25)	14(26.92)
15 – 19	1(7.14)	1(16.67)	5(15.63)	7(13.46)
20 – 24	2(14.29)	-	7(21.88)	9(17.31)
25 – 29	-	1(16.67)	2(6.25)	3(5.77)
30 – 34	1(7.14)	1(16.67)	1(3.13)	3(5.77)
35 – 39	-	-	-	-
≥40 years	2(14.29)	-	-	2.(3.85)
Total	14(100)	6(100)	32(100)	52(100)

Source: Field survey, 2015

Educational level of paddy rice farmers

Table 4 showed that 26% of the respondents were illiterates who had no formal education, while about 43% proceed beyond first school leaving certificate. About 46% had either Modern school or Secondary school leaving certificates. Only 11% of the respondents had higher degrees such as OND, HND or B.Sc. It can be inferred from these results that low level of formal education would be an impediment to technological capability development or adoption of new farming technologies by the farmers. This factor can greatly influence the quality of farmers' output as they will not have where to institute a good quality control system or total quality management.

Types of rice ecosystems practiced

Majority(44.4%) of paddy rice farmers practiced on swamp ecosystem, 31.5% rice farmers practiced on upland ecosystem, 16.7% practiced on lowland farming and 7.4% of the farmers practiced on irrigated system (Table 5). The reason for low use of the irrigation could be attributed to high cost of irrigation system which most of the farmers could not afford because it is capital intensive.

Table 4: Educational level of paddy rice farmers

Educational level	Igbemo Frequency (%)	Ikole Frequency (%)	Osu Frequency (%)	All Respondents Frequency (%)
No formal edu.	4(26.67)	2(33.33)	8 (24.24)	14(25.93)
Primary school	2(13.333)	1(16.67)	6(18.18)	9(16.67)
Modern school	-	1(16.67)	9(27.27)	10(18.52)
Secondary	9(60.00)	1(16.67)	5(15.15)	15 (27.78)
Tertiary	-	1(16.67)	5(15.15)	6(11.1)
Total	15(100)	6(100)	33(100)	54(100)

Source: Field survey, 2015

Table 5: Types of rice ecosystem practiced by paddy farmers

Rice Ecosystem	Igbemo Frequency (%)	Ikole Frequency (%)	Osu Frequency (%)	All Respondents Frequency (%)
Upland	1(7.14)	6(100)	10(29.41)	17(31.48)
Swamp	-	-	24(70.59)	24(44.44)
Irrigated	4(28.57)	-	-	4(7.41)
Lowland	9(64.29)	-	-	9(16.67)
Other	-	-	-	-
Total	14(100)	6(100)	34(100)	54(100)

Source: Field survey, 2015

Farm management practices

The agronomic practices by paddy rice farmers showed that most (76.4%) of the farmers used their own seeds (Table 6). About 21.8% of the respondents got their seeds through the agricultural development extension service of Agricultural Development Programme (ADP). Harvesting of paddy rice was carried out by almost (98%) all the farmers manually. About 38.0% of the farmers did not use harvesting machine because they could not afford the high cost of the harvester while the remaining 62.0% did not get the harvester to buy. About 68.0% of the farmers employed knives for harvesting while the remaining 32.0% used sickles. There are two distinct methods of harvesting: harvesting "from the top" and harvesting "from the bottom". About 47% of farmers employed the first technique while 53% used the other method.

Harvesting from the top involves grasping six or eight heads and cutting them from the stalk about one or two inches below the head. Depending on the stage of ripeness of the head, little shattering occurs and all of the straw is left on the field. Also selective harvesting can be practiced with the laborers going over a field several times. Harvesting from the bottom consists of grasping a handful of stem and cutting them about two to three inches above the surface of the soil. Two or three times more heads are gathered per cut when harvesting from the bottom rather than from the top. However, because of uneven maturation of the heads, some are over ripe and shatter while some are immature and subsequently either mold before threshing or produce lightweight and shriveled kernels. The stalks and attached heads are piled at various spots throughout the field.

