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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 the rice value chain of paddy processors in Jigawa State of Nigeria. Despite the role of small-scale paddy rice processors as the main engine of growth of upstream rice value chain, and the growth and development of the 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 utilised cross-sectional data elicited through a well-structured questionnaire from a total of 200 processors (133 parboilers 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 analysed using both descriptive and inferential statistics. Based on the empirical evidence, it is established that the rice processing potential has not been fully exploited in the study areas. In addition, it is evident that the rice processing enterprise is not only viable and profitable; it features good prospects in the supply value chain of rice in the study areas. However, to maintain the prospects in the supply value chain, the target actors must adopt a defensive mechanism, as inferred by the SPACE matrix.

Keywords: agripreneurship, paddy, smallholders, value chain, Jigawa State, Nigeria

JEL Classification: D01, D21, D22, G21

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 labour 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) and Enesi and Ibrahim (2021), SMEs in Nigeria play a crucial part in the country's economic development through their ability to increase productivity, reduce 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 parboilers. In the early 2000s, the sector was mainly a 'cottage industry', made up of small-

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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 also frequently out of commission because of subpar maintenance and a lack of replacement parts. Under ATA (Agricultural Transformation Agenda), which began in 2011, the Federal Government of Nigeria (FGN) made significant investments to increase the 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 the 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 include 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 distances from urban markets across the nation contribute to the high expenses of trade and marketing.

Despite the significant efforts to promote small-scale rice processing enterprises through microfinance loans in Nigeria's Jigawa State, there remains a gap in understanding the actual prospects and challenges faced by beneficiaries in sustaining and expanding their businesses. The prospects of small-scale rice processing enterprises among beneficiaries of microfinance loans in Nigeria's Jigawa State present a critical area for investigation and intervention. While microfinance loans aim to empower individuals to start or grow small businesses, particularly in the agricultural sector, such as rice processing, there are persistent issues hindering the realisation of their full potential. Despite the implementation of microfinance initiatives aimed at fostering entrepreneurship and economic development, the sustainable growth and success of small-scale rice processing businesses remain uncertain. Therefore, a comprehensive understanding of the challenges and opportunities faced by these enterprises is essential to inform targeted policies and support mechanisms.

Furthermore, the absence of desired research findings and the 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 this, the absence of empirically verified research findings on the prospects of this enterprise in the study area coupled with the failure to evaluate the prospect proposition of the enterprise constitutes an empirical and evidence gaps. Nevertheless, the literature has shown evidence of a related study in a relative state with a comparative advantage in the rice value chain (Sadiq et al., 2020c), with little or no information in the study area, thus amounting 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 is important 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 prospects of the rice processing enterprise in the study areas, as the literature shows little or empirical information to justify empirically the sustainability of this important segment of the rice supply value chain in the study area. Consequently, the broad objective of this research was to determine the prospects of the rice processing enterprise in Nigeria's Jigawa State while the specific objectives were to estimate the profitability of the rice processing enterprise; the contribution of this processing to the rice supply value chain; and, to determine the prospects of the rice processing enterprise in the study area.

Research methodology

The research region, which was formerly part of Kano State, has a total land area of about 22,410 square kilometres. Its boundary to the west is Kano State, to the east are Bauchi and Yobe States, to the north are Katsina and Yobe States and to the south is the Republic of Niger. With a generally flat in topography, the state's northern, central, and eastern regions are traversed by undulating sand dunes that stretch from southwest to northeast. The area around Dutse, the state capital, is rocky and hilly to a lesser extent. The hills in the regions of Birnin Kudu and Kazaure, in the state's southern and western regions, reach heights of 600 metres above sea level. The Hadejia River flows through the state from west to east, 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, with monthly average temperatures that range from 15°C to 35°C. The rainy season lasts from May to September, and the rainfall volume typically ranges between 600 and 1000 millimetres.

