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Perspectivas de una pequeña empresa de procesamiento de arroz entre los beneficiarios de préstamos de microfinanzas en el estado de Jigawa en Nigeria

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RESUMEN El presente estudio determinó empíricamente las perspectivas de la cadena de valor del arroz de los procesadores de arroz en el estado de Jigawa de Nigeria. A pesar del papel de los pequeños procesadores de arroz con cáscara como principal motor de crecimiento de la cadena de valor del arroz; crecimiento y desarrollo de la economía rural en el área de estudio, la literatura no se deja intimidar por la escasez de información empírica sobre las perspectivas de la cadena de valor del procesamiento del arroz en el área de estudio. El estudio utilizó datos transversales obtenidos a través de un cuestionario bien estructurado de un total de 200 procesadores (133 parcoilers y 67 molineros) seleccionados mediante una técnica de muestreo de múltiples etapas. Se utilizó un enfoque de ruta de costos fácil para la recopilación de datos durante el período de procesamiento de 2022 y los datos recopilados se analizaron utilizando estadísticas tanto descriptivas como inferenciales. Con base en la evidencia empírica, se establece que el potencial de procesamiento del arroz no ha sido aprovechado en su totalidad en el área de estudio. Además, es evidente que la empresa procesadora de arroz no solo es viable y rentable, sino que tiene una buena perspectiva en la cadena de valor de suministro de arroz en el área de estudio. Sin embargo, para que las perspectivas en la cadena de valor de suministro se mantengan bien, los actores objetivo deben adoptar un mecanismo defensivo como lo infiere la matriz espacial.

PALABRAS CLAVE Procesadores, arroz, pequeños agricultores, cadena de valor, estado de Jigawa, Nigeria.

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Prospects of small-scale rice processing enterprise among beneficiaries of microfinance loan in Nigeria's Jigawa State

ABSTRACT The present study empirically determined the prospects of rice value chain of paddy processors in Jigawa State of Nigeria. In spite of the role of small-scale paddy rice processors as the main engine of growth of upstream rice value chain; growth and development of rural economy in the study area, literature is undaunted with paucity of empirical information on the prospects of rice processing value chain in the study area. The study utilized cross-sectional data elicited through a well-structured questionnaire from a total of 200 processors (133 par-boilers and 67 millers) selected through a multi-stage sampling technique. An easy cost-route approach was used for data collection during the 2022 processing period and the collected data were analyzed using both descriptive and inferential statistics. Based on the empirical evidence, it is established that rice processing potential has not been fully exploited in the study area. In addition, it is evident that rice processing enterprise not

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only being viable and profitable; it holds a good prospect in the supply value chain of rice in the study area. However, for the prospects in the supply value chain to hold well, the target actors must adopt a defensive mechanism as inferred by the space matrix.

KEY WORDS Processors, rice, smallholders, value chain, Jigawa state, Nigeria.

JEL CODES D61, E51, E58, M20.

INTRODUCTION

About 80% of the world's population relies on rice to meet their dietary calorie needs (FAO, 2020; Sadiq et al., 2021a; Sadiq et al., 2021b). In Nigeria, it has established itself as a staple food, with every household consuming a sizable amount, regardless of wealth (Esiobu, 2020; Esiobu et al., 2020; Sadiq et al., 2022). The structural rise in consumption of rice over time, which has spread to include all socioeconomic groups, including the poor, appears to have been caused by a number of different factors (Ojo et al., 2020). Small and medium-sized enterprises (SMEs) play a significant role in economic growth and development as employers of labor because they are essential to economic growth and also add to the development of the global economy in general and developing economies in particular. According to Aderemi et al. (2020); Enesi and Ibrahim (2021), SMEs in Nigeria play a crucial part in the country's economic development because of their ability to increase productivity, lower unemployment, and promote the welfare of the populace.

As the demand for rice has increased over time, rice milling in Nigeria has developed into a sizable agro-processing industry that employs thousands of merchants, millers, and par-boilers. In the early 2000s, the sector was mainly a «cottage industry», made up of small- and medium-sized businesses (Nzeh and Ugwu, 2015; Sadiq et al., 2020c). The three major industrial mills owned by the government, Badeggi, Uzo-Uwani, and Agbede, were additionally frequently out of commission because of subpar maintenance and a lack of replacement parts. Under ATA, which began in 2011, the Federal Government of Nigeria (FGN) made significant investments to increase national capacity for rice cultivation, processing, and marketing. Private companies were drawn to the rice industry by these investments and government concessions. Despite these expenditures, it has been demonstrated that the efficiency of rice value chain is less competitive than that of other significant global rice producers, especially those in Asia. According to Sadiq *et al.* (2020c), Nigeria's typical paddy production costs are significantly higher than Thailand's, including expenses for rice milling and marketing. The higher paddy procurement costs in Nigeria, which included high search costs and a price premium for the rare superior paddy varieties pursued by big mill operators, were the main cause of the increased milling costs in the country. The distance from urban markets across the nation contributes to the high expenses of trade and marketing. Furthermore, the absences of desired research findings and variation of novel research methods that generate new insights devoid of distorted findings create both knowledge and methodological voids on this enterprise in the study area. Besides, the absence of empirically verified research findings on prospect of this enterprise in the study area coupled with failure to evaluate the prospect proposition

of the enterprise constitutes an empirical and evaluation gaps. Nevertheless, literature has shown evidence of related study in relative state with comparative advantage in rice value chain (for example, Sadiq et al., 2020c) with little or no information in the study area, thus amount to a population gap. Thus, all these aforementioned gaps call for a need to look into the prospect of this enterprise in the study area. Consequently, this research germane as nearly 70% of the domestic rice eaten in Nigeria is provided by small-scale milling businesses, who also provide services to smallholder paddy growers, village merchants, primary and secondary wholesalers, retailers, and final consumers. The largest segment of Nigeria's domestic rice milling business is made up of small-scale millers. It is in view of the foregoing that this research intends to determine the prospect of milling enterprise in the study area as literature showed little or empirical information to justify empirically the sustainability of this important segment of rice supply value chain in the study area. Consequently, the broad objective of this research was to determine the prospect of rice processing enterprise in Nigeria's Jigawa State while the specific objectives were to estimate the profitability of rice processing enterprise; the contribution of processing to rice supply value chain; and to determine the prospect of rice processing enterprise in the study area.