After cutting and piling exercise, the grain is threshed by beating with sticks. Close to 93% of the farmers beat grains with sticks while the remaining 7% trampled on the collection. Either practice, if care is not taken could lead to substantial grain wastages. In addition, the grain may contain broken or whole pieces of weed seeds, chaffs, stones and insects. If harvested grain is to be dried and stored, it should be clean for better drying. It is obvious, when the harvest is to be sold, a clean homogeneous product will get a premium. For example, the Marketing Board pays a price differential for various kernels. The benefits are even more, when the product is to be used on the farm e.g. rice for planting. A clean sample of seeds from which weed seeds have been removed to give higher yields, lower cultivation costs, and reduced weed control practice and with a uniform grade of seeds, drills and planters will perform better and more.

The drying of paddy rice is carried out by all the farmers (100%) through sun-drying possibly because it is a more convenient and cheaper method than the artificial drying. However, this procedure is slow and not always reliable especially during raining season and cloudy weather. It is important to regulate the rate of drying of the grains to avoid setting up excessive moisture gradients within the grain. During drying, the grains are spread thinly on hard earth surface, mats, concrete or tarpaulins and exposed to the sun. Many of the farmers (40.4%) in the study areas used tarpaulins for spreading the grains, while 25.0%, 21.2% and 13.5% employed concrete surface, hard earth surface and mats as spreading materials respectively (Table 6). It is at this stage that the produce could become infested or contaminated with foreign materials such as stones, soil, rice straws, stalks, nails, trash etc.

With respect to parboiling in the study areas, many of the farmers parboiled their paddy rice employing different parboiling methods. Many (67.6%) of the farmers parboiled their rice by steeping in warm water while 8.1% steeped in cold water. Some of the farmers (16.2%) parboiled for few hours while 4.0% of them parboiled for longer hours.

Table 6: Farm management practices by paddy rice farmers

Source of seed	Igbemo Frequency (%)	Ikole Frequency (%)	Osu Frequency (%)	All Respondents Frequency (%)
Agric-Extens	1(7.14)	1(20)	10(27.78)	12(21.82)
Own seed	12(85.71)	4(80)	26(72.22)	42(76.36)
Winnowing	1(7.14)	-	-	1(1.82)
Total	14(100)	5(100)	36(100)	55(100)
Harvest Method				
Manual	14(93.33)	6(100)	34(100)	54(98.18)
Machine	1(6.67)	-	-	1(1.82)
Total	15(100)	6(100)	34(100)	55(100)
Why Not machine				
Cost High	7(70.00)	3(75.00)	9(25.00)	19(38.00)
Not available	(30.00)	1(25.00)	27(75.00)	31(62.00)
Total	10(100)	4(100)	36(100)	50(100)
Harvesting instrument used				
Sickle	-	2(40)	15(44.12)	17(32.08)
Knife	14(100)	3(60)	19(55.88)	36(67.92)
Total	14(100)	5(100)	34(100)	53(100)
Harvesting method				
From top	13(92.86)	3(100)	9(25.00)	25(47.17)
From bottom	1(7.14)	-	27(75.00)	28(52.83)
Total	14(100)	3(100)	36(100)	53(100)
Threshing				
Beat with stick	14(93.33)	2(40)	34(100)	50(92.59)
Tramp on the collection	1(6.66)	3(60)	-	4(7.41)
Total	15(100)	5(100)	34(100)	54(100)
Drying Method				
Sun drying	14(100)	5(1000)	33(100)	52(100)
Mechanical drying	-	-	-	-
Total	14(100)	5(100)	33(100)	52(100)
Materials used for spreading grains				
Tarparlins	-	-	21(67.74)	21(40.38)
Concrete	6(37.5)	4(80)	3(9.68)	13(25.00)
Mats	-	-	7(22.58)	7(13.46)
Hard earth surface	10(62.5)	1(20)	-	11(21.15)
Total	16(100)	5(100)	31(100)	52(100)
Parboiling methods				
Steep in warm water	17(65.38)	2(25.00)	31(77.5)	50(67.57)
Steep in cold water	-	-	3(7.5)	6(8.11)
Steep for few hours	7(26.92)	1(12.5)	4(10)	12(16.22)
Steep for many hours	1(3.85)	-	2(5)	3(4.05)
Steep up to a day & above	1(3.85)	2(25.00)	-	3(4.05)
Total	26(100)	8(100)	40(100)	74(100)

