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CONSTRAINTS TO RICE MILLING IN SOKOTO STATE: ARE THE SOCIO-ECONOMICS, MILLING TECHNOLOGIES AND LACK OF TRAININGS RESPONSIBLE FACTORS?

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ABSTRACT

This study assessed the constraints of rice milling in Sokoto State, Nigeria. Multistage sampling technique was used to arrive at the sample size of 120 rice millers in the study area. Structured questionnaire was used to elicit data for the study using interview questionnaire administration method. Data generated was analyzed using descriptive (frequency counts, percentages, mean and standard deviation) and inferential (linear regression) statistics. Findings of the study reveal that majority (87.5%) of the rice millers were males in their active and productive ages (25.6 years) out of who most (63.3%) were single. Results of the study further revealed that almost all the technologies used for parboiling of rice was locally fabricated as such 57.5% of the millers used half-cut engine oil drums for steaming, 78.81% of the millers used firewood as source of energy for steaming, old rice packaging sacs were used for drying of the rice by 95.83% of the millers while the dried rice was milled with the use of obsolete electric powered milling machines by 90% of the millers. Findings of the study also reported that majority (93.3%) of the millers were trained through apprenticeship, and the common constraints faced by the millers included lack of steady electricity supply, use of obsolete milling machines and water supply. Hypotheses tests results revealed a significant relationship ($P<0.05$) between the constraints faced by the rice millers and technologies and trainings provided to the operators of the milling technologies in the study area.

Keywords: Constraints Faced, Rice millers, Socio-economics, Technologies, Trainings.

1. INTRODUCTION

1.1 Background to the Study

Rice is the seed of the grass species *Oryza sativa* (Asian rice) or *Oryza glaberrima* (African rice). As a cereal grain, it is the most widely consumed staple food for a large part of the world's human population, especially in Asia. It is the agricultural commodity with the third-highest worldwide production of about 741.5 million tonnes. Rice is one of the oldest cereal grains and believed to have been grown for at least 5000 years. Rice is a staple food for more

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than half of the world's population, particularly those living in southern and eastern Asia, Europe and Africa (IRRI, 2017).

There are two common types of rice worldwide, the white and the brown type. White rice is the most commonly consumed type, but brown rice is becoming increasingly popular in some western countries due to its health benefits. Various products are made from rice and these include rice flour, rice syrup, rice bran oil, and rice milk. Rice is a type of grain that is eaten as staple food in many parts of the world. It is grown in warm parts of the world, mainly Asia, Africa, northern Italy, and the west coast of North America. Rice used to be the main diet in many countries and usually eaten in cooked form. It is a fundamental food in many cuisines around the world and it is an important cereal crop that feeds more than half of the world's population. In addition to its consumption, rice has some health benefits and which included its ability to provide instant energy, regulate and improve bowel movements, stabilize blood sugar levels, and slow down the aging process. It also plays a role in providing vitamin B1 to the human body and other benefits include its ability to aid in skin care, boost the metabolism, aid in digestion, reduce high blood pressure, help in weight loss, boost the immune system, and provide protection against dysentery, cancer, and heart diseases (Organic Facts, 2017).

The benefits of rice can be found in more than forty thousand of its varieties available throughout the world. The two main categories of the crop are whole grain and white rice. Whole grain is not that processed, so it is high in nutritional value, whereas white rice is processed so that the bran or outer covering is removed, leaving it with fewer nutritional value. People choose different types of rice depending on their culinary needs, availability, and the potential health benefits as well.

Rice is one of the staple foods of the people of the study area and it's mostly grown in both upland and lowland (Fadama land). Processed rice is the only grain food that was acknowledged by the people as simple and could be cook and put on table without other additional processing costs. When compared to additional cost of processing before cooking, rice is termed as the cheapest foodstuff in Sokoto state. But the problem associated with the crop was lack of proper processing procedure (milling) that leads to a clean and sorted product that enhances its palatability to the consumers. This is because locally produced rice in Nigeria at present is uncompetitive in the market because its value chain is fragmented and cannot offer a standard. The locally processed rice is fraught with poor quality- presence of extraneous materials such as stones and debris because all the operations are done manually and cost of production is also high.