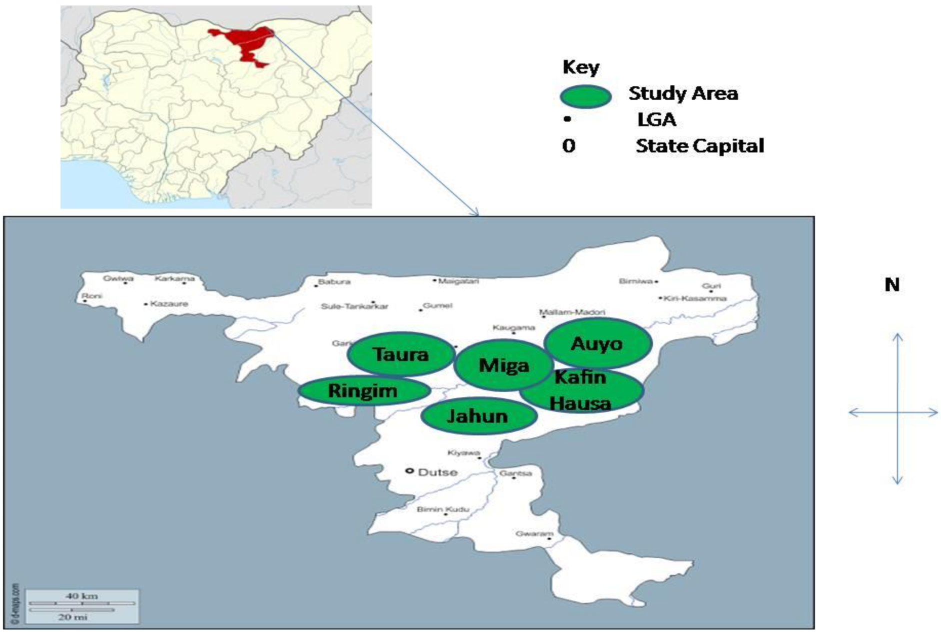

Fig. 1. Map of Jigawa State showing Study Areas

Source: Jigawa State Diary (2017)

More rain falls in the southern than in the northern parts of the state (www.jigawastate.gov.ng). Although remnants of Guinea savannah 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 is not marshy. Agriculture/cultivating crops, raising livestock, and non-farm activities are the main sources of employment of the local population. Other occupations include hunting and artisanal work.

Table 1. Sampling frame of rice processors in Jigawa State

Zone	LGA	Village	Sampling frame		Sample size	
			Parboiler	Miller	Parboiler	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.

$n = N/1 + N(e)^2$ …………………………………………….. (1)

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

A multi-stage sampling technique was used to elicit information from a total of 200 actors (133 parboilers and 67 millers) of the processing chain of the rice value chain in Nigeria's Jigawa State. Based on the high concentration of rice production, three out of four of the stratified agricultural zones were purposively selected, with the chosen agricultural strata being Zones 1, 2 and 3. Using simple random sampling technique, 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 (Figure 1). Also, using simple random sampling technique, from each of the selected LGAs, three villages were randomly selected, giving a total of 18 villages. The random selection of the LGAs and villages were achieved by using an inbuilt Microsoft sampling tool. Afterwards, on the basis of the activities in the processing chain, the processing population was stratified into parboilers and millers. Using Yamane's formula (Yamane, 1967), a total of 200 processors, composed of 133 parboilers 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 an interview schedule using an easy-route cost approach (i.e., at no interval period) in the year 2022. Data syntheses were performed using descriptive and inferential statistics. In order of arrangement, the first, second and third objectives, respectively, were achieved using a farm budgeting technique, the Gini decomposition model, and a SWOT (Strength, Weakness, Opportunity and Threat) matrix in conjunction with exploratory factor analysis.

