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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.

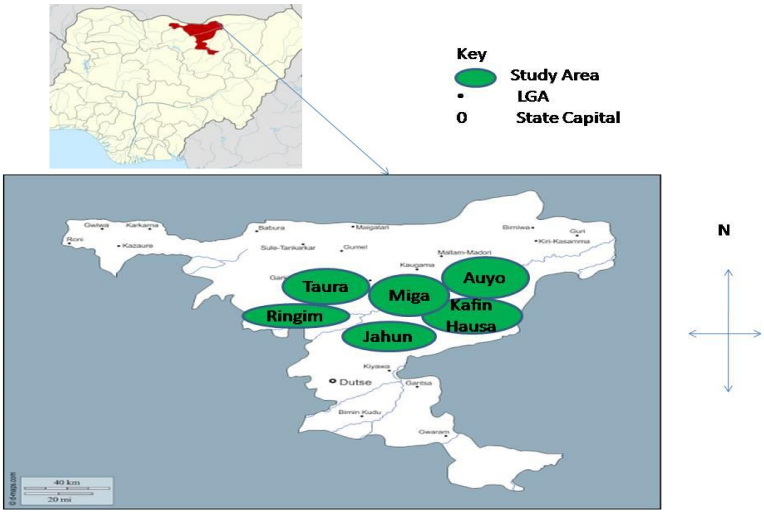

Fig. 1. Map of Jigawa State showing Study Areas

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:

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

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

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

$ROI = \frac{GM}{TVC}$ ……..(5)

$ROCI = \frac{NI}{TC}$ ..…….. (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:

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

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

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:

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

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

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:

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

$\forall \mu_j < \mu_h$

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

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

with:

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

and:

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

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

$S_j = \frac{n_j \mu_j}{n\mu}$ …… (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 $x^m (m = 1, \ldots\ldots\ldots, q)$, 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.

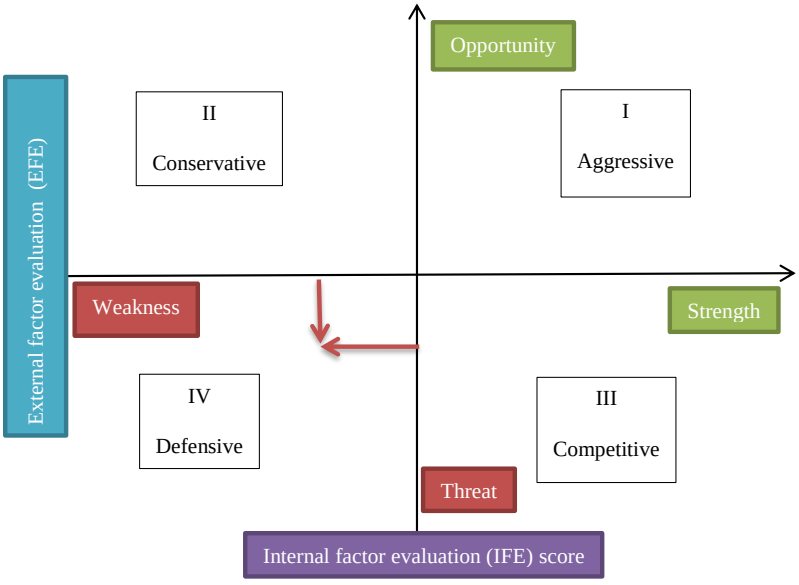

Fig. 1. Space matrix (recommended strategy for all the target categories)

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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Zeszyty Naukowe Szkoły Głównej Gospodarstwa Wiejskiego w Warszawie
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Sytuacja podażowa w sektorze kakao w Ghanie w latach 2016-2022 i jej potencjalny wpływ na import kakao do Polski

Supply Situation in Ghanaian Cocoa Sector in 2016-2022 and its Potential Impact on Cocoa Imports to Poland

Synopsis. Celem artykułu jest analiza sytuacji podażowej na rynku kakao w Ghanie, przegląd zmian legislacyjnych na świecie w sektorze kakao i ocena ich potencjalnego wpływu na import kakao do Polski. Analizą objęto lata 2016-2022, by podkreślić dynamikę zachodzących zmian rynkowych w tym sektorze. Uwzględniono przy tym uwarunkowania prawne i politykę prowadzoną przez globalnych importerów i kluczowych producentów kakao na świecie. To ważny aspekt zwłaszcza w kontekście zmian unijnej polityki środowiskowej i odpowiedzialności biznesu. Analiza wykazała istotną rolę importu kakao z Ghany w jego imporcie ogółem do Polski i przewagę cenową ghańskiego przywozu. Zaobserwowano też silną zależność statystyczną między zużyciem nawozów mineralnych w Ghanie i wielkością plonów kakao. Bardzo duży spadek nawożenia skutkuje ograniczeniem podaży ghańskiego kakao. Dodatkowo proponowane zmiany regulacji mogą ograniczyć podaż kakao i podnieść koszty operacyjne. Może to prowadzić do dalszego wzrostu cen kakao.

Słowa kluczowe: bilans kakao, relacje cen kakao, import kakao

Abstract. The aim of the article is to analyse the cocoa market supply situation in Ghana, review the global legislative changes in the cocoa sector, and assess their potential impact on cocoa imports to Poland. The analysis covered the years 2016–2022 to highlight the dynamics of the market and political changes in this sector, taking into account political and market initiatives of both global importers and key cocoa producers. This is an important area of research, especially in the context of changes in EU environmental policy and corporate responsibility. The analysis showed a significant role of cocoa imports from Ghana in total imports to Poland and its price advantage, a strong statistical relationship between fertiliser consumption in Ghana and cocoa yields, and a very strong decline in fertilisation, which results in a reduction in the supply of Ghanaian cocoa. Additionally, the proposed regulatory changes may limit the supply of cocoa and increase operating costs. This may result in an increase in cocoa prices.

Key words: cocoa balance, cocoa price relations, cocoa imports

JEL Classification: C10, D40, D20

Wstęp

Do Zatoki Gwinejskiej europejscy żeglarze przybili pod koniec XV wieku. Od odkrytych tam bogatych złóż złota region zaczęto nazywać Złotym Wybrzeżem. Od 1821 roku określenie to stało się oficjalną nazwą brytyjskiej kolonii, która w 1957 roku ogłosiła niepodległość jako Ghana. Ghana jest drugim co do wielkości producentem kakao na świecie

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i drugim wśród nieunijnych jego dostawców do Polski (Encyklopedia PWN). Ghańskie ziarno jest cenione na rynku ze względu na wysoką jakość i poszukiwany przez konsumentów profil smakowy (Daniels i in. 2012, Abbadi i in. 2019). W ostatnich latach obserwowany jest wzrost znaczenia importu kakao z Ghany do Polski, a przywóz z tego kierunku jest atrakcyjny cenowo na tle importu ogółem. Dodatkowo dostawy bezpośrednio z Ghany wpisują się w globalną tendencję do zakupów kakao bezpośrednio w kraju zbiorów. Problemy ekonomiczne i społeczno-polityczne, z jakimi boryka się Ghana od kilku lat, negatywnie odbijają się na sektorze kakao, czego wymiernym i dotkliwym efektem jest spadek zbiorów. Problemem całego sektora kakao na świecie są nierówności dochodowe. Dlatego też zarówno kraje produkujące kakao, jak i te, które importują ten towar podejmują szereg działań, żeby wzmocnić pozycję rolników w łańcuchu dostaw.