Rice crop is being process in the study area locally using rudimentary facilities that are obsolete and could not lead to the production of palatable products. In most cases, the product is full of stones, husks, unpalatable materials, odd colours and broken head/rice ratios. According to Ogunforowa (2007) the efficiency of parboiling and milling systems of rice determines the broken/head rice ratio, which in turn impacts the quality and, consequently, the price of milled rice. The method of drying, as well as post parboiling storage before milling, affect milling and

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broken/ head rice ratios. Shade drying and post parboiling storage before milling have also been reported to affect the proportion of broken/head rice ratios. These odd appearances of the product made most of the people to opt for foreign product that was known to be less in nutritive contents compared to the locally processed rice. Based on Ogunforowa (2007) the quality of the local rice still remains a major concern for the future of the Nigerian rice sector.

Previous rice sector studies have identified poor physical appearance and cleanliness as the major problems of the rice delivered to the Nigerian markets. In consequence, the demand for better quality imported rice had been increasing steadily over the last two decades, creating rice supply-demand gaps. This is because milling is a crucial step in post-production of rice and its basic objective is to remove the husk and the bran layers, and produce an edible, white rice kernel that is sufficiently milled and free of impurities. Depending on the requirements of the customer, the rice should have a minimum number of broken kernels.

It's against this background that this study analyzed some factors responsible for improper milling of rice in the study through providing answer to the following objectives: a) describe the socio-economic characteristics of the rice millers (b) assess the milling technologies used by the processors (c) determine the trainings provided to the processors on rice processing and (d) find out the constraints faced by the processors in the study area.

Hypotheses

i. No significant relationship between the constraints faced in rice milling in the study area and technologies used in milling.
ii. No significant relationship between the constraints faced in rice milling and trainings provided to the rice millers.

2. RESEARCH METHODOLOGY

Study Area

This study on factors affecting rice milling was conducted in Sokoto state, Nigeria. The state is located in the Sudan Savannah agro-ecological zone of Nigeria. It is located between latitude $11^{o}00`$ - $14^{o}00`$N and longitude $3^{o}50`$ - $8^{o}00`$E. The study area experienced erratic rainfall that hardly sustains agricultural crops. The average rainfall of the area is about 550mm per annum with maximum rainfall of 1100mm and minimum of 800mm. The area had a maximum temperature of about 45^{0}C between the months of March to June and minimum temperatures of about 15-18 ^{0}C during Harmatan season, in the months of November to early February with relative humidity between 15-20% during the dry season and up to 70-75% during the rainy season (NIMET, 2014).

Sokoto state has a projected population of 4,850,374 at 3% population growth rate/year (NPC, 2015). Internally, the state shares a common boundary with Kebbi State to the South-east, Zamfara State to the East and externally with Niger Republic to the North. The study area is basically an agrarian society with over 90% of the population engaged in agricultural activities. The common crops grown in the study area are millet, sorghum, rice, wheat, cowpea, vegetables, tuber and root crops. Animal husbandry and fishery activities are also engaged upon by the people of the study area.

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Sampling Procedure and Sample Size

The target population for this study constituted the rice processors of Sokoto state, Nigeria. Four stages sampling techniques were used to arrive at the sample size of the study. In the first stage, Wamakko, Silame and Goronyo Local Government Areas (LGAs) of the state were purposively selected for the study due to abundant local rice processors. The second stage included the random selection of two districts from each of the selected LGAS. Thirdly, from each of the selected districts, two villages were randomly selected and finally, from each village, 10 processors were randomly selected, making the sample size of the study to constitute 120 processors.

Data for this study were obtained from both primary and secondary sources. The primary data was collected directly from the processors with the aid of structured questionnaire while the secondary information was obtained from related literatures (journals, books and book of proceedings) and internet sources. Objectives **a-d** of the study were analyzed using descriptive (frequency, percentage, mean and standard deviation) statistics while the proposed hypothesis was tested using inferential statistic (Linear regression).

3. RESULTS AND DISCUSSION

Socio Economic Characteristic of Rice Millers

Age: Results in Table 1 reveal that most (66.6%) of the rice millers were within the age bracket of 14-24 years, 25.8% of them were within the ages of 29-43 years while only few (7.5%) of the rice millers were 44 years and above with mean age of 25.6 years implying that most of the millers were at their active and productive ages and as such could cope with the rigors associated with rice processing. These findings are in accordance with Usman *et al.* (2013) reported that the active productive age of individuals are the ages when individuals are more capable and energetic to perform assigned duties.

Sex: As shown in the Table, majority (87.5%) of the rice millers were male while the female millers constituted only 12.5 %. The findings indicated that rice milling was dominated by males. The reason behind the low number of female rice millers in the study area could be attributed to the culture of the people of the study where females are not allowed to freely mix with their male counterpart due to tradition and religious restrictions.