Empirical model

1. Budgeting technique: Following Sadiq and Samuel (2016), this technique is used to estimate both short and long-run profitability of an enterprise. The formula is as follow:

$$NI = \sum_{i=1}^{n} TR - \sum_{i=1}^{n} TC \quad \text{.......} (2)$$

$$TC = \sum_{i=1}^{n} TVC - \sum_{i=1}^{n} TFC \quad \text{.......} (3)$$

$$GM = \sum_{i=1}^{n} TR - \sum_{i=1}^{n} TVC \quad \text{.......} (4)$$

$$ROI = \frac{GM}{TVC} \quad \text{.......} (5)$$

$$ROCI = \frac{NI}{TC} \quad \text{.......} (6)$$

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 Rate of return on naira invested, and 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,…………,n), composed of Q_j(j,h=1,…………,k) sub-groups, each of which is composed of n_j individuals (i,r=1,…………,n_j). Let us represent Q_j by μ_j and the arithmetic mean of Q's earnings. Ouedraogo and Ouedraogo (2015) measure the related Gini coefficient as follows:

$$G = \frac{\sum_{i=1}^{n}\sum_{r=1}^{n} |x_{Q,i} - x_{Q,r}|}{2n^2\mu} \quad \text{.......} (7)$$

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 2μG.

The degree to which the revenue distribution is unbalanced increases as the index G approaches one.
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 & complex evolution.

Decomposition into sub-groups

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

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

The term $x_{j,i}$ refers to 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, and 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:

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

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

The revenue distribution between groups Q_j and Q_h is uneven when G_{jh} tends towards the value one, while an 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:

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

$\forall\mu_j < \mu_h$

The breakdown of the Gini index can then be expressed as:

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

with:

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

and:

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

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

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

Decomposition in income sources

Using the equation:

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

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

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

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

$x_{Q,i} = \sum_{m=1}^{q} x_{Q,i}^{m}$ ……………………………………………….. (19)

The Gini index can be expressed in the following way:

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

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

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

Multi-decomposition

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

$G = G_w + G_{nb} + G_t$ ……………………………………………….. (22)

with:

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

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

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

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

Conducting a SWOT analysis helps to determine an organisation'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, Enterprise, Farm, Industry, or Product) can and cannot do for both internal (the strengths, and weaknesses) and external (the potential opportunities and threats) elements (Sadiq *et al*., 2021c; Kiani *et al*., 2021). It suggests a structure for aiding researchers, planners, and investors in identifying and prioritising 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 Strengths, Weaknesses, Opportunities, and Threats.

Table 2. SWOT of small-scale rice processors

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

Source: Reconnaissance survey, 2022.

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 internal factor analysis summary (IFAS) and external factor analysis summary (EFAS) matrixes (Hosseini *et al*., 2019; Kiani *et al*., 2021), including:

- SO strategy/plan (Strengths and Opportunities): By using all the power available to seize and profit from opportunities, this approach combines the strengths and opportunities. This tactic is also known as a forceful/aggressive tactic.
- ST strategy/plan (Strengths and Threats): An approach that best makes use of personal assets to address problems or weaknesses. This tactic is known as a competitive plan.
- WO strategy/plan (Weaknesses and Opportunities): A comprehensive approach that addresses both internal and external opportunities and weaknesses in order to maximise internal strengths. This tactic is commonly described as conservative.
- WT strategy/plan (Weaknesses and Threats): In order to reduce internal weaknesses and prevent threats, combine tactics between threats and weaknesses. Defensive strategy is another name for this tactic.

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

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

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

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 parboilers during the rainy and dry seasons and the overall period were ₦59,168.81, ₦76,191.89 and ₦69,495.33, respectively (Table 4a). Of the cost of production per month vis-à-vis the rainy and dry seasons and the overall period, the total variable and fixed costs amounted to ₦43,332.31 and ₦15,836.50, ₦60,503.84 and ₦15,688.05, and ₦54,613.15 and ₦14,882.18, respectively. Furthermore, the proportions of the total variable and fixed costs in the cost of production per month for the rainy and dry seasons and the 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 storage sacks consumed the largest proportion of the costs (> 30%), distantly followed by the cost of firewood (15.79%), while the proportions of the other cost items were either small or marginal. The total revenue, gross margin and net income per tonne for the rainy and dry seasons and the overall period were ₦209,508.30, ₦16,6176 and ₦150,339.50, ₦209,460.90, ₦148,957 and ₦133,269, and ₦209,484.60, ₦154,871.40 and ₦139,989.30, respectively. Furthermore, the respective rate of return on naira invested (ROI) index in the parboiling enterprise during the rainy and dry seasons and the overall period showed that for every naira invested in the enterprise, the incurred respective cost (₦1) will be defrayed and profits of ₦2.84k, ₦1.46k and ₦1.83k will be earned, respectively. Also, based on the rate of return on capital invested (ROCI), it can be suggested that if a parboiler is given a short-term loan at an interest rate of 12%, he/she will be able to pay back the cost of the loan and still make a substantial profit, as the respective ROCI of the targeted periods were 100% greater than the cost of credit.