RESEARCH METHODOLOGY

The research region, which was separated from Kano State, has a total land area of about 22,410 square kilometers. Its boundaries on the west are Kano State, the east are Bauchi and Yobe States, the north is Katsina and Yobe States, and the south is the Republic of Niger. Generally flat in topography, the state's northern, central, & eastern regions are traversed by undulating sand dunes that stretch from southwest to northeast. The area around Dutse, the state seat, is rocky and hilly to a lesser extent. Hills in the region of Birnin Kudu and Kazaure, in the state's southern and western regions, attain heights of 600 meters above sea level. From west to east, the Hadejia River flows through the state, traversing the Hadejia-Nguru marshland before flowing into Lake Chad. With a tropical environment that changes with the seasons, the state is situated between latitudes 11˚ 00' N and 13˚ 00' N and longitudes 8˚ 00' E and 10˚ 35' E. April and September are typically the months with the highest reported temperatures. 15 degrees Celsius for the low and 35 degrees Celsius for the high are the monthly averages. The rainy season lasts from May to September, and rainfall amounts typically range between 600 and 1000 millimeters. More rain falls in the southern than in the northern parts of the province (www.jigawastate.gov.ng). Although Guinea savannah remnants can be found in the state›s southernmost regions, the Sudan savannah flora zone dominates the region. The nation›s total forest cover is only about 5% because of rainfall patterns and deforestation mainly brought on by the use of wood for cooking. The Hausa term «Jigawa» describes a sizable loamy soil that isn't marshy. Agriculture-cultivating crops, raising livestock, and other non-farm activities-is the main employment of the locals. Other occupations include hunting and artisanal work.

A multi-stage sampling technique was used to elicit information from a total of 200 actors of the processing chain of the rice value chain in Nigeria's Jigawa State. Based on high concentration of rice production, three out of the four stratified agricultural

zones were purposively selected; and the chosen agricultural strata were Zones 1, 2 and 3. From each of the chosen agricultural strata, two Local Government Areas (LGAs) were randomly chosen. The chosen LGAs from Zones 1, 2 and 3 were Miga and Jahun; Ringim and Taura; and Kafin-Hausa and Auyo respectively. From each of the selected LGAs, three villages were randomly selected, thus given a total of eighteen (18) villages. The random selection of the LGAs and villages were achieved by using an inbuilt Microsoft sampling tool. Afterward, on the basis of activities in the processing chain, the processing population was stratified into par-boilers and millers. Using Yamane's formula (Yamane, 1967), a total of 200 processors composed of 133 par-boilers and 63 millers were randomly drawn from the sampling frame obtained from the relevant agencies- Jigawa State Agricultural and Rural Development Authority (JARDA), Co-operative societies and Microfinance Banks in the State (Table 1). Data collection was done through a well-structured questionnaire complemented with interview schedule using an easy-route cost approach in the year 2022. Data syntheses were achieved using descriptive and inferential statistics. In order of arrangement, the first, second and third objectives respectively were achieved using farm budgeting technique; Gini decomposition model; and SWOT (Strength, Weakness, Opportunity and Threat) matrix in conjunction with exploratory factor analysis (see Table 1).

$$n = N/1 + N(e)^2 \quad (1)$$

Where, n is the finite sample size, N is the population size and e is the error gap at 5%.

EMPIRICAL MODEL

1. Budgeting technique

$$NI = \sum_{i=1}^{n} TR - \sum_{i=1}^{n} TC \quad (2)$$
$$TC = \sum_{i=1}^{n} TVC - \sum_{i=1}^{n} TFC \quad (3)$$
$$GM = \sum_{i=1}^{n} TR - \sum_{i=1}^{n} TVC \quad (4)$$
$$ROI = \frac{GM}{TVC} \quad (5)$$
$$ROCI = \frac{NI}{TC} \quad (6)$$

Where, NI is Net income; GM is Gross margin; TR is Total revenue; TC is Total cost; TVC is Total variable cost; TFC is total fixed cost; ROI is Return on Naira invested; ROCI is Return on capital invested (Sadiq and Samuel, 2016).

2. Gini index

Ouedraogo and Ouedraogo (2015) suggest that Q is a population of n people whose incomes are defined by $x_{q,i}(i = 1, \ldots\ldots\ldots\ldots, n)$, composed of $Q_j(j, h = 1, \ldots\ldots\ldots\ldots, k)$ sub-groups, each of which is composed of n_j individuals $(i, r = 1, \ldots\ldots\ldots\ldots, n_j)$. Let's represent the one of Q_j by μ_j and the arithmetic mean of Q's earnings. Ouedraogo and Ouedraogo (2015) measure the related Gini coefficient as follows:

Table 1. Sampling frame of rice processors in Jigawa State

Zone	LGA	Village	Sampling frame		Sample size	
			Par-boiler	Miller	Par-boiler	Miller
Zone 1	Miga	Sakuwa	15	7	8	4
		Hantsu	10	11	5	5
		Gwari	8	9	4	5
	Jahun	Harbosabuwa	13	6	7	3
		Harbutsohuwa	18	10	9	5
		Agufa	15	8	8	4
Zone 2	Ringim	Sintimawa	21	9	11	4
		Yan-Dutse	18	8	9	4
		Yakasawa	19	6	10	3
	Taura	Maje	11	10	6	5
		Gilma	10	6	5	3
		Majiya	12	4	6	2
Zone 3	Kafin-Hausa	Bulangu	11	7	5	4
		Kafin-Hausa	13	6	6	3
		Baushe	19	5	9	2
	Auyo	Arawa	21	5	10	2
		Gatafawa	17	10	8	5
		Ayama	14	7	7	4
Total	**6**	**18**	**265**	**134**	**133**	**67**

Source: JARDA, Co-operative Society and Micro Finance Bank (2019).

$$G = \frac{\sum_{i=1}^{n}\sum_{r=1}^{n}|x_{Q,i}-x_{Q,r}|}{2n^2\mu} \tag{7}$$

The average income difference between two people chosen at random from Q is given in Equation (7) as a % of the mean. The average income difference is indicated by $2\mu G$. The degree to which the revenue distribution is unbalanced increases as the index G approaches 1.

On the other hand, when the allocation is egalitarian, it approaches zero. However, even when multiple groups are found within Q, this global approach falls short of understanding the intricate structure of inequality and complex evolution.