Uprawa kakaowca w Polsce nie jest możliwa ze względów klimatycznych i zapotrzebowanie na kakao musi zostać w całości zaspokojone importem. Część przywozu jest jednak reeksportowana. Obecnie struktura polskiego importu kakao zdaje się bardziej odzwierciedlać uwarunkowania historyczne światowego rynku kakao (import jest w znacznej części realizowany przez unijnych pośredników) niż zmieniający się paradygmat sektora, który zdeterminowany jest w dużej mierze przez rosnący udział w handlu wysyłki z kraju zbiorów i w konsekwencji wzrost znaczenia kraju zbiorów w globalnym łańcuchu wartości.

Celem artykułu jest analiza sytuacji podażowej na rynku kakao w Ghanie, przegląd uwarunkowań prawnych produkcji kakao i ocena ich potencjalnego wpływu na import kakao do Polski. Analiza sytuacji podażowej na rynku kakao w Ghanie i zmian legislacyjnych na światowym rynku kakao pozwala na wskazanie genezy zjawisk i określenie ich potencjalnego wpływu na import kakao do Polski, co z kolei umożliwia antycypację wyzwań sektorowych. Analizą objęto lata 2016-2022, by podkreślić dynamikę zachodzących zmian rynkowych i politycznych w tym sektorze, uwzględniono inicjatywy polityczne i rynkowe zarówno globalnych importerów, jak i kluczowych producentów kakao. To ważny aspekt zwłaszcza w kontekście zmian unijnej polityki środowiskowej i odpowiedzialności biznesu. Artykuł uzupełnia lukę badawczą, podejmując nieobecne w dyskursie naukowym zagadnienie. Brakuje sektorowo i produktowo zorientowanych badań nad czynnikami wpływającymi na podaż surowców rolno-spożywczych z egzotycznych destynacji, które są istotnymi pozycjami w polskim imporcie, a także ich potencjalnego pływu na wysokość importu i ceny.

Przegląd literatury

Podstawy teoretyczne wymiany międzynarodowej kakao

Historia Ghany może być traktowana jako egzemplifikacja zmian światowej gospodarki i rozwoju teorii handlu. Jednym z kół zamachowych kolonializmu były bulionizm i wczesny merkantylizm, czyli doktryny zakładające, że o bogactwie stanowi posiadanie zasobów złota i srebra oraz dodatni bilans w handlu zagranicznym, przy czym korzystnie jest eksportować dobra przetworzone, a nie surowce. Krytyczne podejście do tych koncepcji zaowocowało stworzeniem przez Adama Smitha teorii przewagi absolutnej, która zakłada, że za sprawą specjalizacji pracy następuje jej międzynarodowy podział, co jest korzystne dla obu stron wymiany handlowej. O wyborze specjalizacji decydować powinny absolutne koszty wytwarzania danego dobra, na co wpływ mają między inny zasoby naturalne i know-how.

Rozszerzeniem takiego podejścia jest spopularyzowana przez Davida Ricardo teoria przewagi komparatywnej i teoria obfitości zasobów Eli Heckschera i Bertila Ohlina (Gomes 1987, Klimiuk 2016). Pierwsza zakłada, że o specjalizacji pracy i jej podziale decydują względne koszty. Dany kraj będzie wytwarzał i eksportował te towary, które wymagają mniejszych nakładów, a sprowadzał te, które wymagają większych. Z kolei zgodnie z teorią obfitości zasobów dany kraj będzie eksportował te dobra, których wytworzenie wymaga zużycia dużo czynnika produkcji (rozumianego jako praca i kapitał), w który dany kraj obfituje. Przedmiotem importu będą zaś te dobra, których wytworzenie wymaga dużo czynnika, który jest rzadki w danym kraju. Taka międzygałęziowa koncepcja dobrze opisywała relacje handlowe państw wysokorozwiniętych i ich kolonii, czyli wymianę surowców za produkty o wartości dodanej. Globalny handel zaczął jednak mocno zmieniać się w XX wieku i te koncepcje przestały wystarczać do opisu rzeczywistości, gdzie obserwowano między innymi wymianę między państwami o zbliżonym poziomie rozwoju gospodarczego czy dobrami substytucyjnymi (Krugman 2010).

Doświadczenie empiryczne zaowocowały koncepcją handlu wewnątrzgałęziowego, która zakłada jednoczesny import i eksport produktów z tej samej branży, przy czym przedmiotem dyskusji jest stopień agregacji danych, który umożliwiłby taki rodzaj przepływów (Czarny 2002). Wymiana wewnątrzgałęziowa może mieć charakter horyzontalny lub wertykalny. Handel zróżnicowanymi dobrami tej samej kategorii definiuje się jako organizację poziomą, a organizacja pionowa dotyczy wymiany dóbr zróżnicowanych jakościowo. Wertykalizacja handlu obserwowana jest między krajami o różnym stopniu rozwoju gospodarczego, obejmuje też wymianę podobnych towarów na różnym etapie produkcji. Skutkiem pionowej organizacji rynku jest specjalizacja produkcji i handlu. Żeby do tego doszło, dobro musi zostać wytworzone w przynajmniej dwóch kolejnych stadiach, przynajmniej dwa kraje muszą dostarczać wartości dodanej w procesie produkcyjnym i przynajmniej jeden kraj musi wykorzystać w produkcji importowane dobra, a część finalnej produkcji musi zostać wyeksportowana. Jednocześnie obserwowana jest dezintegracja produkcji, czego przykładem są outsourcing i offshoring (Sako 2006). Proces globalizacji handlu spowodował nasilenie się znaczenia transgranicznych koncernów w międzynarodowej wymianie, zarówno pomiędzy oddziałami jednej firmy zlokalizowanymi w różnych krajach, jak i między odrębnymi właścicielsko podmiotami. Taka wymiana określana jest jako intra-firm trade. Wertykalna organizacja rynku prowadzi także do wytworzenia globalnego łańcucha wartości, czyli systemu produkcji danego dobra w kilku odmiennych lokalizacjach (krajach), przy czym dana firma może brać udział w produkcji tylko na jednym z jej etapów lub całościowo, na wszystkich. Rosnące znaczenie wpływu postępu technologicznego na gospodarkę zaowocowało neotechnologicznymi koncepcjami wymiany handlowej jak teoria luki technologicznej (Hummels, Ishii, Yi 2001, Gereffi i in. 2005).

Przystąpienie Polski do UE pozytywnie wpłynęło na dynamikę wzrostu handlu polskiego zagranicznego i poprawę dodatniego salda obrotów, o czym w dużej mierze zadecydował dostęp do europejskich rynków i brak barier celnych (Szczepaniak 2019). Skutkiem akcesji była także silna koncentracja wymiany handlowej z rynkami nasyconymi, które mają ograniczony potencjał wzrostu popytu importowego na produkty rolno-spożywcze z Polski, co wymusza dywersyfikację i szukanie rynku zbytu w krajach trzecich (Pawlak, Smutka 2022).

Na światowe ceny kakao wpływa wiele czynników, wśród których za kluczowe uznaje się warunki pogodowe, choroby i szkodniki, spekulacje na giełdzie, niestabilność polityczną

w krajach producenckich i zużycie nawozów (Beg i in. 2017, Kongor i in. 2018). W okresie 1963-2013 podaż i popyt na kakao były nieelastyczne cenowo (Tothmihaly 2017). Przeprowadzone w latach 90. XX wieku przez największych producentów kakao reformy handlowe miały zróżnicowany wpływ na transfer cen. W krótkim horyzoncie na szoki zewnętrzne najsilniej i najszybciej reagowały Wybrzeże Kości Słoniowej i Ekwador, nie odnotowano takiego wpływu w Ghanie i Kamerunie. W długiej perspektywie obserwowano taką zależność w tych czterech krajach. Pozwala to przyjąć, że reformy handlu, jakie przeprowadziły kraje producenckie, skutkowały większą wrażliwością sektora kakao w tych państwach na zmiany globalnej sytuacji cenowej (Tsowou1, Gayi 2019).