Table 4a. Costs and return structures of parboilers per tonne 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	5,516.268	9.322933	27.04166	509.782	13,785.35	18.09294	10,973.4	15.79012
Tax			1,500	2.53512		700	700	0.918733	1,287.198	1.852208
Interest on working capital		12% TVC	4,642.747	7.846613		12% TVC	6,482.555	8.508195	5,599.863	8.057897
Miscellaneous expenses			4,408.421	7.450583		3,935.045	4,583.045	6.015135	4,486.426	6.455722
Sacks	1,200	17	19,361.17	32.72192	34.2978	754.9323	25,892.52	33.9833	22,688.6	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	1,141.738	1.929629	3.258523	300	977.557	1.28302	1,076.17	1.54855
Family labour	0.54547	9,868.421	4,923.997	8.321947	0.455907	11,375.94	5,186.376	6.806992	5,042.049	7.255234
Hired labour	0.29769	9,868.421	2,687.272	4.541704	0.262568	11,375.94	2,986.962	3.920315	2,826.114	4.066624
Permanent labour	0.369878	9,868.421	3,338.918	5.643038	0.275088	7,958.647	2,189.328	2.87344	2,951.049	4.246399
Depreciation			1,209.463	2.044089			1,209.463	1.587391	1,209.463	1.740351
Managerial cost		10% TVC	4,333.231	7.323505		10% TVC	6,050.384	7.940982	5,226.539	7.520704
Rental value			5,000	8.450398			5,000	6.562378	5,000	7.194728
TC			59,168.81	100			76,191.89	100	69,495.33	100
TVC			43,332.31				60,503.84		54,613.15	78.58535
TFC			15,836.5				15,688.05		14,882.18	21.41465
Processed paddy	1,000	200	200,000		1,000	200	200,000		200,000	
By-product	950.8334	10	9,508.334		946.0874	10	9,460.874		9,484.604	
TR			209,508.3				209,460.9		209,484.6	
NI			150,339.5				133,269		139,989.3	
GM			166,176				148,957		154,871.4	
ROI			3.834922				2.461943		2.83579	
RORCI			2.540858				1.749123		2.014369	

Source: Field survey, 2022.

Note: TC = Total cost, TVC= Total variable cost, TFC= Total fixed cost, TR= Total revenue, NI= Net income, GM= Gross margin, ROI= Return on Naira invested, and RORCI= Rate of return on capital invested.

On the other hand, for the millers, the cost of production per month for the rainy and dry and the overall period, respectively, was ₦72,048.05, ₦90,317.79 and ₦82,075.72 (Table 4b). Of the cost of production per month for the rainy and dry seasons and the overall period, the total variable and fixed costs were ₦44,583.53 and ₦27,464.51, ₦60,394.90 and ₦29,922.88, and ₦5,113.90 and ₦26,961.82, respectively. The cost proportion of the total variable cost in the cost of production was also the highest, while that of the total fixed cost was marginal. Furthermore, the total revenue, gross margin and net income per tonne per month for the rainy and dry seasons and the overall period were ₦203,485.20, ₦158,901.70 and ₦131,437.20, ₦205,282.40, ₦144,887.50 and

₦114,964.60, and ₦204,383.80, ₦149,269.90 and ₦122,308.10, respectively. The ROI index of the rainy and dry seasons and the overall period were 3.56, 2.40 and 2.71, respectively.