DECOMPOSITION INTO SUB-GROUPS

The Gini index was revised to read as follows to emphasize the gross disparities between and within groups:

$$G = \frac{\sum_{j=1}^{k}\sum_{i=1}^{n_i}\sum_{r=1}^{n_i}|x_{Q,i}-x_{Q,r}|}{2n^2\mu} + \frac{2\sum_{j=2}^{k}\sum_{h=1}^{j-1}\sum_{i=1}^{n_i}\sum_{r=1}^{n_h}|x_{Q,i}-x_{Q,r}|}{2n^2\mu} = G_w + G_{gb} \quad (8)$$

The term $x_{j,i}$ refers to the person i's income level within group Q_j. G_{gb} is the gross contribution of the Gini between-group index, which allows one to measure the income gaps between each peer group and sub-group. G_w is the Gini within-group index of inequality, which reflects the contribution of inequalities from each category to the overall inequality.

The sub-population Gini values $Q_j(G_{ij})$ and the sub-populations Q_j and Gini indicators $Q_h(Q_{jh})$, respectively, are provided by:

$$G_{jj} = \frac{\sum_{i=1}^{n_i}\sum_{r=1}^{n_i}|x_{Q,i}-x_{Q,r}|}{2n_j^2\mu_j} \quad (9)$$

$$G_{jh} = \frac{\sum_{i=1}^{n_i}\sum_{r=1}^{n_h}|x_{Q,i}-x_{Q,r}|}{2n_jn_h(\mu_j+\mu_h)} \quad (10)$$

The revenue distribution between groups Q_j and Q_h is uneven when G_{jh} tends toward the value 1; the even distribution is represented by a value of zero.

The net intergroup Gini index of inequality G_{nb}, which tracks differences in mean income between groups, is the first component of the between-group index of inequality. The second assesses the degree to which income distributional overlaps are responsible for disparities between groups G_t. The economic distance, D_{jh}, is used in this analysis. When the means of the sets Q_j and Q_h are equal, it is null. It gauges the degree to which two groups overlap:

$$D_{jh} = \frac{\sum_{xi,j<xh,r}(x_{h,r}-x_{i,j})-\sum_{xi,j>xh,r}(x_{i,j}-x_{h,r})}{\sum_{i=1}^{n_i}\sum_{r=1}^{n_h}|x_{j,i}-x_{h,r}|} \quad (11)$$

$\forall \mu_j < \mu_h$

The Gini index breakdown can then be expressed as:

$$G = G_w + G_{nb} + G_t \quad (12)$$

With $G_{nb} = \sum_{j=2}^{k}\sum_{h=1}^{j-1} G_{jh}D_{jh}(P_jS_h + P_hS_j)$ (13)

And $G_t = \sum_{j=2}^{k}\sum_{h=1}^{j-1} G_{jh}(1-D_{jh})(P_jS_h + P_hS_j)$ (14)

$$P_j = \frac{n_j}{n} \quad (15)$$

$$S_j = \frac{n_j\mu_j}{n\mu} \quad (16)$$

DECOMPOSITION IN INCOME SOURCES

Using the equation:

$$|x_{Q,i} - x_{Q,r}| = x_{Q,i} + x_{Q,r} - 2min\{x_{Q,i}, x_{Q,r}\} \quad (17)$$

Based on population *Q*, the total Gini index is calculated as follows:

$$G = \frac{\sum_{i=1}^{n}\sum_{r=1}^{n}(x_{Q,i}+x_{Q,r}-2min\{x_{Q,i},x_{Q,r}\})}{2n^2\mu} \quad (18)$$

Considering that each person's income is split up into q sources $x^m(m = 1, \ldots\ldots, q)$, the ith person's income from population Q is then divided up additively:

$$x_{Q,i} = \sum_{m=1}^{q} x_{Q,i}^{m} \tag{19}$$

The Gini index can be expressed in the following way:

$$\mathrm{G}= \sum_{m=1}^{q} \frac{\sum_{i=1}^{n}\sum_{r=1}^{n}(x_{Q,i}+x_{Q,r}-2x_{Q,ir}^{*m})}{2n^2\mu} = \sum_{m=1}^{q} S^m \tag{20}$$

Where S^m represents the share of factor m to the total Gini and

$$\sum_{m=1}^{q} 2x_{Q,ir}^{*m} = 2\min\{x_{Q,i}, x_{Q,r}\} \tag{21}$$

MULTI-DECOMPOSITION

The Gini index's multi-decomposition is represented as follows Ouedraogo and Ouedraogo (2015) based on decompositions in sources and subgroups:

$$G = G_w + G_{nb} + G_t \tag{22}$$

$$\text{With } \mathrm{G}= \sum_{m=1}^{q} \frac{\sum_{j=1}^{k}\sum_{i=1}^{n_j}\sum_{r=1}^{n_j}(x_{j,i}^{m}+x_{j,r}^{m}-2x_{j,ir}^{*m})}{2n^2\mu} \tag{23}$$

$$G_{nb} = \sum_{m=1}^{q} \frac{2\sum_{j=2}^{k}\sum_{i=1}^{j-1}(\sum_{xj,i>xh,r}\sum_{i=1}^{n_j}\sum_{r=1}^{n_h}(x_{j,i}^{m}+x_{h,r}^{m}))}{2n^2\mu}$$

$$-\sum_{m=1}^{q} \frac{2\sum_{j=2}^{k}\sum_{i=1}^{j-1}(\sum_{xj,i<xh,r}\sum_{i=1}^{n_j}\sum_{r=1}^{n_h}(x_{h,r}^{m}+x_{j,i}^{m}))}{2n^2\mu} \tag{24}$$

$$G_t = \sum_{m=1}^{q} \frac{4\sum_{j=2}^{k}\sum_{i=1}^{j-1}(\sum_{xj,i<xh,r}\sum_{i=1}^{n_j}\sum_{r=1}^{n_h}(x_{h,r}^{m}+x_{j,i}^{m}))}{2n^2\mu} \tag{25}$$

A Gini indicator for equations has a multi-decompositional structure by nature. They claim that this natural decomposition makes it feasible to calculate all factors that contributed (sources, sub-groups, sources and sub-groups).