Charakterystyka światowego i ghańskiego rynku kakao

Uprawa kakaowca jest możliwa jedynie w klimacie tropikalnym (Lahive i in. 2019). Roślina naturalnie rosła w lasach deszczowych w Ameryce Południowej, a w XIX wieku została sprowadzona do Afryki, która stała się głównym ośrodkiem jej upraw. Komercyjnie uprawiane są trzy odmiany: Criollo, Trinitario i Forastero, która daje największe plony i z tego powodu jest najpopularniejsza – jej uprawy wynoszą około 90% globalnego areału (Jahurul 2012, Wickramasuriya, Dunwell 2017). Kakaowiec owocuje przez średnio 15-20 lat. Roślina potrzebuje także cienia, co wymusza uprawę w sadach lub lasach. W ostatnich dekadach wycinano na świecie lasy pod uprawę kakaowca (Beg i in. 2017, Suh, Molua 2022). Zbiory kakao nie są zmechanizowane i zwykle odbywają się ręcznie. Zebrane ziarno najpierw poddawane jest fermentacji i suszeniu, później zaś jest mielone na miazgę, z której otrzymuje się masło i proszek kakaowe (Di Mattia i in. 2017, Voora i in. 2019). Tak przetworzone kakao jest podstawowym surowcem do produkcji czekolady.

Około 90% produkcji kakao na świecie jest wytwarzana przez około 5 milionów gospodarstw rolnych, z czego 70% jest małymi gospodarstwami rodzinnymi (Tröster i in. 2019, Voora i in. 2019). Wielkość plantacji nie przekracza 4 hektarów (Roldán i in. 2013). Obok struktury właścicielskiej i biznesowej rozdrobnienie jest jedną z głównych przyczyn słabych wyników produkcyjnych i niskiego dochodu. W Ghanie i Wybrzeżu Kości Słoniowej dochody 30-58% gospodarstw zajmujących się uprawą kakao są poniżej progu ubóstwa ONZ (van Vliet i in. 2021).

Kakao jest kluczowym surowcem dla ghańskiej gospodarki ze względów społecznych i ekonomicznych. Uprawą kakaowca w tym kraju zajmuje się około 800 tys. osób, co stanowi około 17% pracujących. Sektor generuje około 30% wartości eksportu rocznie (Hudson, 2022), a w latach 2014-2018 odpowiadał za 7,9-10,5% PKB, przy czym udział ten wykazywał tendencję spadkową (Ghana Statistical Service 2020). Kakao z Ghany uważane jest na świecie za produkt wysokiej jakości (Abbadi i in. 2019). Obok dobrego marketingu wpływ na taki wizerunek mają właściwości ziaren, które mają nieco wyższą od średniej zawartość tłuszczu i niski poziom zanieczyszczeń, co skutkuje większą wydajnością produkcji masła kakaowego w procesie przemiału ziarna. W efekcie uzyskuje się specyficzny aromat produktów przerobu, który jest pożądany na rynku (Kolavalli, Vigneri 2011). Ghana konkuruje z sąsiednim Wybrzeżem Kości Słoniowej w eksporcie kakao, a ghańska gospodarka jest bardziej uzależniona od jego wywozu niż iworyjska (Gyan, Bajan 2022). Zmienia się także klimat Zachodniej Afryki, zwłaszcza w przypadku wzorców opadów i wahań temperatury, a także poprzez nasilenie częstotliwości i intensywności szoków pogodowych, jak powodzie czy susze. W efekcie kurczy się areał, na jakim można prowadzić

zrównoważoną uprawę kakaowca w Ghanie. Przewiduje się, że postępujące zmiany klimatu będą negatywnie wpływać na plonowanie (Boeckx i in. 2020).

Warto nadmienić, że w ostatniej dekadzie Ghana zmaga się z wieloma przeciwnościami o charakterze endo- i egzogennym. Powszechnie przyjmuje się, że zmiana prezydenta w 2017 roku nie tylko zahamowała rozwój gospodarczy, ale także za sprawą nadmiernych wydatków i nieumiejętnej polityki monetarnej doprowadziła do kryzysu ekonomicznego i protestów społecznych. Problem pogłębiła pandemia COVID-19 i wojna w Ukrainie. W 2022 roku średnioroczna inflacja konsumencka w Ghanie sięgnęła 31,3%, a dług banku centralnego był rekordowo wysoki, wynosząc ponad 5 mld USD (Naadi 2023, Bank Światowy 2023). W 2022 roku ghańska waluta, cedi osłabiła się w relacji rocznej wobec dolara amerykańskiego o 65% do 10,2 GHS. W latach 2018-2022 deprecjacja wyniosła 109,9%. W maju 2023 roku Międzynarodowy Fundusz Walutowy przyznał Ghanie wsparcie rzędu 3 mld USD (IMF 2023). Sytuacja polityczna i ekonomiczna w Ghanie odbija się także na sektorze rolno-spożywczym. Osłabienie cedi, covidowe zaburzenia w globalnym łańcuchu dostaw i wzrost cen nawozów w wyniku wprowadzanych restrykcji po 2020 r. i wojny rosyjsko-ukraińskiej sprawiają, że nawozy były w ostatnim czasie nie tylko znacznie droższe, ale także trudniej dostępne.

Hodowla bydła, uprawy kakaowca, soi, palmy olejowej, kauczukowca, kawy i produkcja drewna są uznawane za działania antropogeniczne o negatywnym wpływie na ekosystem. W latach 2001-2015 uprawa kakaowca doprowadziła do wylesienia 2,3 mln ha gruntów (Goldman i in. 2020). Konieczność walki ze zmianami klimatu niejako wymusza na krajach rozwiniętych, które generują popyt na te produkty, działania mające ograniczyć negatywne skutki prowadzenia takich upraw. Takimi działaniami są dwie unijne inicjatywy legislacyjne: ustawa o zakazie importu produktów z terenów wylesionych (KE 2021) i dyrektywa o należytej staranności przedsiębiorstw w obszarze zrównoważonego rozwoju (KE 2022, Rada Europejska 2022). Z szacunków UE wynika, że unijna konsumpcja drewna, bydła, soi, oleju palmowego, kawy i kakao spowoduje do 2030 roku wzrost obszarów wylesionych o 248 tys. ha rocznie. Na deforestację największy wpływ mają olej palmowy (33,9% w strukturze) i soja (32,8%), a kakao wyraźnie mniejszy (7,5%). Dlatego UE zamierza zakazać importu i sprzedaży towarów, które wytworzono w sposób mający negatywny wpływ na lasy. Zakazem zostaną objęte nie tylko surowce rolne, ale także powstałe z nich produkty przetworzone. Importerzy będą musieli wykazać, że sprowadzane towary spełniają kryteria zrównoważonego rozwoju. W tym celu konieczne ma być między innymi gromadzenie i przechowywanie dokładnych danych geolokacyjnych, które pozwolą wskazać uprawę na mapie. Zakaz dotyczy produktów, których powstanie doprowadziło do wylesienia od 2021 roku, i w przypadku sektora kakao obejmuje ziarno i produkty jego przemiału (kody CN 1801-05) oraz wyroby cukiernicze zawierające kakao (CN 1806). Proponowane regulacje należy uznać za duże wyzwanie logistyczne i biznesowe dla całego łańcucha dostaw (importerów w UE i producentów w kraju zbiorów).