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

Items	Rainy season				Dry season				Overall	
	Quantity	**Unit price**	**Total**	**%**	**Quantity**	**Unit price**	**Total**	**%**	**Total**	**%**
Diesel	13.9446	348.6269	4,861.462	6.747527	20.23532	348.2836	7,047.631	7.803148	6,033.847	7.351562
Electricity			2,000	2.775925			3,500	3.875206	2,873.958	3.501593
Repairs/Maintenance			7,383.582	10.24814			9,697.015	10.73655	8,567.221	10.43819
Charges on hired machinery			1,300	1.804351			1,300	1.439362	1,300	1.583903
Tax		2,517.91	2,517.91	3.494766		1,059.701	1,059.701	1.173303	2,151.395	2.621231
Interest on working capital		12% TVC	4,776.807	6.63003		12% TVC	6,470.883	7.164572	5,656.668	6.892011
Miscellaneous expenses		5,277.612	5,277.612	7.325128		5,937.463	5,937.463	6.573968	5,589.707	6.810427
Sacks	26.23319	884.9254	23,214.42	32.22074	35.49942	915.3731	32,495.22	35.97875	28,110.52	34.24949
Water charges	2.99338	20	59.86761	0.083094	2.258692	20	45.17384	0.050017	54.3464	0.066215
Transportation		1,383.09	1,383.09	1.919677		1,750.448	1,750.448	1.938099	1,567.646	1.909999
Family labour	0.051169	24,165.67	1,236.543	1.716276	0.063571	21,820.9	1,387.175	1.535882	1,307.681	1.593262
Hired labour	0.035567	13,319.4	473.7355	0.657527	0.042536	10,835.82	460.9156	0.510327	468.1335	0.570368
Permanent labour	0.036286	5,100	185.0575	0.256853	0.039741	5,210.448	207.0678	0.229266	195.4381	0.238119
Depreciation			2,919.609	4.052309			2,919.609	3.232596	2,919.609	3.557214
Managerial cost		10% TVC	4,458.353	6.188028		10% TVC	6,039.49	6.686933	5,279.556	6.432543
Rental value			10,000	13.87963			10,000	11.07202	10,000	12.18387
TC			72,048.05				90,317.79		82,075.72	
TVC			44,583.53				60,394.9		55,113.9	
TFC			27,464.51				29,922.88		26,961.82	
Processed paddy	1,000	200	200,000		1,000	200	200,000		200,000	
By-product	348.5245	10	3,485.245		528.2419	10	5,282.419		4,383.832	
TR			203,485.2				205,282.4		204,383.8	
NI			131,437.2				114,964.6		122,308.1	
GM			158,901.7				144,887.5		149,269.9	
ROI			3.564134				2.399002		2.70839	
ROCI			1.824299				1.27289		1.490186	

Source: Field survey, 2022.

The ROI index implies that for every naira invested in the enterprise during the rainy and 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 parboiling and milling enterprises are profitable enterprises in the study area. Generally speaking, this is very significant for the credit policy; financial and non-financial institutions are advised to explore any condition of supplying Small and Medium Enterprise (SME) credit for the progressive development of milling and parboiling at a reasonable interest rate to these processors, to enable them to cope without hindrance to their enterprise's going concern. However, the profitability ratio of the rainy season is due to the availability of paddy rice at low cost – a glut that characterises the boom period from the producers and suppliers in the local markets. These results agree 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 the small-scale rice milling enterprise to be a profitable venture. In contrast, Bime *et al*. (2014) reported the milling enterprise not to be profitable in their study area as evident from the negatively skewed benefit-cost ratio analysis.