SWOT ANALYSIS

The method of conducting a SWOT analysis helps to determine an organization's Strengths, Weaknesses, Opportunities, and Threats. Likewise, it is employed in the analysis of the advantages, disadvantages, strengths, and threats related to a specific business venture. SWOT is a fundamental analytical framework that evaluates what an entity (Business, Enterprises, Farms, Industry, or Product) can and cannot do for both internal (The Strength, and Weaknesses) and external (The potential Opportunities and Threats) elements, according to Sadiq et al. (2021c); Kiani et al. (2021) it suggests a structure for aiding researchers, planners, and investors in identifying and prioritizing goals as well as further identifying the strategies for achieving such aims (Ommani, 2011; Sadiq et al., 2021). The four parts of a SWOT analysis are typically displayed as a grid or matrix table, and they are Strength, Weakness, Opportunities, and Threats. Typically, the strategy selected will have the best chance of success and

pose the fewest dangers. Four different strategic options will result from the creation of the processors' SWOT strategy using the IFAS and EFAS matrix (Hosseini et al., 2019; Kiani et al., 2021), including:

- The SO Strategy/Plan (Strength-Opportunities): By using all of the power available to grasp and profit from opportunities, this approach combines strength and opportunity. This tactic is also known as a forceful/ aggressive tactic.
- The ST Strategy/Plan (Strength-Threats): An approach that best make use of personal assets to address problems or weaknesses. A competitive plan is what this tactic is known as.
- The WO Strategy/Plan (Weakness-Opportunity): A comprehensive approach that addresses both internal and external chances and weaknesses in order to maximize internal strengths. Conservative describes this tactic.
- The WT Strategy/Plan (Weakness-Threats): In order to reduce internal weaknesses and prevent threats, combine tactics between threats and weaknesses. Defensive strategy is another name for this tactic. (See tables 1 and 2).

RESULTS AND DISCUSSION

PROFITABILITY ESTIMATES OF PADDY RICE PROCESSORS

The level of financial gain or profit that a business action generates is referred to as profitability; Table 4 shows the costs & return frameworks of paddy rice processors. The per month cost of production of the par-boilers during the rainy, dry seasons and overall period were ₦59168.81, ₦76191.89 and ₦69495.33 respectively (Table 4a). Of the cost of production per month vis-à-vis the rainy, dry seasons and the overall period, the total variable cum fixed costs gulped ₦43332.31 and ₦15836.50; ₦60503.84 and ₦15688.05; ₦54613.15 and ₦14882.18 respectively. Besides, the proportions of total variable cum fixed costs in the cost of production per month for the rainy, dry seasons and overall period were 73.24 and 26.76%; 79.41 and 20.59%; and, 78.59 and 21.42% respectively. Of the total cost across the study periods, the sack had the largest cost proportion (> 30%) and distantly followed by cost of firewood while other cost items proportions were either small or marginal. The total revenue, gross margin cum net income per ton for the rainy, dry seasons and overall period were ₦209508.30, ₦166176 and ₦150339.50; ₦209460.90, ₦148957 and ₦133269; and ₦209484.60, ₦154871.40 and ₦139989.30 respectively. Furthermore, the respective rate of return on naira invested (ROI) index in par-boiling enterprise during the rainy, dry seasons cum the overall period respectively showed that for every naira invested in the enterprise, the incurred respective cost (₦1) will be defray and profits of ₦2.84k, ₦1.46k and ₦1.83k will be earned. Also, based on the rate of return on capital invested (ROCI), it can be suggested that if a parboiler is given a short-term credit at an interest rate of 12%, he/she will be able to pay the cost of the credit and still make a handsome profit as the respective ROCI of the targeted periods were 100% greater than the cost of credit.

On the other hand, for the millers, the cost of production per month for rainy, dry and overall period respectively was ₦72048.05, ₦90317.79 and ₦82075.72 (Table 4b).

Table 2. SWOT of small-scale rice processors

STRENGTH	Low involvement of the private industry (W14)
Economic power (employment, source of income) (S1)	Value chain has few solid links (15)
Societal clout/ social acuity/ social power (S2)	**OPPORTUNITY**
Inexpensive labor (S3)	Market segment is new (O1)
Milling industries have a large pool of trained labor (S4)	Partnership (O2)
Family and rural labor supply (S5)	Business formation procedure (O3)
Public commitment (S6)	Assistance from regional or global groups (FAO, IFAD, JARDA, world Bank, ADB, research institute) (O4)
Agriculture's contribution to the local economy (S7)	Strong business demand locally (O5)
Using agricultural equipment (S8)	Profitability (O6)
The required labor population is small (S9)	Technologies available off-the-shelf: Creation of novel technology (O7)
Rice of various varieties is processed and provided (S10)	Both a large local and global market (O8)
Paddy rice is accessible (S11)	Increased attention paid to agribusiness financing (O9)
Superior profitability (S12)	Adoption of cutting-edge technology (O10)
Significant consumer-based (S13)	High income (O11)
Higher quality of life (S14)	Support for training (O12)
Value addition (S15)	Quality development (O13)
Stable income generation (S16)	Demand for rice goods that have been processed (O14)
WEAKNESS	**THREAT**
Economic power (employment, source of income) (W1)	A cap/limit on studies (T1)
Poor/inadequate Infrastructure (W2)	Government concern is low (T2)
Insufficient industrial drive as a result of bad government strategy (W3)	No legal or accounting mechanism (T3)
Mostly small-scale farmers (W4)	Minimal cost of substitute product (T4)
Low skilled/ technical know-how (W5)	Climate change (T5)
Government incentives are lacking (W6)	Environmental variables such as land degradation (T6)
Revenue is too low for investment (W7)	Governmental policy inconsistencies (T7)
Bad credit access (W8)	Cost of cultivation has increased (T8)
Excessive interest rates (W9)	Paddy rice prices in the local market compete with those of imported rice (T9)
Hefty family budget (W10)	Available water (T10)
Insufficient information or processing (W11)	Increasing gasoline costs (cost of inputs) (T11)
Insufficient processing capacity (W12)	Diseases and pests (12)
Inadequate research and outreach efforts (W13)	

Source: Reconnaissance survey (2022).