Z kolei dyrektywa o odpowiedzialności biznesu obliguje unijne i działające na terenie UE przedsiębiorstwa do określenia, jaki wpływ na środowisko i prawa człowieka ma ich działalności i do takiego jej dostosowania, aby miała jak najmniej negatywnych skutków dla społeczeństwa i planety. Również kraje producenckie podjęły działania, których celem jest poprawa sytuacji ekonomicznej rolników zajmujących się uprawą kakao. Od sezonu 2020/21 Wybrzeże Kości Słoniowej i Ghana wprowadziły w porozumieniu dwa mechanizmy wparcia dochodów rolniczych. Są nimi LID (Living Income Differential) – mechanizm niwelujący nierówności dochodów w wysokości 400 $/t doliczany do sprzedaży kakao i minimalna cena

sprzedaży kakao w wysokości 2600 $/t, z czego 70% ma trafić do rolnika. Te rozwiązania będą mieć istotny wpływ na ceny kakao i strukturę łańcucha dostaw, w której wzrośnie znaczenie krajów producenckich. Będę też działać prowzrostowo na ceny kakao. Mając na uwadze specyfikę upraw kakao, można przyjąć, że brak szybkich, skoordynowanych i komplementarnych działań dostosowawczych, doprowadzi do poważnego ograniczenia podaży kakao w UE w ciągu dekady i wzrostu cen.

Dane i metoda badania

Analizą objęto lata 2016-2022, by scharakteryzować *in statu nascendi* tendencje rozwojowe i wyzwania rynku kakao w Ghanie oraz ich potencjalny wpływ na import kakao do Polski. Takie ujęcie tematu jest ważne i konieczne z dwóch powodów. Po pierwsze Ghana, która jest drugim na świecie producentem kakao i czołowym jego dostawcą do Polski, boryka się w ostatniej dekadzie ze zmianami klimatu i kryzysem ekonomicznym, co będzie mieć wymierny wpływ na podaż z tego kierunku. Po drugie zarówno kraje producenckie, jak i importerskie wprowadzają szereg zmian o charakterze polityczno-rynkowym, które będą mieć istotny wpływ na handel kakao. Taki działaniami są zmiany unijnej polityki dotyczącej odpowiedzialności społecznej, środowiskowej i biznesowej oraz mechanizmy poprawiające dochody rolników, jakie wprowadzają kraje producenckie. Wybór okresu analizy wynika także z dostępności danych.

Wykorzystano dane w ujęciu rocznym:

- publikowane i niepublikowane dane Ministerstwa Finansów dotyczące polskiego handlu zagranicznego kakao dla czterocyfrowych kodów CN (od 1801 do 1805) w ujęciu ilościowym (t) i wartościowym (€), a także przeliczeniowymi średnimi cenami importu (€/t);
- publikowane dane Międzynarodowej Organizacji Kakao (ICCO) dotyczące wolumenu (t) zbiorów i przemiału kakao w ujęciu regionalnym i globalnym, z uwzględnieniem głównych producentów i przetwórców z Afryki, publikowane dane FAOSTAT dotyczące plonów kakao w Ghanie (t/ha);
- publikowane dane International Fertilizer Association (IFASTAT) odnośnie zużycia nawozów mineralnych (azotowych, fosforowych i potasowych) w Ghanie (t).

Charakterystykę sytuacji podażowo-popytowej i cenowej wykonano z wykorzystaniem analizy dynamiki i zmienności (obliczono m.in. współczynnik zmienności V, dzieląc odchylenie standardowe przez średnią arytmetyczną x 100%) (Luderer i in. 2010). Pozwala to na komparatywną identyfikację dominujących tendencji i wskazanie kluczowych dyferencji. W celu określenia relacji zużycia nawozów i plonów kakaowca przeprowadzono analizę korelacji i regresji liniowej. Takie podejście pozwala nie tylko na określenie siły współzmienności, ale i stopnia, w jakim współzależność wyjaśnia zmienną, a także na oszacowanie potencjalnych zmian predykatu.

Wyniki badań

Uwarunkowania podażowo-popytowe sektora kakao w Ghanie

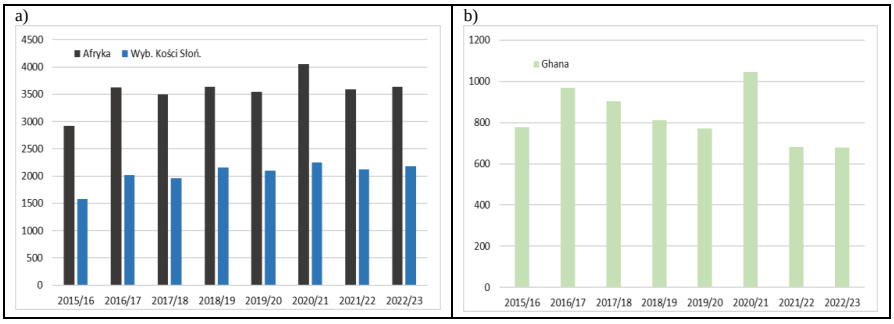
W okresie 2016-2022 światowe zbiory kakao zwiększyły się o 20,5% do 4818 tys. ton, średnioroczne tempo wzrostu wyniosło 3,2%. Zbiory charakteryzowały się niską zmiennością (V=8,0%) (tabela 1). W ujęciu geograficznym 75,7% zbiorów zlokalizowane było w Afryce. Zbiory w Afryce wzrosły o 22,8% do 3589 tys. ton, średnioroczne tempo wzrostu wyniosło 3,5%, a zmienność 9,4%. W analizowanym okresie obserwowano w tych krajach odmienne tendencje rozwojowe w sektorze kakao. Zbiory w Wybrzeżu Kości Słoniowej zwiększyły się o 34,2%, średnioroczne tempo wzrostu wyniosło 5,0%, a wolumen zebranego ziarna kakaowca nie wykazywał istotnej zmienności (V=10,7%). W przypadku Ghany odnotowano spadek zbiorów o 12,2%, średnioroczne tempo było ujemne i wyniosło -2,1%. Ghańskie zbiory nie ulegały znaczącym wahnięciom (V=14,9%), ale były one zauważalnie wyższe niż w ujęciu globalnym, kontynentalnym i wobec sąsiadującego konkurenta (rys. 1). W analizowanym okresie zbiory kakao w Ghanie stanowiły 17,1% światowych, a w Wybrzeżu Kości Słoniowej 44,4%. Tendencje rozwojowe sektora kakao w Ghanie i w sąsiednim Wybrzeżu Kości Słoniowej oraz Afryce były odmienne, co pokazuje, że Ghana nie wykorzystuje potencjału, jaki ma region, dlatego też dostawy z tego kraju mogą wiązać się z większym ryzykiem i wyższymi kosztami.

Tabela 1. Dynamika zbiorów kakao na świecie i w Afryce w latach 2016-2022 (tys. t)

Table 1. Dynamics of global and African cocoa harvest in 2016–2022 (thousand tonnes)

Wyszczególnienie	Mediana 2016-2022	2022	Zmiana 2016=100	Średnioroczne tempo	Zmienność (%)
Świat	4741	4818	120,5	103,2	8,0
Afryka	3589	3589	122,8	103,5	9,4
Wyb. Kości Słoniowej	2105	2121	134,2	105,0	10,7
Ghana	812	683	87,8	97,9	14,9

Źródło: Obliczenia własne na podstawie danych ICCO.