Disparity and share contribution of processors to rice value chain

Looking into the Gini decomposition analysis showed that moderate inequality exists in the value addition of the processors in the rice processing value chain (Table 5). For the sub-groups in the processing chain regarding the parboilers and millers, the empirical evidence showed moderate and low inequalities, respectively, in the distribution of value addition among the respective actors. For the overall, parboilers and millers, the disparity in the value addition distribution between the low and high profit margin actors were 31.76, 30.89 and 17.94%, respectively. Furthermore, the disparity between the value addition of the parboilers and millers was 16.75%, the disparity in value addition 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 noting that as the stages progressed, the disparity in the value addition distribution declined regarding the between, within and interaction effects. More so, the share contribution of the parboilers to the value addition disparity was higher, at 10.22%, while the millers' share contribution to value addition disparity was 3.02%. The high share contribution of the parboilers to the value addition disparity may be attributed to diseconomies of scale due to poor production efficiency, unlike the millers, who take advantage of economies of scale by adopting partial-to-modernised operational technologies. Nevertheless, the share contributions of the parboilers and millers, respectively, to the value addition were 49.75 and 50.25%, as evidenced by their respective share value addition indexes. Therefore, there is a need for a paradigm shift in the technical operations of the parboilers, to enable them to take advantage of economies of scale, which translates into production efficiency.

Table 5. Contribution to rice value chain

Items	Pool	Parboilers	Millers
Gini decomposition			
Total	0.317552	0.308906	0.179441
Within	0.132401	-	-
Between	0.167524	-	-
Overlap/interaction	0.017626	-	-
Contribution	-	0.102193	0.030208
Share of total profit	-	0.497476	0.502524
Mean log deviation			
Total	0.199627	0.184335	0.059346
Within	0.142464	-	-
Between	0.057163	-	-
Overlap	-	-	-
Contribution	-	0.122583	0.019881
Share profit	-	0.497476	0.502524

Source: Field survey, 2022.

Prospects of paddy rice processing value chain enterprise

The prospects of the paddy rice processing value chain regarding its strengths, weaknesses, opportunities and threats (SWOT) are presented in Table 6. For the parboilers, it was determined that the majority perceived the strengths, weaknesses, opportunities and threats inherit in the enterprise to be high, at 92, 94, 93.2 and 93.2%, respectively (Table 6a). Further, these findings were justified by the respective average index of the SWOT analysis 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 labour supply (S5), Public commitment (S6), Agriculture’s contribution to the local economy (S7), The required labour population is small (S9), Rice of various varieties is processed and provided (S10), Paddy rice is accessible (S11), Significantly consumer-based (S13), Higher quality of life (14), and Value addition (S15) (Table 6c). The 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 private industry (W14). The major opportunities were New market segment (O1), Partnerships (O2), Business formation procedure (O3), Assistance from regional or global groups (O4), Strong business demand locally (O5), Large local and global markets (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%), weaknesses (94%), opportunities (92.5%) and threats (91%) in the milling enterprise to be high (Table 6a), with the average index of the respective dimensions (SWOT) being above the threshold index of 2.0 justifying 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), Milling industries have a large pool of trained labour (S4), Agriculture's contribution to the local economy (S7), Using agricultural equipment (S8), Paddy rice is accessible (S11), Significantly consumer-based (S13), and Stable income generation (S16). The determined major opportunities were Market segment is new (O1), Partnerships (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 weaknesses and the threat indicators were perceived to be a major challenge (Table 6c). Generally, most of the processors (pool group) perceived the strengths, weaknesses, opportunities and threats inherent in the study value chain to be high (Table 6a). Furthermore, the average index of the SWOT dimensions was higher than the threshold value of 2.0, supporting the high perception status among most of the processors in the study area (Table 6c). Also, the perceived statuses of all the respective indicators in the SWOT dimensions were high.

In general, based on the SPACE matrix, the parboilers, millers and the pool groups are advised to adopt a 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 parboilers are advised to adopt defensive, competitive, conservative and aggressive measures, respectively, to optimise their operations in the rice supply value chain (Table 6b). For the millers, 41, 8, 20.9, 20.9 and 16.4% are advised to adopt defensive, competitive, conservative and aggressive strategies, respectively, to maintain their operational activities in the supply value chain (Table 6b). Generally, 49, 21, 17.5 and 12.5% of the processors 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 good prospects if most of the actors will tap into the defensive mechanism, thus enhancing the sustainability of the rice supply value chain in the study area.