Table 3. Strategic position and action evaluation (SPACE) matrix of SWOT

Internal factor	Weakness	Strength
External factor		
Opportunity	II	I
	Conservative (W-O)	Aggressive (S-O)
Threat	IV	III
	Defensive (W-T)	Competitive (S-T)

Source: Hosseini et al. (2019); Kiani et al. (2021)

Of the cost of production per month vis-à-vis rainy, dry and overall period, the total variable cum fixed costs were ₦44583.53 and ₦27464.51; ₦60394.90 and ₦29922.88; and, ₦5113.90 and ₦26961.82 respectively. Besides, the cost proportion of the total variable cost in the cost of production was the highest while that of the total fixed cost was marginal. Furthermore, the total revenue, gross margin and net income per ton per month for the rainy, dry seasons and the overall period were ₦203485.20, ₦158901.70 and ₦131437.20; ₦205282.40, ₦144887.50 and ₦114964.60; and, ₦204383.80, ₦149269.90 and ₦122308.10, respectively. The ROI index of rainy, dry seasons and the overall period were 3.56, 2.40 and 2.71 respectively. Based on the ROI index, it implies that for every naira invested in the enterprise during the rainy, dry seasons and the overall period, the incurred cost (₦1) in the enterprise in each of the reference periods will be returned, and a profit of ₦2.56k, ₦1.40k and ₦1.71k will be made respectively. Therefore, it can be suggested that both the par-boiling and milling enterprises are profitable enterprises in the study area. Generally, it is very significant for the credit policy; the financial and non-financial institutions are advised to explore any condition of Small and Medium Enterprise (SME) credit for milling and par-boiling progressive development at a reasonable interest rate to these processors, so as to enable them to cope without hindrance to their enterprise going concern. However, the profitability ratio of the rainy season is due to availability of paddy rice at low cost- glut that characterized the boom period from the producers and suppliers in the local markets. These results agreed with the findings of Emeka et al. (2015); Bose et al. (2020); Ebukiba et al. (2020); and Sadiq et al. (2021c) who in their various study areas found small-scale rice milling enterprise to be a profitable venture. Contrarily, Bime et al. (2014), reported milling enterprise not to be a profitable enterprise in their study area as evident from the negatively skewed benefit-cost ratio analysis (see Tables 4a and 4b).

DISPARITY AND SHARE CONTRIBUTION OF PROCESSORS TO RICE VALUE CHAIN

A perusal of the Gini decomposition analysis showed that moderate inequality exists in the value addition of processors in the rice processing value chain (Table 5). Besides, for the sub-groups in the processing chain vis-à-vis the par-boilers and millers, the empirical evidence showed moderate and low inequalities respectively in the distribution of value addition among the respective actors. For the overall, par-boilers and millers, the disparity in the value addition distribution between the low and

Table 4a. Costs and return structures of par-boilers per ton per month

Items	Rainy season				Dry season				Overall	
	Quantity	Unit Price	Total	%	Quantity	Unit Price	Total	%	Total	%
Repairs/ Maintenance			454.8872	0.768796		538.8722	538.8722	0.707257	495.129	0.712464
Firewood	521.8797	10.57	5516.268	9.322933	27.04166	509.782	13785.35	18.09294	10973.4	15.79012
Tax			1500	2.53512		700	700	0.918733	1287.198	1.852208
Interest on working capital		12% TVC	4642.747	7.846613		12% TVC	6482.555	8.508195	5599.863	8.057897
Miscellaneous expenses			4408.421	7.450583		3935.045	4583.045	6.015135	4486.426	6.455722
Sacks	1200	17	19361.17	32.72192	34.2978	754.9323	25892.52	33.9833	22688.6	32.64765
Water charges	20	32.5347	650.694	1.099725	30.47414	20	609.4827	0.799931	633.3402	0.911342
Transportation	248.4211	4.59598	1141.738	1.929629	3.258523	300	977.557	1.28302	1076.17	1.54855
Family labour	0.54547	9868.421	4923.997	8.321947	0.455907	11375.94	5186.376	6.806992	5042.049	7.255234
Hired labour	0.29769	9868.421	2687.272	4.541704	0.262568	11375.94	2986.962	3.920315	2826.114	4.066624
Permanent labour	0.369878	9868.421	3338.918	5.643038	0.275088	7958.647	2189.328	2.87344	2951.049	4.246399
Depreciation			1209.463	2.044089			1209.463	1.587391	1209.463	1.740351
Managerial cost		10% of TVC	4333.231	7.323505		10% of TVC	6050.384	7.940982	5226.539	7.520704
Rental value			5000	8.450398			5000	6.562378	5000	7.194728
TC			59168.81	100			76191.89	100	69495.33	100
TVC			43332.31				60503.84		54613.15	78.58535
TFC			15836.5				15688.05		14882.18	21.41465
Processed paddy	1000	200	200000		1000	200	200000		200000	
By-product	950.8334	10	9508.334		946.0874	10	9460.874		9484.604	
TR			209508.3				209460.9		209484.6	
NI			150339.5				133269		139989.3	
GM			166176				148957		154871.4	
ROI			3.834922				2.461943		2.83579	
RORCI			2.540858				1.749123		2.014369	

Source: Field survey (2022).

high profit margin actors were 31.76, 30.89 and 17.94% respectively. Furthermore, the disparity between the value addition of par-boilers and millers was 16.75%; value addition disparity within the actors was 13.24%; and the disparity in value addition due to interaction or overlap among the actors was 1.76%. It is worth to note that as the stages trickled down, the disparity in the value addition decline vis-à-vis between, within and interaction effects. To nuance further, moderate inequality exists in the value chain of rice processors which owes to differences in the scale of operation, and when it narrow-down to within the operation of each actors, the disparity winds down; likewise between the two actors in the value chain. Besides, distinct effect of

Table 4b. Costs and return structures of millers per ton per month

Items	Rainy season				Dry season				Overall	
	Quantity	Unit price	Total	%	Quantity	Unit price	Total	%	Total	%
Diesel	13.9446	348.6269	4861.462	6.747527	20.23532	348.2836	7047.631	7.803148	6033.847	7.351562
Electricity			2000	2.775925			3500	3.875206	2873.958	3.501593
Repairs/ Maintenance			7383.582	10.24814			9697.015	10.73655	8567.221	10.43819
Charges on hired machinery			1300	1.804351			1300	1.439362	1300	1.583903
Tax		2517.91	2517.91	3.494766		1059.701	1059.701	1.173303	2151.395	2.621231
Interest on working capital		12% of TVC	4776.807	6.63003		12% of TVC	6470.883	7.164572	5656.668	6.892011
Miscellaneous expenses		5277.612	5277.612	7.325128		5937.463	5937.463	6.573968	5589.707	6.810427
Sacks	26.23319	884.9254	23214.42	32.22074	35.49942	915.3731	32495.22	35.97875	28110.52	34.24949
Water charges	2.99338	20	59.86761	0.083094	2.258692	20	45.17384	0.050017	54.3464	0.066215
Transportation		1383.09	1383.09	1.919677		1750.448	1750.448	1.938099	1567.646	1.909999
Family labour	0.051169	24165.67	1236.543	1.716276	0.063571	21820.9	1387.175	1.535882	1307.681	1.593262
Hired labour	0.035567	13319.4	473.7355	0.657527	0.042536	10835.82	460.9156	0.510327	468.1335	0.570368
Permanent labour	0.036286	5100	185.0575	0.256853	0.039741	5210.448	207.0678	0.229266	195.4381	0.238119
Depreciation			2919.609	4.052309			2919.609	3.232596	2919.609	3.557214
Managerial cost		10% of TVC	4458.353	6.188028		10% of TVC	6039.49	6.686933	5279.556	6.432543
Rental value			10000	13.87963			10000	11.07202	10000	12.18387
TC			72048.05				90317.79		82075.72	
TVC			44583.53				60394.9		55113.9	
TFC			27464.51				29922.88		26961.82	
Processed paddy	1000	200	200000		1000	200	200000		200000	
By-product	348.5245	10	3485.245		528.2419	10	5282.419		4383.832	
TR			203485.2				205282.4		204383.8	
NI			131437.2				114964.6		122308.1	
GM			158901.7				144887.5		149269.9	
ROI			3.564134				2.399002		2.70839	
ROCI			1.824299				1.27289		1.490186	

