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RICE PROCESSING METHODS IN MIDDLE RIMA VALLEY IRRIGATION SCHEME (MRVIS), SOKOTO STATE, NIGERIA

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ABSTRACT

The study was conducted to examine the rice processing techniques employed by rice processors in MRVIS. A table of random numbers was used to sample 103 rice processors comprising parboilers and millers. Data were collected using questionnaire and interview schedule and then analysed using descriptive statistics, Strength, weakness, opportunities**,** and threats (SWOT) and Strategic Orientation Round (SOR). The findings revealed that parboiling is a gender discriminating activity conducted by females, only one of the parboilers in the area used modern techniques to parboil the rice. About 62.5% of the millers were male who milled the parboiled paddy traditionally using locally available equipment at a cottage level. The mean age of the processors (40) shows that adults dominated the processing enterprise. The most important strengths were good health, existence of small capital, availability of raw materials, experience, and teamwork. The most important weaknesses were non-existence of modern parboiling equipment, non-existence of credit source, lack of knowledge on improved practices, Lack of standardization of measure and non-existence of milling machines. The most important opportunities were availability of market, job creation, existence of modern milling machines, existence of packaging machines and increasing urban demand for local rice. The most important threats were the seasonal water scarcity, desertification (climate change), poor quality of paddy and price variation. The rice processing sub-sector in MRVIS, is a rudimentary enterprise and fragmented leading to the production of inferior milled rice which is lower in quantity as well. The Government and cooperative societies should employ modern techniques for rice processing in MRVIS.

Keywords: Rice; Processing; SWOT; SOR

INTRODUCTION

Rice is a staple in the diet of many cultures (FAOSTAT, 2018). The per capita consumption of rice in Nigeria has been estimated to about 102.5g/day. The crop contributed about 0.22% (US$888 million) to the Total Gross Domestic Product (GDP) of Nigeria in

2016 (Ajala and Gana, 2016). Rice plays a pivotal role in the economic development of Nigeria, and it is as a result of this that government has given a top priority in increasing the availability of food in the country with sufficient rice production and processing being a key to ensure food security in Nigeria. To achieve this, many Agricultural Development Projects and policies have been established like the World Bank funded Agricultural Projects (Fadama I, II and III), Operation Feed the Nation launched in 1976, River Basin Development Authorities (RBDAs) also established in 1976, Green Revolution Programme, National Fadama Development Project (NFDP), and Agricultural Development Projects (ADPs) (Aondoakaa and Agbakwuru, 2012).

The dependency on rice imports is a major concern of Nigeria's government, and since the early 1980s numerous strategies have been implemented to encourage domestic rice production and processing to achieve rice self-sufficiency (or at least to reduce the growth in imports). Trade policies (import tariffs and even import bans) have also been used in an attempt to slow the increase in imports and boost domestic production and processing (Emodi and Madukwe, 2008). Recently in 2019, there is a total embargo on rice importation in Nigeria. Similarly, the Federal Ministry of Agriculture and Rural Development (FMARD) in 2012 put forward a plan called "Rice Value Chain Transformation Plan" with a principal goal of improving productivity and processing significantly (Brempong *et al.*, 2012).

However, on the basis of these policies the Federal Government of Nigeria between the year 201l-2015 focused on 'Value Chain' in the agricultural sector (Chidiebere 2017). Some programs implemented under the Value Chain scheme are Transforming Irrigation Management in Nigeria (TRIMING), Nigerian Incentive-based Risk Sharing for Agricultural Lending (NIRSAL), Growth Enhancement Scheme Support (GESS), and Crop value chains. The priority crop value chains include rice, cassava, sorghum, cocoa, and cotton. The crop value chain was aimed at increasing local production of staple crops for food and nutrition security as well as to make the country self-sufficient in production of certain crops. The major objectives for policy options required in MRVIS are: Enhance strengths of the rice processor, Transform the opportunities in tangible fact that actors can benefit and Transform weaknesses in strengths to improve the performance of the rice processing in the study area.