Source: Field survey, 2015

Also 4.0% of the farmers parboiled up to a day or above while the rest employed a variety of other methods (Table 6). Most (56.6%) of the farmers used water from rivers for steeping or steaming, while 24.5% employed well water and 18.9% employed tap water. Use of dirty water from streams or well water for parboiling could be a source of infestation and contamination of rice products. Also these could account for the bad taste odor and coloration usually associated with rice and products. There was no systematic quality management practices carried out by the farmers, this resulted to a tremendous variation in the quality of products in the market.

Socio-economic characteristics of rice millers

About 49.0% of the millers were 50 years old and above, while 6.1% of the millers were below 30 years of age (Table 7). Almost 45% of the millers were middle aged between 30 and 49 years of age. These results are similar to those earlier reports on paddy rice farmers' in this study. The results showed that millers were either middle

aged group or old people. These have implication on farmers or millers productivity. Most (96.2%) of the millers were male against 3.9% female. This indicates that rice-milling enterprise is more male friendly. Generally, tasks are allocated along gender lines. Women were probably employed to assist men who were the main millers. Results on years of experience of the millers showed that majority (96%) of the millers had between 1 to 34 years of rice milling experience. Quite a few (4.1%) had less than 1 year of experience. These results showed that young people were not attracted to rice milling business in the study areas, who probably do not view it as a source of sustainable livelihood. About 19.2% of the rice millers had no formal education while 17.3% did not proceed beyond primary school leaving certificate. Forty two percent of the millers had either modern school or secondary school leaving certificates while 21.2% of the respondents had tertiary education.

Table 7: Rice millers' socio-economic characteristics

Age Distribution	Igbemo Frequency (%)	Ikole Frequency (%)	Osu Frequency (%)	All Respondents Frequency (%)
< 20yrs	1 (7.69)	-	-	1 (2.04)
20-24	-	1 (20)	-	1 (2.04)
25-29	1 (7.69)	-	-	1 (2.04)
30-34	2 (15.38)	1 (20)	-	3 (6.12)
35-39	1 (7.69)	-	1 (3.23)	2 (4.08)
40-44	2 (15.38)	1 (20)	8 (25.81)	11 (22.45)
45-49	1 (7.69)	-	5 (16.13)	6 (12.24)
50-54	2 (15.38)	1 (20)	11 (35.48)	14 (28.570)
55-59	2 (15.38)	-	4 (12.90)	6 (12.24)
≥60yrs	1 (7.69)	1 (20)	2 (6.45)	4 (8.16)
Total	13 (100)	5 (100)	31 (100)	49 (100)
Sex				
Male	13 (92.86)	6 (100)	31 (96.88)	50 (96.15)
Female	1 (7.14)	-	1 (3.13)	2 (3.85)
Total	14 (100)	6 (100)	32(100)	52 (100)
Years of Experience				
< 1 year	1 (7.69)	1 (16.67)	-	2 (4.08)
1-4	1 (7.69)	1 (16.67)	-	2 (4.08)
5-9	2 (15.38)	-	-	2 (4.08)
10-14	1 (7.69)	2 (33.33)	3 (10.00)	6 (12.24)
15-19	3 (23.08)	1 (16.67)	6 (20.00)	10 (20.41))
20-19	1 (7.69)	1 (16.67)	12 (40.00)	14 (28.57)
25-29	3 (23.08)	-	2 (6.67)	5(10.20)
30-34	-	-	6 (20.00)	6 (12.24)
35-39	-	-	1 (3.33)	1 (2.04)
≥40 years	1 (7.69)	-	-	1 (2.04)
Total	13 (100)	6 (100)	30 (100)	49 (100)
Education Level				
No formal	1 (6.25)	1 (16.67)	8 (26.67)	10 (19.23)
Primary	3(18.75)	-	6 (20.00)	9 (17.31)
Modern	4 (25.00)	3 (50.00)	1 (3.33)	8 (15.38)
Secondary	6 (37.50)	1 (16.67)	7 (23.33)	14 (26.92)
Tertiary	2 (12.50)	1 (16.67)	8 (26.67)	11 (21.15)
Total	16 (100)	6 (100)	30 (100)	52 (100)