scale of operation peculiar to each sector might be the possible reason for the less inequality in the value chain vis-à-vis within and between. However, the interaction effect showed that the par-boilers favours value addition in chain. More so, the gini contribution of par-boilers to the value addition disparity was higher- 0.10 while the

millers' gini contribution to value addition disparity was 0.03. This implies that the value addition is more equally distributed among the millers compared to that of the par-boilers. The high gini contribution of par-boilers to the value addition disparity may be attributed to diseconomies of scale that owe to poor production efficiency unlike the millers that take advantage of economies of scale owing to adoption of partial-to-modernized operational technologies. Nevertheless, the share profits of par-boilers and millers respectively to the value addition were 49.75 and 50.25% as evident by their respective share value addition index. Succinctly, the share profit difference between the two actors is very marginal despite the fact that the latter actor operates on an efficient scale than the former. Nevertheless, the possible reason might be as a result of crowd-out effects of the par-boilers in the value chain. Therefore, there is a need for a paradigm shift in the technical operations of the par-boilers so as to enable them to take advantage of economies of scale- production efficiency (see Table 5).

PROSPECTS OF PADDY RICE PROCESSING VALUE CHAIN ENTERPRISE

Presented in Table 6 were the prospects of the paddy rice processing value chain vis-à-vis strengthen, weakness, opportunities and threats (SWOT). For the par-boilers, it was determined that the majority perceived strengthen, weakness, threats and opportunities inherit in the enterprise to be high vis-à-vis 92, 94, 93.2 and 93.2% respectively (Table 6a). Further, these findings were justified by the respective average index of the SWOT that was above the threshold index of 2.0 (Table 6c). The major determined strengths perceived by the respondents were Societal clout/ social acuity/ social power (S2), family and rural labor supply (S5), public commitment (S6), agriculture's contribution to the local economy (S7), the required labor population is small (S9), rice of various varieties is processed and provided (S10), paddy rice is accessible (S11), significant consumer-based (S13), higher quality of life (14); and value addition (S15) (Table 6c). The determined major weaknesses perceived by the respondents were economic power (employment, source of income) (W1), low skilled/ technical know-how (W5), Government incentives are lacking (W6), Excessive interest rates (W9), inadequate research and outreach efforts (W13); and, low involvement of the private industry (W14). The determined major opportunities were new market segment (O1), partnership (O2), business formation procedure (O3), assistance from regional or global groups (O4), strong business demand locally (O5), both a large local and global market (O8), increased attention paid to agribusiness financing (O9); and, quality development (O13). The determined major threats were a cap/limit on studies (T1), government concern is low (T2), no legal or accounting mechanism (T3), minimal cost of substitute product (T4), governmental policy inconsistencies (T7); and available water (T10). Furthermore, the SWOT matrix of the millers showed that the majority of the millers perceived the strengths (94%), weakness (94%), opportunities (92.5%) and threats (91%) in the milling enterprise to be high (Table 6a). Besides, the average index of the respective dimensions (SWOT) being above the threshold index of 2.0 justified the high perceptions status of the enterprise SWOT among most of the millers (Table 6b). The identified major strengths of the milling enterprise were economic power (employment, source of income) (S1), societal clout/ social acuity/ social power (S2),

Table 5. Contribution to rice value chain

Items	Pool	Par-boilers	Millers
		Gini decomposition	
Total	0.3175516	0.3089065	0.1794412
Within	0.132401	-	-
Between	0.1675241	-	-
Overlap/interaction	0.01762643	-	-
Contribution	-	0.10219290	0.03020813
Share profit	-	0.4974759	0.5025241
		Mean log deviation	
Total	0.1996266	0.18433554	0.05934564
Within	0.1424639	-	-
Between	0.0571627	-	-
Overlap	-	-	-
Contribution	-	0.12258313	0.01988079
Share profit	-	0.4974759	0.5025241

Source: Field survey, 2022

milling industries have a large pool of trained labor (S4), agriculture's contribution to the local economy (S7), using agricultural equipment (S8), paddy rice is accessible (S11), significant consumer-based (S13); and stable income generation (S16). The determined major opportunities were market segment is new (O1), partnership (O2), assistance from regional or global groups (O4), strong business demand locally (O5), profitability (O6), Technologies available off-the-shelf: creation of novel technology (O7), adoption of cutting-edge technology (O10), high income (O11), support for training (O12), quality development (O13); and demand for rice goods that have been processed (O14) (Table 6c). However, all the weakness and the threat indicators were perceived to be a major challenge (Table 6c). Generally, most of the processors (pool group) perceived the strengths, weakness, opportunities and threats inherent in the study value chain to be high (Table 6a). Besides, the average index of the SWOT dimensions to be higher than the threshold value of 2.0, thus support the high perception status among most of the processors in the study area (Table 6c). Also, the perceived status of all the respective indicators vis-à-vis the SWOT dimensions was high.