Marital Status: The findings in Table 1 further reveal most (63.3%) of the rice millers were single, 32.5% were married, 2.5% were widows and only few (1.7%) of them were divorced. The implication of these findings is that, rice milling was dominated by unmarried people in the study area and which could determines the effort and struggle of bachelors to get a means of existence and getting married. Also, the findings indicated that the business of rice milling in the study area was mostly carried out by one section of the people groups, and mostly by the unmarried men.

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Table 1: Distribution of Millers According to their Age, Sex, Marital Status and Educational Attainment (n=120)

Variables	Frequency	Percentage	Mean	Standard Deviation
Age				
14 – 28	80	66.60	25.6	10.6
29 – 43	31	25.80		
44 years and above	9	7.50		
Sex				
Male	105	87.50		
Female	15	1.50		
Marital status				
Single	76	63.30		
Married	39	32.50		
Divorce	2	1.70		
Widow	3	2.50		
Educational attainment				
Formal education	17	74.17		
Qur'anic education	89	14.17		
Adult Education	17	11.66		

Source: Field Survey, 2015.

Household size: As indicated in Table 2, most (64.1%) of the rice millers had one person as family size because they were single (see Table 1) and as such they had no children and wives rather they are part of their family, 18.3% of the millers had family size of 1-3 people, 12.5% of them had a family size of 4-6 people while few (5%) of them had a family size of 7 people and above.

Primary occupation: Results in Table 2 also reveal that most (51.09%) of the rice millers had rice processing as their primary occupation, 19.23% were in to vegetable farming as their primary occupation, 10.98% engaged in poultry keeping and only (8.80%) and (6.60%) of the millers were in to trading and livestock rearing respectively. These findings indicate that majority of the rice processors had some income generating activities in addition to adding value to rice purposely to increase their income.

Secondary occupation: The findings in the Table further show that 23.3% of the rice millers had chosen rice milling as their secondary occupation, 18.3% them were in to rainy season farming and 18.3% were bricklayers. The implication of this finding is that almost all the processors have one business or the other to supplement their primary occupation (rice milling). This statement is in line with Adegeye and Ditto (1982) reported that 88.9% of rice processors in his study area obtained capital for their business through personal savings.

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Table 2: Distribution of Rice Millers According to their Household size, Primary and Secondary Occupation (n=120)

Variables	Frequency	Percentage
Household size		
No family	**77**	64.10
1-3	22	18.30
4-6	15	12.50
7 and above	6	5.00
Primary occupation		
Rice processing	93	51.09
Weaving	2	1.10
Animals rearing	12	6.60
Vegetables farming	35	19.23
Carpentry	2	1.10
Poultry keeping	20	10.98
Business	16	8.80
Security guard	2	1.10
	182*	
Rice processing	28	23.30
Rainy season farming	22	18.30
Trading	7	5.80
Animal rearing	6	5.00
Bricklaying	22	18.30
Driving	5	4.20
Fish farming	3	2.50
Vegetable farming	15	12.50
Poultry keeping	3	2.50
Handcraft	3	2.50
Pure water making	2	1.70
Tailoring	4	3.30

Source: Field survey, 2015; ***** Multiple response

Technologies Used for Rice Milling

Technologies used for parboiling:

Parboiling is the central activity in rice processing and an important operation that determines rice quality. It consists of three major activities namely, soaking either overnight in warm water or in hot water for 4-5 hours, steaming and drying either in the sun or under the shade (Ogunforowa, 2007). Parboiling is the hydrothermal treatment of raw paddy before milling, it consist of three major activities; soaking, steaming and drying (Mustapha *et al.,* 2010) According to Bello *et al.* (2005) parboiling of rice in Nigeria is mostly done manually using aluminium and

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drum pots and according to them lack of modern parboiling technologies and poor understanding of the process of parboiling are the major constrains faced by the processors. Results in Table 3 show that most (57.5%) of the rice millers used cut drums in parboiling, while the remaining (42.5%) of them parboiled the paddy rice with the use of aluminium pots (*tukunya*). The findings revealed that majority of the rice millers used empty engine oil drums that was cut in two halves in parboiling the rice which could be due to the ability of drum to contain more rice compared to the aluminium pots. This finding is in line with Bello *et al.* (2005) reported that majority of the rice processors in his study area used traditional method of parboiling paddy with only a fraction of them adopt what they described as an improved parboiling technology.