Source: Field survey, 2015

Rice miller's business characteristics

Table 8 showed that majority (86.3%) of the enterprises were owned by sole-proprietors while 9.8% engaged in partnership, about 2% were government owned or cooperative societies. The result further showed that personal savings constituted major source of funding for most of the entrepreneurs (40%) while personal saving plus borrowing accounted for 48%. All the millers interviewed did not take loan. About 4.0% and 8.0% used their inheritance money in addition to personal savings for capitalization. These results showed that millers generally had very low potential for economies of scale not only due to poor capitalization but also due to low level of technology employed by them. Majority (90.4%) of the millers had rice milling as primary occupation but all in addition still had secondary occupations as a result of seasonal nature of paddy rice production and supply. They indicated that milling activities were usually between the months of August and November, a time not adequate

for full time job. This situation normally compelled them to engage in other occupations in addition to rice milling business and marketing.

These miller also processed other food items such as maize, cassava, palm kernel, yam etc. Most (94%) of them claimed that they process between two and five varieties of paddy rice. The fact that these millers processed rice from different sources as well as more than one variety at a time gives concern with respect to the purity of raw material processed. This situation would definitely create some problems in subsequent processing. A mixture of varieties could cause difficulties at milling and usually results in reduced capacity, excessive grain breakage and lower milled rice recovery. Different sizes and differently shaped grains make it more difficult for the adjustment of the hullers and polishers to produce whole grains. This resulted in low initial de-hulling efficiencies, a higher percentage of recirculated paddy, non-uniform whitening and lower grade of milled rice (Lull, 1980, and Grist, 1986).

Table 8: Rice miller's business characteristics

	Igbemo Frequency (%)	Ikole Frequency (%)	Osu Frequency (%)	All Respondents Frequency (%)
Ownership of Milling Business				
Sole	8 (57.14)	5 (83.33)	31(100)	44 (86.27)
Partnership	5 (35.71)	-	-	5 (9.80)
Cooperative	1 (7.14)	-	-	1 (1.96)
Govt. owned	-	1 (16.67)	-	1 (1.96)
Others	-	-	-	-
Total	14 (100)	6 (100)	31 (100)	51 (100)
Sources of initial Capital				
Own savings	11 (68.75)	1 (33.33)	8 (25.81)	20 (40.00)
Borrowed	-	-	-	-
Inheritance	2 (12.50)	-	-	2(4.00)
Own saving + inheritance	-	-	4 (12.90)	4(8.00)
Own savings + borrowing	3 (18.75)	2 (66.67)	19(61.29)	24(48.00)
Bank loan	-	-	-	-
Total	16 (100)	3(100)	31 (100)	50 (100)
Rice milling is the primary Occupation				
Yes	11 (78.57)	5 (83.33)	31(96.88)	47(90.38)
No	3 (21.43)	1 (16.67)	1(3.13)	5(9.62)
Total	14 (100)	6 (100)	32 (100)	52 (100)
No of varieties processed				
1	1 (7.14)	-	-	1(2.00)
2	8 (57.14)	3 (60.00)	5(16.13)	16(32.00)
3	3 (21.43)	2 (40.00)	7(22.58)	12(24.00)
4	-	-	14(45.16)	14(28.00)
5	2 (14.28)	-	3(9.63)	5(10)
6	-	-	1(3.23)	1(2.00)
7	-	-	-	-
8	-	-	1(3.23)	1(2.00)
Total	14 (100)	5 (100)	31 (100)	50 (100)