Furthermore, on the average, based on the space matrix, the par-boilers, millers and the pool groups respectively are advised to adopt defensive mechanism to stay afloat in the rice supply value chain (Table 6b and Figure 1). Moreso, individual-wise, based on the space matrix, 52.6, 21.1, 15.8 and 10.5% of the par-boilers respectively are advised to adopt defensive, competitive, conservative and aggressive measures to optimize their operations in the rice supply value chain (Table 6b). Besides, for the millers, 41, 8, 20.9, 20.9 and 16.4% of millers are advised to adopt defensive, competitive, conservative and aggressive strategies respectively, for sustenance of their operational activities in the supply value chain (Table 6b). Generally, 49, 21, 17.5 and 12.5% of the processors

Table 6a. Individual-wise distribution of SWOT

	Strength	Weakness	Opportunity	Threats
	Par-boilers			
Low	10 (7.5)	8 (6.0)	9 (6.8)	9 (6.8)
High	123 (92.5)	125(94.0)	124 (93.2)	124 (93.2)
Total	133 (100)	133 (100)	133 (100)	133 (100)
	Miller			
Low	4 (6.0)	4 (6.0)	5 (7.5)	6 (9.0)
High	63 (94.0)	63 (94.0)	62 (92.5)	61 (91.0)
Total	67 (100)	67 (100)	67 (100)	67 (100)
	Pool			
Low	14 (7.0)	12 (6.0)	14 (7.0)	15 (7.5)
High	186 (93.0)	188 (94.0)	186 (93.0)	185 (92.5)
Total	200 (100)	200 (100)	200 (100)	200 (100)

Source: Field survey, 2022
Note: Figure in parenthesis is percentage

Table 6b. Individual-wise distribution of SWOT Space matrix

Strategy	Par-boilers	Millers	Pool
Aggressive	14 (10.5)	11 (16.4)	25 (12.5)
Conservative	21(15.8)	14 (20.9)	42 (21.0)
Competitive	28 (21.1)	14 (20.9)	35 (17.5)
Defensive	70 (52.6)	28 (41.8)	98 (49.0)
Total	133 (100)	67(100)	200 (100)

Source: Field survey, 2022
Note: Figure in parenthesis is percentage

are advised to adopt defensive, competitive, conservative and aggressive mechanisms respectively to remain active and vibrant in the rice supply value chain in the study area (Table 6b). Therefore, it can be inferred that the enterprises have a good prospect if most of the actors will tap on the defensive mechanism, thus enhance the sustainability of rice supply value chain in the study area (see Tables 6a, 6b, 6c, etc.), (see Figure 1).

CONCLUSION AND RECOMMENDATIONS

Small-scale processors of paddy rice continue to be the primary drivers of the primary/upstream rice value chain growth in Nigeria, despite the obstacles to the development of SME's there. Under the different period of operations, the empirical

Table 6c. Indicator-wise SWOT analysis of processors

Par-boilers (Strength- Weakness)							
Strength	**Index**	**W**	**Decision**	**Weakness**	**Index**	**W**	**Decision**
S1	1.989654	0.596	L	W1	2.774761	0.774	H
S2	2.172256	0.835	H	W2	1.663687	0.591	L
S3	1.621895	0.642	L	W3	1.723789	0.534	L
S4	1.995549	0.754	L	W4	1.36818	0.446	L
S5	2.03109	0.667	H	W5	2.310612	0.767	H
S6	2.022085	0.802	H	W6	2.339774	0.759	H
S7	2.276857	0.741	H	W7	1.908211	0.616	L
S8	1.309143	0.474	L	W8	1.062647	0.397	L
S9	2.252421	0.823	H	W9	2.013636	0.739	H
S10	2.340737	0.777	H	W10	1.599278	0.552	L
S11	2.134877	0.742	H	W11	1.801494	0.598	L
S12	1.718905	0.567	L	W12	1.782782	0.655	L
S13	2.057017	0.723	H	W13	2.286421	0.749	H
S14	2.247263	0.777	H	W14	2.143799	0.772	H
S15	2.142005	0.755	H	W15	1.812842	0.654	L
S16	1.981178	0.685	L				
Average	**2.842688**		**H**		**2.977394**		**H**
Difference				**-0.13471**			

Source: Field survey, 2022

Table 6c. Continued .....

Par-boilers (Opportunity – Threat)							
Opp.	**Index**	**W**	**Decision**	**Threat**	**Index**	**W**	**Decision**
O1	2.042496	0.601	H	T1	2.788912	0.868	H
O2	2.164531	0.788	H	T2	2.695203	0.811	H
O3	2.507469	0.845	H	T3	2.371739	0.718	H
O4	2.078436	0.886	H	T4	2.206316	0.786	H
O5	2.54396	0.793	H	T5	1.91019	0.647	L
O6	1.901333	0.644	L	T6	1.605073	0.578	L
O7	1.427544	0.515	L	T7	2.555594	0.821	H
O8	2.189253	0.797	H	T8	1.936421	0.657	L
O9	2.017524	0.662	H	T9	1.551789	0.546	L
O10	1.469684	0.537	L	T10	2.498622	0.785	H
O11	1.794135	0.615	L	T11	1.98819	0.646	L
O12	1.630226	0.586	L	T12	1.710125	0.626	L
O13	2.258817	0.769	H				
O14	1.966737	0.756	L				
Average	**2.858091**		**H**		**3.041368**		**H**
Difference				**-0.18328**			
Strategy				**WT=Defensive**			

Source: Field survey, 2022

Table 6c. Continued .....

Millers (Strength- Weakness)							
Strength	**Index**	**W**	**Decision**	**Weakness**	**Index**	**W**	**Decision**
S1	2.393194	0.786	H	W1	2.700597	0.83	H
S2	2.575379	0.836	H	W2	2.553493	0.807	H
S3	1.851224	0.646	L	W3	2.64043	0.816	H
S4	2.440746	0.79	H	W4	2.037234	0.613	H
S5	1.444299	0.448	L	W5	2.769576	0.872	H
S6	1.837572	0.548	L	W6	2.122699	0.656	H
S7	2.027493	0.651	H	W7	2.100716	0.634	H
S8	2.182925	0.66	H	W8	2.120024	0.648	H
S9	1.896756	0.592	L	W9	2.478806	0.72	H
S10	1.824716	0.566	L	W10	2.514896	0.759	H
S11	2.013803	0.664	H	W11	2.272478	0.732	H
S12	1.866567	0.555	L	W12	2.692537	0.82	H
S13	2.063343	0.646	H	W13	2.519552	0.765	H
S14	1.902149	0.633	L	W14	2.530746	0.785	H
S15	1.957576	0.633	L	W15	2.031323	0.634	H
S16	2.493333	0.737	H				
Average	**3.153794**		**H**		**3.253549**		**H**
Difference				**-0.09975**			

Source: Field survey, 2022

Table 6c. Continued .....