Source of Energy for Parboiling: Soaking of paddy rice as an aspect of parboiling is the process where the paddy is immersed in water and heated for some hours. The heat sources would then be withdrawn and the mixture of parboiled paddy and water is left for some time before draining some of the water (Bello *et al.*, 2005). Findings in the Table further indicated that majority (78.81%) of the rice millers used firewood as source of energy, 9.93% of them used cereal crop stalks as source of energy, 5.3% parboiled the rice using polythene bags and 3.97% of them used kerosene as source of energy for rice parboiling. The reason behind using fire woods, stalks and polythene bags as source of energy for parboiling could be due to lack of capital to purchase kerosene and other modern sources of energy. Findings of research conducted by Ibrahim et al. (2015) reported that the energy analysis for processing of local rice in Benue State, Nigeria suggested that 3 unit operations (parboiling, soaking and milling) were required for processing local rice paddy and wood fuel was the major energy input in the processing process. Kwofie and Ngadi (2015) also reported that parboiling energy for rice is met by wood in most West African countries. Based to them, wood retailers are the main suppliers of parboiling energy in West Africa, accounting for 65% of wood supply and wood consumption ranges from 0.30 to 0.92 kg wood/kg of paddy soaked and 0.35–1.16 kg wood/kg of paddy for steaming. In a related study reported by Erenstain *et al.* (2003) posits that the majority of the rice mills (85%) in Nigeria are powered with fuel engines while 10% are using electric engines and four mills (5%) have invested in both types. Operators of the mills recognized that it is cheaper to run electric-powered mills than fuel-powered equipments.

Rice milling technologies: Findings in the Table further indicated that almost all (90%) of the local rice millers adopted long time introduced electrical powered rice milling machines, 6.7% of them adopted gasoline powered rice milling machines while few (3.3%) of them adopted petrol powered milling machines. These findings imply that majority of the millers adopted the obsolete milling technologies introduced to them 20-40 years ago. This finding is in line with Adeniyi (1984) reported that modern milling machines are not much used by the processors because majority of them process rice and other agricultural produce on small-scale basis.

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Table 3: Distribution of the Millers based on Technologies Used for Parboiling, Source of Energy and Technologies Used for Milling (n = 120)

Variables	Frequency	Percentage
Technologies used for parboiling		
Drums	69	57.5
Aluminium pots	51	42.5
Source of energy		
Firewood	119	78.81
Electric cooker	1	0.66
Gas cooker	2	1.32
Cereal stalks	15	9.93
Polythene bags	8	5.30
Kerosene	6	3.97
	****151**	
Technologies used for drying		
Tarpaulin	4	3.33
Old rice packaging sacks	115	95.83
On the bare floor/ground/tarred road	1	0.83
Milling technologies		
Electrical powered machine	108	90.0
Gasoline powered machine	8	6.7
Petrol powered machine	4	3.3

Source: Field Survey, 2015. **: Multiple Responses

Training Needs for Rice Milling

Learning milling techniques: Training needs is defined as skill, knowledge and attitude an individual requires in order to overcome problem as well as to avoid creating problem situation in his/her enterprise (Obaniyi *et al.,* 2014). Based on this study, the need for training by the rice millers is essentially aimed at resolving the ignorance faced by them in the act of coming up with clean and unbroken rice devoid of stones and other extraneous materials.

As shown in the findings in Table 4, majority (93.3%) of the millers learned rice processing techniques through apprenticeship and 6.7% of them learned the business from skill acquisition centres. Due to the presence of many local milling centres in the study area, most of the millers were engaged in to the business through owners of the milling centres as apprenticeship while some learned the business through the family members that owned the enterprise.

Provision of formal training on rice milling: As shown in the Table, 86.7% of the rice millers in the study area were not formally trained on rice processing but received training through apprenticeship, 10% of them received formal training on rice processing through skill acquisition

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centres while 3.3% of the rice millers were trained by nongovernmental organizations. This implies that majority of the rice millers were not formally trained on rice processing and which could be due to nonchalant attitudes of the past governments on adding value to agricultural produce before internal consumption and export. This finding is in accordance with the food and agricultural organization – FAO (1982) reported that great importance and emphasis should be placed upon the promotion of agro-allied crop processing industries in Nigeria due to the potential economic value of products exported and the fact that by-products from processing will be retained in the country.