METHODOLOGY

The Study Area

The Middle Rima Valley Irrigation Scheme (MRVIS) is an area which falls between Goronyo and Gada Local Government areas of Sokoto state. The area covers about 5,360 ha on the banks of Rima River between the towns of Goronyo and Keta on the left bank and Tuleske and Gidan-Alwali on the right bank. It lies between longitudes $5^0 39'$ and $5^0 50'$ East and latitudes $13^0 25'$ and $13^0 33'$ North (Sokoto Rima River Basin Development Authority (SRRBDA), 2006). Most of the people in the area are Hausa/Fulani by tribe and the major crops grown are rice, maize, watermelon, vegetables, sweet potatoes, sorghum and wheat (SRRBDA, 2006).

Middle Rima Valley Irrigation Scheme (MRVIS) is one of the major irrigation schemes managed by Sokoto Rima River Basin Development Authority (SRRBDA) (RBDA, 2006). The scheme provides both surface and underground water resources for multi-purpose use. MRVIS is serviced by Goronyo dam, which construction was completed in 1984.The dam was built across River Rima and provide water for irrigation and agricultural

development of downstream areas including Argungu and Zauro Polder project, covering over 17,000 hectares. The dam provides an annual regular flow of 425 million cubic metres to irrigate approximately 5000ha of land and rice is the major crop cultivated (RBDA 2006). However, farming communities in the scheme faced numerous challenges in their agricultural activities which did not allow them to achieve desired goal of attaining maximum profit from their rice production (AfricaRice, 2019).

Sampling Procedure and Sample Size

Simple random sampling technique using a table of random numbers was used to sample 103 respondents generated using Yamane sample size formula. The sample comprised of parboilers and millers.

Data Collection and Analysis

Two set of data were collected for this study: these are the data from sample survey and the focus group discussions (FGD), through primary source which was generated using questionnaire administered to the 103 rice processors through face-to-face contact. The data were analysed using descriptive statistics (frequencies and percentages) and SWOT and SOR.FGD checklist was used for both SWOT and SOR of each segment of rice value chain framework. Data elicited from the stakeholders for this study include information on the Strength, weakness, opportunities and threats (SWOT) and Strategic Orientation Round (SOR).

FGD session were conducted with the rice processors stockholders to appraise both SWOT and SOR. First, segment data were collected during one-day workshop organized for the processors. During this one-day workshop, FGDs were used to characterize and diagnose each segment of the rice value chain while plenary session was used to conduct the SWOT analysis of the rice processors.

Strength, Weakness, Opportunities and Threats (SWOT)

The mixed sequential design of Van Wezemael *et al*. (2013) was used. It is a two stages approach referring to a qualitative analysis followed by a quantitative analysis using the qualitative results. The qualitative analysis consists of SWOT analysis used to evaluate in a systematic way the external threats and opportunities, and the internal weaknesses and strengths of a sector (Fine, 2009). This first stage allows identifying the main points of interest for the future strategy development (Sabbe *et al*., 2009) for the rice value chain in MRVIS. At this stage, stakeholders identified all possible internal strengths and weaknesses, and external opportunities and threats of the rice processors in MRVIS. After aggregation, the lists were filtered from repeated and overlapping answers. However, the misclassifications of internal and external factors were relocated in the appropriate cell of SWOT matrix. Furthermore, stakeholders ranked elements of each component of the SWOT analysis.

Strategic Orientation Round (SOR) Analysis

The second stage of the mixed sequential design consisted of scoring the SWOT matrix and performing a quantitative analysis through a Strategic Orientation Round (SOR).