Rys. 1. Zbiory kakao w Afryce i na Wybrzeżu Kości Słoniowej(a) oraz w Ghanie (b) w latach 2016-2022 (tys. t)

Fig. 1. Cocoa crop in Africa and Ivory Coast (a) and in Ghana (b) in 2016–2022 (thousand tonnes)

Źródło: jak tabela 1.

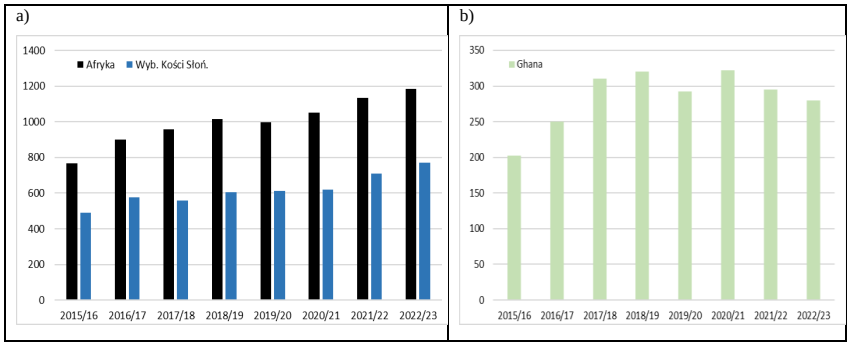
W okresie 2016-2022 światowy przemiał kakao wzrósł o 21,0% do 4995 tys. ton, średnioroczne tempo wzrostu wyniosło 3,2%, wolumen przemiału był stabilny (V=6,7%) (tabela 2). Przemiał w kraju zbiorów rósł szybciej, o 29,5%, a w Afryce jeszcze bardziej dynamicznie, o 47,8%. W obu przypadkach zmienność była wyższa niż globalnie. Przemiał w Ghanie zwiększył się o 46,0% do 295 tys. ton, przy średniorocznym tempie w wysokości 6,5%. Ghański przemiał nie ulegał istotnym zmianom (V=15,4%), ale był zauważalnie bardziej narażony na wahnięcia niż w globalnym czy kontynentalnym ujęciu (rys. 2). Dynamika zmian przemiału, znacznie wyższa w kraju zbiorów niż globalnie, pokazuje zmianę łańcucha dostaw: kraje producenckie koncentrują się nie tylko na uprawie i wywozie surowca, ale chcąc zarabiać na wartości dodanej, rozwijają także przemiał ziarna, by dostarczać półprodukty dla przemysłu na całym świecie. Taka pionowa integracja może nie tylko poprawić sytuację ekonomiczną w sektorze, w tym rolników, ale także pozwala efektywniej wpływać na ceny.

Tabela 2. Dynamika przemiału kakao na świecie w latach 2016-2022 (tys. t)

Table 2. Dynamics of global cocoa grindings in 2016-2022 (thousand tonnes)

Wyszczególnienie	Mediana 2016-2022	2022	Zmiana 2016=100	Średnioroczne tempo	Zmienność (%)
Świat	4706	4995	121,0	103,2	6,7
W kraju zbiorów	2150	2334	129,5	104,4	8,3
Afryka	998	1134	147,8	106,7	12,0
Wyb. Kości Słoniowej	605	710	144,3	106,3	11,1
Ghana	295	295	146,0	106,5	15,4

Źródło: jak tabela 1.

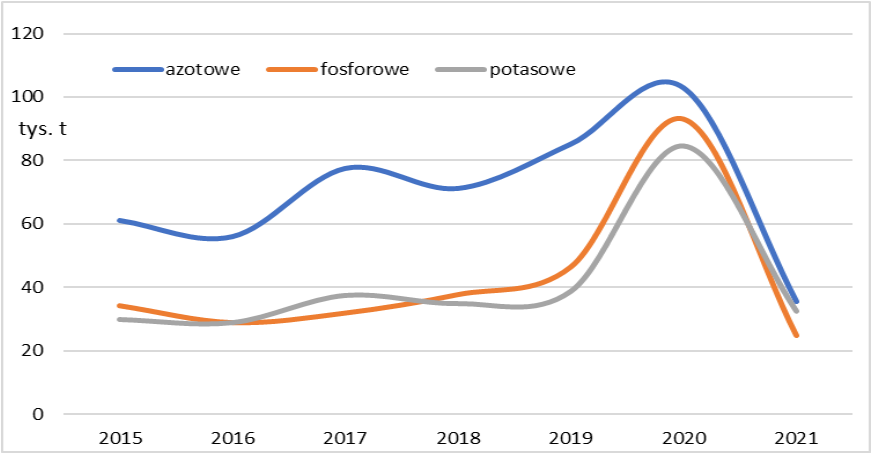


Rys. 2. Przemiał kakao w Afryce i na Wybrzeży Kości Słoniowej (a) oraz w Ghanie (b) w latach 2016-2022 (tys. ton)

Fig. 2. Cocoa grindings in Africa and Ivory Coast (a) and in Ghana (b) in 2016–2022 (thousand tonnes)

Źródło: jak tabela 1.

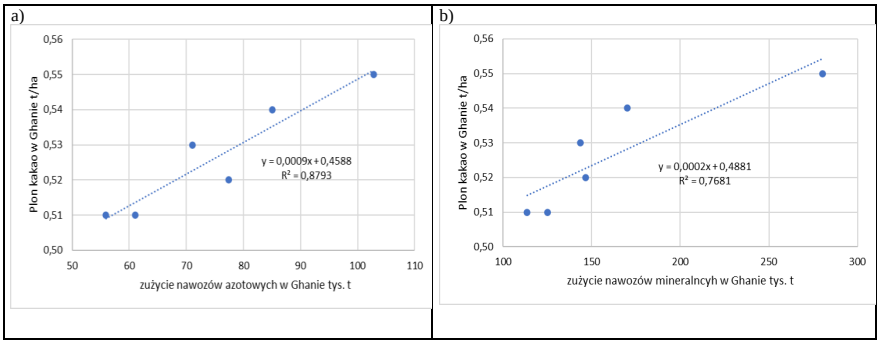
Oprócz warunków pogodowych kluczowe dla plonowania jest nawożenie. W latach 2015-2020 zużycie nawozów mineralnych w Ghanie sukcesywnie rosło. W 2020 roku zużyto 280,3 tys. ton nawozów azotowych, fosforowych i potasowych łącznie, co oznacza wzrost o 124,2% wobec 2015 roku, średnioroczne tempo wyniosło 14,4%, a zużycie charakteryzowało się relatywnie dużą zmiennością (V=37,1%) (rys. 3). Rok 2021 przyniósł załamanie nawożenia w Ghanie. W relacji rocznej zużycie spadło o 67,0% do 92,6 tys. ton. Powodem były deprecjacja ghańskiego cedi wobec dolara i dynamiczne podwyżki cen nawozów na świecie. Nawożenie ma kluczowy wpływ na plonowanie. W latach 2015-2020 areał zbiorów kakao w Ghanie skurczył się o 13,9% do 1,45 mln ha, średnioroczne tempo spadku wyniosło -2,9%, a zmienność była niewielka (V=9,3%). W tym samym okresie zbiory kakao wzrosły o 4,2% do 771 tys. ton, średnioroczne tempo wyniosło 0,8%, a zbiory nie ulegały istotnym wahaniom (V=10,7%). Można zatem przyjąć, że obok optymalizacji procesu produkcyjnego głównym czynnikiem, który umożliwił wzrost zbiorów przy kurczącym się areale, była poprawa plonowania. W okresie 2015-2020 plony kakao w Ghanie wzrosły o 20,9% do 0,53 t/ha, średnioroczne tempo wyniosło 3,9%, plony ulegały relatywnie niedużym zmianom (V=8,5%).