Source: Field survey, 2015

Rice milling management practices

With respect to threshing, Table 9 showed that majority (80%) of the millers threshed by beating paddy with hard sticks, while 20% of respondents threshed by trampling on the rice collection. As a result of the primitive technology employed in threshing, the grain processed may contain broken or whole pieces of weed seeds, chaffs, stones, rice straws, insects etc. If harvested grain is to be dried and stored, it will be better to clean it for better drying. Unclean paddy increases the time taken to clean and process the grain. Foreign matter in the grain reduces milling recoveries and the quality of rice and also increases the wear and tear on milling machinery (Luh, 1980 and Ige and Fred-Okon, 1982). All the paddy rice farmers/millers sun-dried their paddy after parboiling milling on the open. This is a very convenient and cheap method for the millers but it also requires time and some effort to spread and collect the produce. In sun drying, care should be taken to eliminate dust and dirt which represents extraneous materials that accelerate deterioration by permitting an increase in moisture content and fungal contamination. Sun-dried temperature in the tropics varies but it may be assumed that produce spread on mats in a layer not thicker than about 5 centimeters receives a drying temperature of about 30-36°C which is insufficient to kill insects present in the grains. The millers employed varying parboiling techniques. Many of the

millers soaked in either hot water or cold water while others steamed for 5 to 20 minutes. The type of parboiling treatments employed can influence the quality of the milled grains as well as their susceptibility to infestation by insects. For example, prolonged soaking as employed by 86% of the millers is undesirable except it is carried out at temperatures that prevent the development of bacteria. During parboiling, the soaking stage may be responsible for development of off flavor due to the growth of yeast and bacteria in the water.

Table 9: Rice processing techniques

Threshing	Igbemo Frequency (%)	Ikole Frequency (%)	Osu Frequency (%)	All Respondents Frequency (%)
Beat paddy with hand sticks	11 (52.38)	1(50)	32(100)	44(80)
Trampling on the collection	10(47.62)	1(50)	-	11(20)
Others	-	-	-	-
Total	21(100)	2(100)	32(100)	55(100)
Drying				
Sun drying	15(23.57)	2(66.67)	31	48(55.17)
Mechanical	-	-	-	-
Under shade	-	-	-	-
In the open	13(46.43)	1(33.33)	25	39(44.83)
Total	28(100)	3(100)	56(100)	87(100)
Parboiling method				
Soaking in cold water	4(22.22)	-	5(14.29)	9(16.36)
Soaking in hot water	10(55.56)	1(50)	-	11(20.00)
Steaming	1(5.56)	1(50)	25(71.43)	27(49.09)
Boiling	3(16.67)	-	5(14.29)	8(14.55)
Total	18(100)	2(100)	35(100)	55(100)
Equipment for parboiling				
Kettle	-	-	-	-
Drum	14(100)	2(100)	29(100)	45(100)
Total	14(100)	2(100)	29(100)	45(100)

Source: Field survey, 2015

Parboiling was carried out in old gallon oil drums cut in half by all respondents. The milling machines employed by the millers were of various types. These included Engle-Berg, Lewis Grant mills, John Holt, Grantex, Grantex F-2B, etc. These were mainly rice milling machines but could process some other foodstuffs such as palm kernel, dried yam, coffee among others. The milled rice is piled on woven mats outside of the entrance to the mill building and sold to rice wholesalers. The unit of sale is the head pan. The winnower of the mixture of hulls and bran is carried out behind the building by children or women to recover the small and broken grains. Huge mounds of this material are found behind each mill building. This waste material can be utilized as fuel for parboiling. Results of the survey on the Total Quality Management (TQM) based practices related to its core elements that were implemented by the respondents showed that they were poorly rated. These included teamwork (7.7%), customer-supplier relationship (10.7%) and customer-focus (19.2%) among others.

CONCLUSION AND RECOMMENDATIONS

Based on the major findings from the study the following conclusions and recommendations were made: (1) Agro-allied food sector in Nigeria needs the intervention and support of governmental and non-governmental institutions.(2) The young school leavers should be provided with relevant training and motivational programmes that would make agro-allied attractive to them. This will also sensitize the would-be processors to know their capability in operating processing machine. (3) Post milling operations should include separation of broken grains, colour sorting, fortification with B-vitamins (i.e. thiamine, riboflavin and niacin) and iron.(4) The use of hand and animal operated tools and implements as well as motorized equipment should be encourage this will reduce human efforts, drudgery and improves timeliness and quality of various farm operations and the products.