The SOR allows translating the Statements in the SWOT analysis. Following the sampling method of Van Wezemael *et al.* (2013) who first selected different number of stakeholders for qualitative analysis and 33% of them for quantitative analysis, 33% of the sample size of direct actors combined with indirect actors was randomly selected. The five most important elements of each SWOT were combined in a matrix where the rows were filled with the internal components and the column with the external components. Each internal component was confronted with each external component. Rice processors were asked individually to attribute scores to every single cell of the matrix. These scores represent their answers to the questions relating to the quadrants encompassing the cell (Table 1). Scores were attributed according to two guidelines: first, a maximum of 12 points was attributed to each column; and secondly, each single cell score range between 0 to 3
Where: No = 0, Low = 1, Medium = 2 and High = 3

Table 1: Questions for each quadrant of the SOR matrix

	Opportunities	Threats
Strengths	To what degree does the strength facilitate to benefit from the opportunity? (Quadrant 1)	To what degree does the strength allow to cope with the threat? (Quadrant 2)
Weaknesses	To what degree does the weakness prevent to benefit from the opportunity? (Quadrant 4)	To what degree does the weakness prevent to cope with the threat? (Quadrant 3)

RESULTS AND DISCUSSION

Demographic Characteristics of the Processors

These are features which directly or indirectly influence the operational performance of the rice processors. In this article, age and gender were presented and discussed in Table 1 where the age distribution of the parboilers and millers shows that 41.8% and 60.4% respectively were within the age of 30-43. The respective mean age for the actors was 40 and 39 which further indicates that adults dominated the processing enterprise in the study area and hence cooperation toward improving the enterprise can be stimulated easily. This agrees with the findings of Abubakar et al. (2010) who found out that 70% of the rice processors in Sokoto State were between the ages of 35 and 41 indicating that there are adult processors ready to carry out processing operations in the area.

On the other hand, the gender distribution of the processors shows that 100% of the parboilers were female similarly, 62.5% of the millers were also female. The parboiling activities were only performed by women in the area. This may be because of the nature of the parboiling operations which involves the use of fuel mostly firewood to boil the paddy

and hence men are not perfect in carrying out such activities. Moreover, the milling operation was also dominated by females with 62.5% even though the male covered 37.5%. This means that females participate fully in the processing industry in the study area. Parboiling is usually a separate activity done locally by women who operate a parboiling unit located in their own household as a cottage enterprise.

Table 2: Demographic characteristics of the rice processors

	Parboilers		Millers	
Age	Frequency	Percentage	Frequency	Percentage
16-29	9	16.4	5	10.4
30-43	23	41.8	29	60.4
44-57	20	36.4	12	25
58-71	3	5.4	2	4.2
72-85	0	0	0	0
Total	55	100	48	100
Mean	40		39	
Gender				
Male	0	0	18	37.5
Female	55	100	30	62.5
Total	55	100		100

Source: Field survey, 2020.

The milling operation perform by women is mainly traditional unlike the men who use local milling machines without de-stoner. This result is contrary to the findings of John et al. (2012) who disclosed that males dominated the milling operation by 80% in Kwara state, possibly because of the availability of milling machines which are mostly operated by males.

Rice Processing Method Used by Parboilers and Millers

Parboiling is the series of activities through which the paddy passes. It is the hydrothermal treatments of paddy before milling which involve cleaning and soaking the paddy in water, heat the wet paddy by steaming and then drying the paddy to safe moisture content, while milling is the removal of husk and bran from the rice grain. Rice processing entails parboiling and milling. The parboiling and milling techniques are skills (either traditional or modern) the actors employed to perform those operations (Obasi, 2016). Table 2 explained the status of the techniques that these actors were using in rice processing in MRVIS.

The analysis on the processing techniques employed separately by parboilers and millers in the study area shows that none of the parboilers used modern techniques to parboil the paddy. The parboiling operation is 100% traditional usually done by women in their respective household units using equipment such as simple drum or aluminum pot and fireplace, mats, tarpaulin, sieves, soaking containers and tray. Similarly, 62.5% of the millers

mill the parboiled paddy traditionally. Traditional milling in the area is mostly done also by women using locally available equipment which include mortar made up wood, pestle, calabash, tray, sieve, silt or *tuwo*, and water.

The milling is done by pounding the parboiled paddy in a mortar using a pestle in two separate phases. The first phase is meant for de-husking the paddy after which it will be winnowed to separate the grains from the husk, while the second pounding is to polish the brown grains by adding silt or *tuwo* while pounding. At the end, winnowing follows to separate the grains from the rice bran. On the other hand, only 37.5% of the millers mill the parboiled paddy using a single stage milling machine without de-stoner. This activity is carried out by male private millers who provide milling services on commercial basis in the study area. The findings therefore imply that the processing industry in MRVIS was mainly rudimentary, operated at a cottage level.