Table 4: Distribution of the Processors based on Trainings Received and Organizations Involved in Provision of the Trainings (n = 120)

Variables	Frequency	Percentage
Trainings on rice processing		
Through apprenticeship	112	93.3
Skill acquisition centres	8	6.7
Provision of trainings		
No formal trainings	108	86.7
Non-governmental organizations	4	3.3
Skill acquisition centres	12	10.0

Source: Field survey, 2015

Constraints to Rice Milling

Rice processing industries in the study area was found to face a lot of problems that bedevilled its progress in terms of productivity and milling of quality rice products devoid of extraneous materials. Tan (2016) in a related study reported that most of rice mills in Nigeria are suffering with shortages of supplies of national electricity, raw paddy and spare parts, as well as with very high bank interest rate, up to 25%/year. Besides, lacks of well trained technicians and skilled labours are also causing considerable problems for operation and maintenance of the machines in the rice mills. Results in Table 5 show that 24.19% of the rice millers faced problem of electricity supply, 15.81% reported problem of water supply and 13.87% of the millers were of the opinion that lack of improved milling machines was the constraint to the productivity and progress of their enterprise. These findings are in corroboration with Ogunforowa (2007) reported that among other general constraints to capacity utilization identified in the rice mills in Nigeria included low parboiling capacity; low demand for the local rice; non availability of

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paddy all year round; erratic supply of electricity; low capital for inventory build-up and lack of storage facilities.

Table 5: Distribution of Rice Millers based on Constraints Faced (n = 120).

Variables	***Frequency***	***Percentage***
Constraints		
Water supply	*49*	*15.81*
Electricity supply	*75*	*24.19*
Cost and scarcity of firewood	*22*	*7.10*
Government support	*20*	*6.45*
Improved milling machines	*43*	*13.87*
Milling machines maintenance	*7*	*2.26*
Capital	*18*	*5.81*
Milling machines spare parts	*15*	*4.84*
Poor transportation	*9*	*2.90*
Inexperience processors	*30*	*9.68*
Protective wears for the millers	*22*	*7.10*
	*****310***	

Source: Field survey, 2015; **Multiple response

Test of Study Hypothesis

Linear regression analysis result indicates a significant relationship ($P<0.05$) between the constraints faced by the rice millers and the milling technologies used by the millers. The result implies that most of the problems encountered in processing rice in the study were attributed to the obsolete milling technologies used by the rice millers. Based on the findings, a lasting

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solution to the production of stone free, unbroken rice and other unpalatable extraneous materials in the local rice in the study area is the provision of up to date milling technologies that are simple to operate, easy to manage and economically feasible to be purchased by the local rice millers. The findings in the Table further revealed a significant relationship (P<0.05) between the constraints encountered in rice milling and trainings provided to the operators of the milling technologies. The results indicated that lack of adequate and up to date training provided by reliable formal organization to the operators were part of the measures attributing to abnormal processing of rice produce in the study area.

Table 6: Relationship between Milling Constraints and Technologies Used

	Milling Constraints			
Variables	***b***	***SE***	***β***	***Probability***
Constant		*2.03*	*17.23*	*0.000***
Milling technologies	*0.25*	*0.14*	*0.76*	*0.003**
Trainings provided	*0.36*	*0.73*	*0.57*	*0.014**

P<0.05*; P<0.001**

4. CONCLUSION

Based on the findings of this study, it is concluded that rice milling in the study area was male dominated, majority of who were within their active and productive ages with formal educational background. Findings of the study further revealed that majority of the rice millers used half-cut engine oil drums for steaming of the paddy rice with firewood being the common source of energy. The study further concluded that most of the rice millers were trained through apprenticeship with little or no governmental and nongovernmental interventions. The common constraints faced by the rice millers in the study area include lack of adequate supply of electricity, water and improved milling machines. In accordance to the findings of the study, its generally concluded that lack of trainings and modern milling technologies were the constraints responsible for proper and organize milling of rice in the study area. Based on the hypotheses test result is concluded that lack of proper processing of rice in the study was attributed to the use of obsolete technologies and lack proper training of the operators by formally recognized institution.

5. RECOMMENDATIONS

Based on the findings, discussion and conclusion drawn from this study, the following recommendations deemed necessary:

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1. Female folks are encouraged to actively participate in rice process in the study area since it's an enterprise that could be done indoors.
2. It's recommended that government should provide adequate supply of electricity and water to the rice millers in the study area.
3. Modern rice processing machines need to be introduced to the rice millers of the study area
4. It is recommended that government and donor agencies should help in training rice processors on modern rice processing techniques.

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