Rys. 3. Zużycie nawozów mineralnych w Ghanie (tys. t), 2015-2021

Fig. 3. Consumption of mineral fertilisers in Ghana (thousand tonnes), 2015-2021

Źródło: Obliczenia własne na podstawie danych IFASTAT, FAOSTAT.



Rys. 4. Relacja zużycia nawozów mineralnych i plonów kakao w Ghanie, 2015-2020

Fig. 4. Relationship between mineral fertiliser consumption and cocoa yields in Ghana, 2015–2020

Źródło: Obliczenia własne na podstawie danych IFASTAT, FAOSTAT.

Analiza statystyczna wykazała silną i istotną statycznie zależność liniową wysokości plonu kakao i zużycia nawozów mineralnych (azotowych, fosforowych i potasowych łącznie) w analizowanym okresie (korelacja: R=0,88; regresja: R^2=0,77). W przypadku plonowania i zużycia nawozów azotowych odnotowano jeszcze silniejszą zależność liniową (korelacja: R=0,94; regresja: R2=0,88). Biorąc pod uwagę załamanie zużycia nawozów

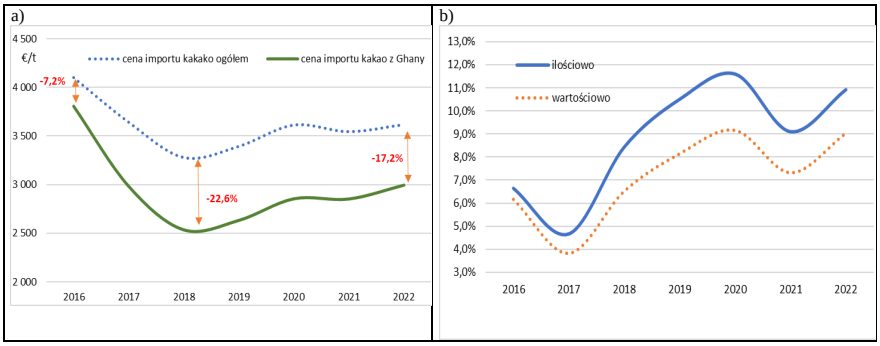
mineralnych w Ghanie w 2021 roku, można na podstawie modelu regresji oszacować, że plony w 2021 roku mogą obniżyć się do 0,49-0,51 t/ha, czyli o 7,9-10,8% (rys. 4). Załamanie zużycia nawozów będzie mieć zatem wymierny wpływ na wysokość zbiorów kakao w Ghanie w kolejnych, a zła sytuacja gospodarcza, społeczna i polityczna w tym kraju sprawia, że trudno oczekiwać, aby zużycie nawóz mogło znacząco wzrosnąć w krótkim horyzoncie. Specyfika upraw kakaowca nie pozwala też na szybkie zwiększenie areału. Pozwala to przyjąć, że w perspektywie najbliższych lat podaż kakao z Ghany może być ograniczona. Potwierdzeniem takiej hipotezy jest obserwowany spadek zbiorów w kolejnych latach w Ghanie (brak danych dotyczących zużycia nawozów i powierzchni upraw uniemożliwia obecnie szczegółową analizę). Należy zauważyć, że świetne zbiory z sezonu 2020/21 są ewenementem w ostatnich latach (rys. 1), które charakteryzuje tendencja spadkowa, a za wynik w dużej mierze odpowiadają dobre warunki pogodowe, niespotykana wcześniej intensyfikacja prac arborystycznych i dobre przygotowanie plantacji, także za sprawą nawożenia w poprzednich latach[2].

Import kakao z Ghany do Polski

W taryfie celnej wyróżnia się dział CN 18, którym objęte są kakao i jego przetwory. Kakao handlowane jest pod kodami CN 1801-05, gdzie wyróżnia się samo ziarno oraz produkty jego pierwotnego przetwórstwa jak pasta kakaowa czy masło kakaowe, z kolei wyroby czekoladowe objęte są kodem CN 1806. Polska jest importerem netto kakao, niewielka część importu jest reeksportowana.

W okresie 2016-2022 przywóz kakao (CN 1801-05) zwiększył się o 31,5% do 144,8 tys. ton, średnie tempo wzrostu wyniosło 4,7% rocznie, a import charakteryzował niewielką zmiennością (V=10,6%). Wartość przywozu wzrosła o 16,1% do 524,3 mln €, średniorocznie zwiększając się o 2,5%. Wartość importu nie była zmienna w istotny sposób (V=10,6%). Średnia cena przywozu kakao ogółem spadła w analizowanym okresie o 11,7% do 3619 €/t, średnioroczna dynamika zmian była ujemna, wynosząc -2,1%. Ceny importowe były stabilne (V=7,1%). Natomiast w okresie 2016-22 import kakao z Ghany do Polski zwiększył się o 115,4% do 15,8 tys. ton, przy średniorocznym tempie wzrostu 13,6%. Przywóz z Ghany był relatywnie dość zmienny (V=35,6%). W ujęciu wartościowym przywóz z Ghany wzrósł o 69,5% do 47,2 mln €, średniorocznie rosnąc o 4,7%. Wartość przywozu nie wykazywała istotnej zmienności (V=9,2%). Średnie ceny importu kakao z Ghany zmniejszyły się o 21,3% do 2995 €/t, przy średniorocznym spadku -3,9%. Ceny importu kakao z Ghany były w analizowanym okresie średnio o 7,2-22,6% niższe od cen importu kakao ogółem (rys. 5). Udział importu z Ghany w imporcie ogółem wyniósł w latach 2016-2022 średnio 10,2% (mediana) i wykazywał tendencję wzrostową. W przypadku wartości przywozu obserwowano podobne zależności, przy czym w strukturze wartościowej znaczenie Ghany było nieco mniejsze niż w towarowej, co należy łączyć z niższymi cenami importu z Ghany niż ogółem.

[2] Vide https://thecocoapost.com/ghana-closes-2020-21-cocoa-crop-year-with-record-production/



Rys. 5. Ceny importu kakao (CN 1801-05) ogółem i z Ghany do Polski i ich różnice (a) (w €/t, %) oraz udział przywozu kakao (CN 1801-05) z Ghany do Polski w ujęciu wartościowym i ilościowym (b) (in t, €) w latach 2016-2022

Fig. 5. Price for cocoa imports (CN 1801-05) in general and from Ghana to Poland and their differences (a) (in €/t, %) and share of cocoa imports (CN 1801-05) from Ghana to Poland in value and quantity (b) (in t, €), in 2016-2022

Źródło: Obliczenia własne na podstawie danych Ministerstwa Finansów.

Znacznie większa dynamika wzrostu przywozu kakao z Ghany niż ogółem pokazuje, że jest to atrakcyjny dostawca, a intensyfikacja zakupów kakao w kraju jego zbiorów wpisuje się w globalne trendy dotyczące zrównoważonego handlu i odpowiedzialności biznesu. Ghańskie kakao jest pożądane na światowym rynku ze względu na swoją renomę i walory smakowe, co w połączeniu z relatywnie niskimi cenami przywozu sprawia, że jest chętnie kupowane i spożywane. Świadczyć może o tym identyfikacja kakao w proszku firmy E. Wedel, które w Polsce jest sprzedawane jako „kakao ciemne z Ghany”[3], co podkreśla jego pochodzenie.