Table 3: Processors' parboiling and milling techniques

	Parboilers		Millers	
Processing technique	Frequency	Percentage	Frequency	Percentage
Traditional	55	100	30	62.5
Modern	0	0	18	37.5
Total	55	100	48	100

Source: Field survey, 2020.

This is in consonant with the findings of Appiah and Dartey (2011) who disclosed that processing industry in Ghana was 75% traditional leading to low quantity of rice production in the rice value chain.

Processors SWOT at MRVIS

The most important element of the strength segment is health that enable the parboilers to perform parboiling activities. The second most important strength is the existence of small capital that enable them to buy paddy from the farmers and or market to perform their activity and satisfy their customers. It is not surprising that they quote capital as one of the most important strength, hence capital is one of the major production factors based on economic theory. Third most important strength is availability of raw material. However, parboiler's raw material was paddy availability all year round.

The most important weaknesses according to parboilers is the non-existence of modern parboiling equipment. Parboilers are using traditional equipment and method to parboil the paddy resulting in high level of impurity, breakage, burnt grains and unpleasant smell rice (poor quality rice). The second most important is the non-existence of credit facilities that prevent them from expanding their business activities. The third most important weakness is lack of improved parboiling practices. However, to increase their knowledge on improved parboiling practices. This requires the development of suitable training modules for them to overcome all mentioned weaknesses.

The first most important opportunity is the readily available market that enable the parboilers to increase their business activity. The second most important opportunity for them is the job creation which enable them to provide parboiling service for other companies and people around them, apart their own parboiling activities. The existence of improved milling

machine is the third most important opportunity. Parboilers think that they can use it to improve the quality of their product and hence get a better market value.

The most important threat is the seasonal scarcity of water in parboiling activity. This could be due to the value they attached to quality water as a critical input for good parboiling. The second most important threat desertification that leads to the destruction of trees. The third most important threat is the poor quality of paddy, having poor quality paddy rice will lead to a high quantity and quality losses during parboiling.

Therefore, fluctuation of diesel price negatively affects the milling business as customers are not usually willing to pay for an increase of the service price due to fuel price increases.

Table 4: Distribution of SWOT matrix according to rice processors in MRVIS

Strengths	Weaknesses	Opportunities	Threats
Health	Nonexistence of modern parboiling equipment	Readily availability of market	Seasonal water scarcity
Existence of small capital	Nonexistence of credit source	Job creation	Desertification (climate change)
Availability of raw material	Lack of knowledge of improved practices	Existence of modern milling machine	Poor quality of paddy
Experience	Lack of standardization of measure	Existence of packaging machine	Price variation
Teamwork	Nonexistence of milling machine	Increasing urban demand for local rice	
Profitability	Nonexistence of modern drying equipment	Use of rice husk	
Availability of family labor	Illiteracy		

Source: field survey, 2020.

Strategic Orientation Round of the Rice Processors at MRVIS

The result reveals that the SOR was used to perform the quantitative phase of diagnostic study. The five most important SWOT were used to elaborate the SOR matrix submitted to the 33% of the rice processors in MRVIS. In this matrix, each of the internal components (strengths and weaknesses) was confronted with each of the external components (opportunities and threats). The aggregated cell score indicates the relevance of each cell related to other cells of the SWOT matrix. The cell scores per actor ranges from 0 to 3 resulting in a maximum score of 99 for the stakeholders. The maximum score attributed per column (scores for opportunities and threats) per person is 12 resulting in maximum column scores of 396. Concerning total score per row for strengths and weaknesses, there are no limitations, and this can be up to 990.