REFERENCES

- Agwu, N. M. 2009. Determinants of profitability among plantain marketers in Abia State, Nigeria, *Nigerian Journal of Development Studies*, 7(1): 49–58.
- Basorun, D. 2013. Assessing the significant factors influencing the location of rice marketers in Igbemo region, Nigeria. Unpublished Ph.D. thesis submitted to Federal University of Technology, Akure, Nigeria. 250p

- Carim, A. 2002. Analysis of Economic Efficiency of Male and Female Rice Farmers in Ekiti State, Nigeria. Nigerian Institute of Social and Economic Research (NISER) Monograph Series No.15, 2002.
- Coalition for African Rice Development (CARD) 2010. Report on the support workshop related to the national rice development strategies for card second group countries *Held at the Africa Rice Center, Cotonou, Benin 05–09 July 2010*
- Ekwumankama, O. O. 2000. Participation of rural women in livestock marketing in Ikwuano area, Nigeria, in proceedings of 12th annual conference of the Nigerian society of animal production, pp. 375 – 376.
- Fasola, O. O., Oladele O., Aliyu, J., Wakatsuki, T., 2006. Dissemination of Sawah rice technology to farmers cultivating inland valleys in Nigeria . Water initiative in Nigeria.
- Fiamohe, R., Nakelse, T., Seck, P. A., Diagne, A. 2014. Assessing the effect of consumer purchasing criteria for types of rice in Togo: A choice modelling approach. *Agribusiness:an International Journal*. In press.
- Grist, D. H. 1986. Rice, Longman, 6th Edition. Web site: <http://www.fao.org/catalog/inter-e.htm>
- Ibitoye, S. J. Idoko, D. and Shaibu, U. M. 2014. Economic assessment of rice processing in Bassa Local Government Area of Kogi State, Nigeria. *Asian journal of basic and applied sciences*. 1(2): 8-17
- Ige, M. T. and Fred-Okoro, I. 1982. Studies of the factors affecting the local and improved methods of processing rice. *Nigeria Journal of Engineering Technology* 5(1):118-126.
- Ige, M. M. 2008. “Effect of total quality management on the quality of locally processed rice in Southwestern Nigeria” Unpublished Ph.D Thesis, Technology Planning and Development Unit, Obafemi Awolowo University, Ile-Ife.
- Luh, B. S. 1980. Rice production and utilization B. S. Lul Ed. AVI Publishing Co. Westport, Connecticut.
- Morris, H. E. 1994. Gender and economic adjustment in sub-saharan Africa: findings of Africa report, draft, no. 9. Washington, DC World Bank, 1994.
- Nasiru, A. 2014. Socio-Economic Factors Influencing the Adoption of Improved Rice Processing Technologies by Women in Jigawa State, Nigeria. Unpublished M.Sc. Thesis Submitted to the Department of Agricultural Economics and Rural Sociology, Ahmadu Bello University, Zaria-Nigeria
- National Cereal Research Institute, 2009. *Training manual on Rice processing*. March 2010.
- Overseas Development Administration (ODA), 1994. Technology for rural livelihoods: Current Issues for engineers and social scientists. In: Proceedings of a workshop, Natural Resources Institute September 6-7
- Ogunfowora, O. 2007. Financial analysis of parboiling and milling techniques in Kura, Kano corridor. Promoting pro-poor opportunities through commodity, and service market (Prop corn) 40. Mississippi. Street, Maitama, Abuja, Nigeria.
- Osunbitan, J. A., Olushina, J. O., Jeje, J. O., Taiwo, K. A., Faborode, M. O. and Ajibola, O. O. 2000. Information on micro-enterprises involved in cassava and palm oil processing in Osun and Ondo states of Nigeria. *Technovation*, 20(10): 577-585
- Usman, R. K. 2009. Problems Associated with Marketing of some selected grains in Bosso Local Government Area of Niger State. *Journal of Agricultural Extension*, 13(2): 55-63