Wnioski

Zmiany klimatyczne i sytuacja społecznoekonomiczna w Ghanie, a także wymagania środowiskowe i w zakresie etyki biznesu, jakie wprowadza UE, będą mieć wymierny wpływ na podaż, a w konsekwencji także na ceny kakao w Polsce. Skala i charakter problemów, z jakimi mierzy się gospodarka i społeczeństwo w Ghanie, są na tyle istotne, że trudno oczekiwać, by mogły być rozwiązane w krótkim terminie. Badania wykazały istotną zależność między zużyciem nawozów a plonami kakao w Ghanie w latach 2015-2021, a drastyczne załamanie zużycia nawozów w 2021 roku pozwala antycypować pogorszenie wyników produkcyjnych w ghańskim sektorze kakao w kolejnych latach. Ograniczeniem badania jest jednak relatywnie krótki okres analizy, który wynika z dostępności danych. Może to mieć wpływ na wyniki, niemniej jednak wpisują się one w doświadczenia badawcze dotyczące zależności nawożenia i plonowania, nie budząc przy tym zastrzeżeń co do logicznego wnioskowania. Sprowadzane z Ghany kakao jest atrakcyjne cenowo, jego

[3] https://wedel.pl/nasze-produkty/inne/kakao-ciemne-z-ghany-180g

znaczenie w strukturze towarowej polskiego importu sukcesywnie rośnie. Badania pokazały, że ceny importu kakao z Ghany były o 7,2-22,6% niższe w latach 2016-2022 od cen importu ogółem, a przywóz ghańskiego kakao rósł znacznie szybciej niż ogółem (średnioroczne tempo wzrostu wyniosło odpowiednio 13,6 i 4,7%). Dodatkowo intensyfikacja importu z tak zwanego kraju zbiorów wpisuje się w globalne trendy dotyczące wzmacniania producenta w łańcuchu dostaw, zrównoważonego handlu i odpowiedzialności biznesu. Ze względu na specyfikę upraw kakao spadek nawożenia i planowane rozwiązania legislacyjne w UE mogą oznaczać ograniczenie dostaw z Ghany do Polski i/lub podwyżki cen importowych. Wydaje się, że sytuacja wymusi dywersyfikację dostaw i/lub akceptację wyższych cen w przypadku ghańskiego kakao. Ciekawym kierunkiem dalszych badań wydaje się próba oszacowania wpływu planowanej certyfikacji unijnego importu kakao na jego ceny i podaż w UE, a także określenie głównych determinantów wysokości zbiorów i stopnia ich wpływu na zbiory kakao u kluczowych producentów i dostawców do UE i Polski.

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Assessing the Level of Knowledge of Ukrainian Consumers Regarding Cows' Welfare on Dairy Farms

Abstract. In modern society, consumers are very often the driving force of change. Therefore, it is important to understand and satisfy their needs. The purpose of the study was to identify modern Ukrainian consumers' level of knowledge, interest and understanding of the importance of cows' welfare on dairy farms, and to determine the willingness to pay a higher price for products from cows with a high level of welfare. The research was carried out through an online survey of representatives of Ukrainian consumers (n=2,345) between March and April 2023. Ukrainian consumers did not feel sufficiently informed on cows' welfare, and most consumers had not come across welfare labelling and wanted to receive more information. Most Ukrainian consumers were ready to pay more (from 5 to 20%) for products from cows with a high level of welfare. Ukrainian consumers believed that the farmer has the greatest influence on welfare, and the consumers themselves have the least influence. Only 5% of consumers believe that government and legislation have a major impact on cows' welfare. The respondents highly rated such parameters of welfare as sufficient space, adequate and high-quality feed, access to pastures, good relations with farm workers and expression of natural behaviour. We consider it important to increase the level of awareness of consumers in the field of animal welfare, to further develop a product certification scheme, and in the future to conduct a survey on awareness in the field of dairy herd welfare among Ukrainian farmers.

Keywords: consumer attitude, animal welfare, dairy products

JEL Classification: I31, Q16

Introduction

Population growth and increased consumption of livestock products challenge the world to ensure sustainable nutrition while controlling the impact of food production on the planet, people, and animals (Cornish et al., 2016). After all, in modern times, agricultural activity is no longer considered just a means of food production, but is fundamental to other key social goals, such as food safety and quality, environmental protection, sustainability and improving the quality of life in rural areas (Harry et al., 2008). The quality of animal products in an economically developed society is also evaluated in relation to the ethics of their production, including the impact on animal welfare and its possible implications for food safety (Rubini et al., 2021).

In turn, Covid-19 has increased consumer awareness of One Health concepts (Sweeney et al., 2022). Directly improving farm animal welfare (FAW) will significantly reduce the level of human diseases that may be associated with the consequences of increased industrial

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production. That is why the welfare of animals has become an integral part of the broad approach of 'One health' (Goldberg, 2016).

Consumers' perception of the quality attributes of foods of animal origin is gradually changing (Pasquale et al., 2014). In recent years, more and more people are becoming interested in the issues of housing, feeding, and in general FAW. Modern studies show that the situation is similar all over the world: EU (Clark et al., 2017), USA (Wolf et al., 2017; McKendree et al., 2014), Canada (Bejaei et al., 2011; Spooner et al., 2014), Latin America (Estévez-Moreno et al., 2022; Miranda-de la Lama et al., 2017), and Australia (Malek et al., 2017).

Unfortunately, there is currently limited information available regarding how modern Ukrainian consumers perceive animal welfare on dairy farms. While the willingness to pay more for high-welfare products has been extensively studied in developed market economies, there is a lack of knowledge in emerging economies, such as Ukraine. This topic holds significant importance in light of the anticipated changes resulting from the implementation of new legislation in the field of veterinary medicine and animal welfare which should enter into force by 2026 (Petkun, Nedosekov, 2022). Therefore, the objective of our study is to examine the current landscape of consumer perceptions regarding dairy cows' welfare parameters and the level of consumer awareness on this subject, and to evaluate the willingness of Ukrainian consumers to pay a premium for products derived from cows with a high level of welfare.

Materials and methods

The survey lasted 4 weeks (March 6, 2023 – April 3, 2023). The questionnaire was created using Google Forms, distributed over the Internet (social media and messengers) and consisted of 28 questions divided into 5 sections.

At the beginning of the survey, there was a broad definition of animal welfare, along with a justification of the importance and relevance of this questionnaire. Section I contained an information and consent paragraph whereby the respondents confirmed their understanding that participation was voluntary and anonymous and agreed to the conditions of participation (being over 18 years old and residing in Ukraine at the time of filling out the questionnaire). Section II (seven questions) collected socio-demographic data from the respondents. Section III (nine questions) aimed to assess the respondents' awareness of dairy cattle's welfare on farms. We also asked the respondents to rate their level of knowledge about dairy farming, namely about methods of keeping cows, their feeding, breeding, and milking, where 1 – 'I don't know anything', 2 – 'I know very little', 3 – 'I have some knowledge', 4 – 'I know enough' and 5 – 'I know a lot'.

Section IV (five questions) asked the respondents to rate the importance of specific welfare parameters on dairy farms (sufficient space, expression of natural behaviour, access to pastures, good relationship with farm workers and high-quality and appropriate feeding) using a five-point scale (1 – 'not important' and 5 – 'very important'). The final section, Section V (six questions), examined consumer behaviour when purchasing dairy products.

A total of 2,358 respondents participated in the survey. Thirteen questionnaires were excluded because some answers were omitted. Thus, 2,345 questionnaires were used for data

analysis. We selected questionnaires with complete responses, where not a single question was missed.

For further statistical analysis of the questionnaires, we used the Microsoft Excel program to determine the means of the average values of the indicators and we used pivot tables for the analysis and comparison of the results.