Millers (Opportunity – Threat)							
Opp.	**Index**	**W**	**Decision**	**Threat**	**Index**	**W**	**Decision**
O1	2.326352	0.738	H	T1	2.37797	0.781	H
O2	2.061413	0.686	H	T2	2.33391	0.747	H
O3	1.899622	0.628	L	T3	2.216597	0.714	H
O4	2.14209	0.69	H	T4	2.130527	0.709	H
O5	2.162579	0.702	H	T5	2.52394	0.813	H
O6	2.394378	0.745	H	T6	2.498149	0.792	H
O7	2.052836	0.69	H	T7	2.389134	0.748	H
O8	1.945612	0.639	L	T8	2.388239	0.734	H
O9	1.735085	0.568	L	T9	2.396657	0.772	H
O10	2.268289	0.733	H	T10	2.618657	0.825	H
O11	2.080318	0.716	H	T11	2.451045	0.782	H
O12	2.080478	0.704	H	T12	2.526149	0.786	H
O13	2.529294	0.853	H				
O14	2.760597	0.867	H				
Average	3.056425		H		3.134953		H
Difference				**-0.07853**			
Strategy				**WT= Defensive**			

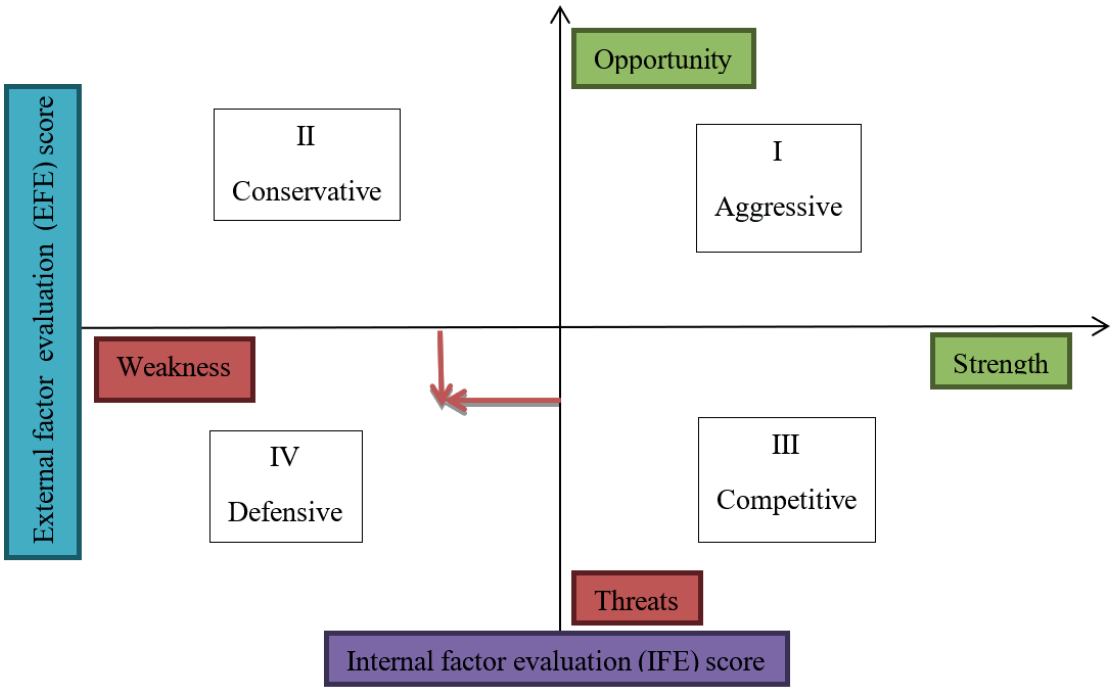
Source: Field survey, 2022

Table 6c. Continued .....

						Pool					
Strength	**Index**	**Decision**	**Weakness**	**Index**	**Decision**	**Opp.**	**Index**	**Decision**	**Threat**	**Index**	**Decision**
S1	3.171381	H	W1	3.413565	H	O1	3.26277	H	T1	3.133343	H
S2	2.841194	H	W2	3.016581	H	O2	2.866991	H	T2	3.227929	H
S3	2.696521	H	W3	3.232755	H	O3	2.991915	H	T3	3.204146	H
S4	2.873248	H	W4	3.215689	H	O4	2.677999	H	T4	2.900898	H
S5	3.116941	H	W5	3.099565	H	O5	3.148187	H	T5	3.037076	H
S6	2.859005	H	W6	3.153691	H	O6	3.092665	H	T6	2.995053	H
S7	3.092205	H	W7	3.207142	H	O7	2.888282	H	T7	3.151516	H
S8	3.079425	H	W8	3.045618	H	O8	2.879433	H	T8	3.109029	H
S9	2.932281	H	W9	3.079124	H	O9	3.050901	H	T9	2.995786	H
S10	3.101603	H	W10	3.138195	H	O10	2.943286	H	T10	3.178434	H
S11	2.950697	H	W11	3.063136	H	O11	2.910934	H	T11	3.108708	H
S12	3.195608	H	W12	3.034115	H	O12	2.876514	H	T12	3.000194	H
S13	3.009759	H	W13	3.174355	H	O13	2.951979	H			
S14	2.942846	H	W14	3.002277	H	O14	2.912713	H			
S15	2.953589	H	W15	2.984601	H						
S16	3.146632	H									
Average	**2.991311**	**H**		**3.1254**	**H**		**2.958087**	**H**		**3.090049**	**H**
Difference			**-0.13409**						**-0.13196**		
Strategy					**WT = Defensive**						

Source: Field survey, 2022
Note: Opp. = Opportunity

Figure 1. Space matrix (recommended strategy for all the target categories)



evidence established that the processing enterprise is viable and profitable under efficient management and can serve as a veritable means of livelihood if properly invested on. However, diseconomies of scale due to use of non-innovative technologies by the par-boilers posed a threat to the sustainability of the supply value chain in the long-run as it creates disparity in their contribution to value addition. Nevertheless, the par-boilers favours the value addition of rice processing in the value chain. Furthermore, the enterprises stand a good chance of being prospective in the rice supply value chain if most of the actors will explore defensive strategy in their business going concern. Therefore, the study recommends the need for innovative marketing tools especially for the par-boilers so as to enable their enterprises achieve economies of scale, a veritable precursor for sustainability of the supply value chain in the long-run.

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