Table 6a. Individual-wise distribution of SWOT

	Strength	**Weakness**	**Opportunity**	**Threats**
		Parboilers		
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 (100.0)	133 (100.0)	133 (100.0)	133 (100.0)
		Millers		
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 (100.0)	67 (100.0)	67 (100.0)	67 (100.0)
		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 (100.0)	200 (100.0)	200 (100.0)	200 (100.0)

Note: Figure in parenthesis is percentage

Source: Field survey, 2022.

Table 6b. Diagnostic test of gain and index

Strategy	Parboilers	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 (100.0)	67(100.0)	200 (100.0)

Note: Figure in parenthesis is percentage

Source: Field survey, 2022.

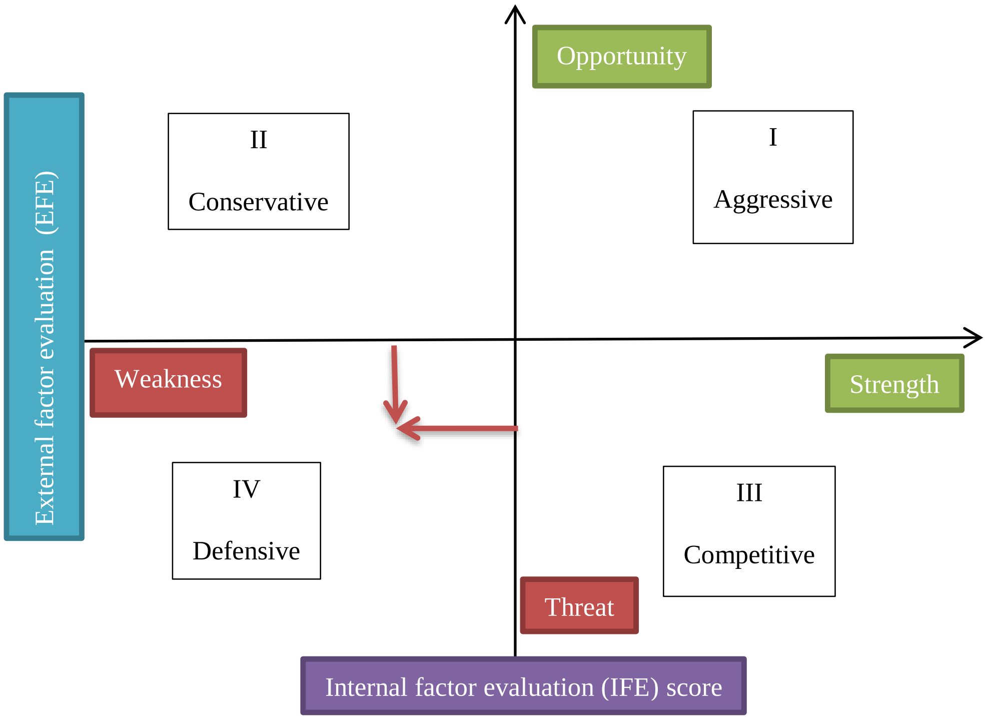

Fig. 1. Space matrix (recommended strategy for all the target categories)

Source: Authors' own computation, 2022.

Conclusion and recommendations

Small-scale processors of paddy rice continue to be the primary drivers of growth of the primary/upstream rice value chain in Nigeria, despite the obstacles to the development of SMEs there. Under the different period of operations (rainy and dry seasons), the empirical 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 in. However, diseconomies of scale due to the use of non-innovative technologies by the parboilers poses a threat to the sustainability of the supply value chain in the long-run as it creates a disparity in their contribution to the value addition. Furthermore, the enterprises stand a good chance of being successful in the rice supply value chain if most of the actors explore a defensive strategy in their business' going concern. Therefore, the study recommends the need for innovative marketing tools, especially for the parboilers, to enable their enterprises to achieve economies of scale, a veritable precursor for the sustainability of the supply value chain in the long run.

Appendix

Table 6c. Indicator-wise SWOT analysis of processors

Parboilers (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**			
Parboilers (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**			
				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**			
				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**			

						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**					

Note: Opp. = Opportunity

Source: Field survey, 2022.

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