Table 5 presents the total score of the 33 processors. Firstly, the total score attributed to the different SWOT components are compared. The most important strength related to the identified opportunities and threats is the good health in the scheme with a score of 297 followed by the Availability of raw material with a score of 256. The major weaknesses in relation to the opportunities and threats in MRVIS is the absence or nonexistence of modern parboiling equipment with a score of 201, followed by Non-existence of credit source (193). Concerning the most important opportunity, readily availability of market recorded the

highest score (221) followed by Job creation which recorded a score of 209. Regarding threats, the most important is Poor quality of paddy with a score of 206 followed by Price variation (190).

Secondly, the aggregated cell scores in each quadrant are analysed. The aggregated cell scores in the first quadrant of the matrix (affecting strengths and opportunities) indicate to what extent a specific strength allows a direct rice processor to benefit from a specific opportunity. The good health (45), the Availability of raw materials (34) and Existence of small capital (29) are the main strengths which can enable them to take advantage with the Readily availability of market for the rice processors in MRVIS. Good health and availability and existence of small capital are also the two main contributors for making profit from opportunities such as job creation, Existence of modern milling machine, Existence of packaging machine and increasing urban demand for local rice.

These are the important weaknesses which prevent actors for taking opportunities such as job creation, government desire to support rice value chains, availability of market and the existence of companies producing branded rice. However, lack of knowledge on improved practices is the main weakness which prevents actors to take advantage from the improved/modern equipment for each segment of the value chain. SOR analysis allows us to translate SWOT analysis into strategic choices and related policy options.

Strategic Choice and Policy Options Rice Processors at MRVIS

The result revealed that summing the score obtained per quadrant in the SOR allows for the identification of strategic choices and the related policy options. According to Van Wezemael *et al.* (2013), strategy is the way that internal strengths and weaknesses are used to tackle the most important external opportunities and tackle the most important threats. The strategy is determined by the quadrant which records the highest relative score. There are four types of strategies: offensive (strength-opportunity), defensive (strength-threat), clean-up (weakness-opportunity) and crisis (weakness-threat). The total scores per quadrant are compared to the maximum possible quadrant score considering the number of rice processors who participated in the SWOT analysis and answered the SOR questions, the number of rows and the maximum column score of 12. The results suggest that the offensive strategy, attack using strengths to take advantages form the different opportunities, is perceived by the rice processors as the most adequate and effective strategy for sustainability and the competitiveness of the rice value chain in MRVIS. This mean that the rice processors would like to focus more on developing and enhancing strengths to tackle current and future opportunities in the Study area.

Table 5: Distribution of aggregated SWOT scoring matrix for rice processors

SWOT-SOR Analysis of Rice Processors		Opportunities						Threats				
	First quadrant							Second quadrant				
Strengths		Readily availability of market	Job creation	Existence of modern milling machine	Existence of packaging machine	Increasing urban demand for local rice	Subtotal	Seasonal water scarcity	Desertification (climate change)	Poor quality of paddy	Price variation	Subtotal
	Health	45	38	38	28	42	191	24	25	26	31	106
	Existence of small capital	29	35	31	22	33	150	28	24	29	25	106
	Availability of raw material	34	27	28	28	30	147	21	21	33	26	101
	Experience	22	26	21	26	23	118	23	16	25	20	84
	Team work	22	25	22	22	23	114	29	19	27	24	99
	Subtotal	130	126	118	104	128		96	86	113	102	
	Fourth quadrant							Third quadrant				
Weaknesses	Non-existence of modern parboiling equipment	27	22	22	17	21	109	21	26	27	18	92
	Non-existence of credit source	19	21	20	19	21	100	19	26	23	25	93
	Lack of knowledge of improved practices	24	21	18	16	21	100	20	18	21	27	86
	Lack of standardization of measure	21	19	22	23	17	102	21	21	22	18	82
	Non-existence of milling machine	15	16	18	23	19		14	17	13	17	61
	Subtotal	91	83	82	75	80		81	91	93	88	
	Total (Column)	221	209	200	179	208		177	177	206	190	

CONCLUSION

Based on the research finding, it could be concluded that the rice processing sub-sector in MRVIS was highly a rudimentary enterprise, operated at a cottage level leading to the processing of lower quantity of milled rice. The government through SRRBDAs should adequately design and fabricate modern and affordable equipment for rice processing in the area.

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