Results

Social-demographic data

Most of the interviewees were women aged 26–35, living in big cities and having an income of 13–20,000 hryvnias per month. Only 20.6% of the respondents had a complete secondary or vocational education. The majority (79.4%) had higher education. Other socio-demographic data are shown in Table 1.

Table 1. Sociodemographic data

Specification	Number of respondents	%
Sex		
Female	2,039	87.0
Male	290	12.3
I do not want to specify	16	0.7
Age		
18–25	435	18.6
26–35	848	36.2
36–45	681	29.0
46–55	272	11.6
56–65	97	4.1
>65	12	0.5
Education		
Complete secondary education	182	7.8
Vocational and technical education	302	12.9
High education	1,861	79.3
Place of residence (thousands of population)		
City >500	1,020	43.5
City 250–500	273	11.6
Town 50–250	257	11.0
Town 20–50	215	9.2
Urban village 5–20	242	10.3
Village <5	338	14.4
Average monthly income (in hryvnia)		
<12,000	442	18.8
13,000–20,000	614	26.2
21,000–35,000	574	24.5
36,000–45,000	266	11.3
>45,000	449	19.2

Source: Own research.

Respondents' awareness of animal welfare on dairy farms

We asked the respondents to rate their level of knowledge about dairy farming, namely about the methods of keeping cows, their feeding, breeding, and milking, where 1 – 'I don't

know anything', 2 – 'I know very little', 3 – 'I have some knowledge', 4 – 'I know enough', 5 – 'I know a lot'. The average score of the knowledge of the respondents was 2.8. The largest group of the respondents, 32.2%, answered 'I have some knowledge', 15.7% answered 'I don't know anything' and only 10.3% of the respondents chose 'I know a lot'.

As for direct visits to farms where dairy cows are kept, 63.5% of the respondents indicated that they had visited such farms. Using pivot tables, we did not notice a connection between visiting a farm and knowledge of dairy farming. Most respondents who had visited a farm chose 'I have some knowledge', while most respondents who had not visited a farm chose 'I know very little'.

Regarding the awareness of the importance of a high level of welfare on dairy farms, an absolute majority of the respondents (83.3%) noted that it is 'very important' (average value, $\mu = 4.78$) and only 0.2% of the respondents considered welfare on dairy farms 'not at all important'. We would also like to note that the maximum score of 5, 'very important', was given equally by both respondents who had visited a farm and those who had not visited a farm.

In one of the questions, the respondents were asked to evaluate who, in their opinion, has the greatest influence on the welfare of animals on a dairy farm (Figure 1).

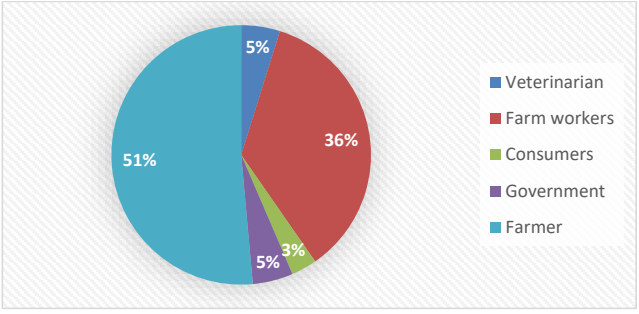

Fig. 1. Who has the greatest influence on the welfare of animals on a dairy farm?

Source: Own research.

It is interesting to note that people who are associated with animal husbandry (43.4%) and people who are not associated with animal husbandry (56.6%) answered this question in the same way. 51.9% of the respondents who had been to a farm believed that the farmer has the greatest influence on animal welfare, while 51.1% of the respondents who had not been a farm believed the same. Respondents who had and had not visited a dairy farm put farm workers in second place in terms of their impact on animal welfare (34.5 and 36.3%, respectively). The lowest rate in both groups was the consumers (2.3 and 3.9%).

In the question of whether the animal welfare depends on the size of the farm, 3 answer options were offered: 1) 'Yes, it depends. On large farms, it is more difficult to achieve a high level of welfare', 2) 'Yes, it depends. It is easier to achieve a high level of welfare on large farms' and 3) 'No, it does not depend on the farm's size'. This question was included to determine the existence of prejudices among the respondents about large farms. 59% were

sure that animal welfare does not depend on the size of the farm, 25% believe that it is more difficult to achieve a high level of welfare on a large farm and 15.9% said that it is easier to achieve a high level of animal welfare on large farms. These results can be interpreted as indicating that the majority of modern consumers do not have stereotypical thinking about farms where a large number of cows are kept.

At the time of the survey, 61.1% of the respondents had not noticed information about animal welfare in the mass media, and 95.2% of the respondents believed that consumers do not receive enough information about animal welfare, while 82% of the respondents wanted to receive more information about dairy cows' welfare on farms. Of those respondents who believed that the information was not enough, 83.8% sought more information. In turn, among the respondents who considered the information sufficient, 54.5% wanted to receive more information.

The last question can be called somewhat 'provocative'. Asking about the average person's opinion (indirect survey) has been studied to elicit moderate social desirability bias (Lusk, Norwood, 2009). In this case, social desirability bias will respond in such a way that a certain percentage of people taking the questionnaire may tend to appear more concerned about this issue. So, we added the question 'Are Ukrainians concerned about cows' welfare on dairy farms?' (Figure 2).

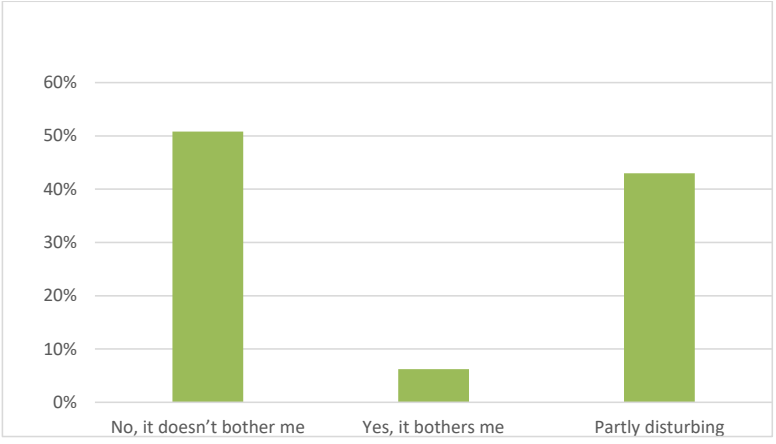

Fig. 2. Are Ukrainians concerned about the cow's welfare on dairy farms?

Source: Own research.

It is interesting to consider this question together with the question about the respondents' opinions about the importance of establishing a high level of welfare on dairy farms since, for example, 81% of those interviewed who chose 'No, it doesn't bother me' gave the highest score 5 – 'Very important' (Table 2).

Table 2. Correlation of the questions 'Are Ukrainians concerned about the welfare of animals on dairy farms?' and assessments of the importance of high levels of cow welfare on dairy farms

Specification	Score given by the respondents to the question 'What is the importance of a high level of welfare on dairy farms?' (1 – not important, 5 – very important)				
	1	2	3	4	5
Yes, it bothers me	1%	0%	2%	6%	91%
No, it doesn't bother me	0.3%	1%	5%	13%	81%
Partly disturbing	0%	1%	3%	12%	85%

Source: Own research.

Importance of welfare parameters on dairy farms

The results in Table 3 show high indicators in all parameters. That is, consumers realise and support the importance of meeting the animals' needs not only in high-quality feeding, which directly affects the quality of livestock production in the future, but also in the expression of natural behaviour, good relations with farm workers, etc.

Table 3. Importance of welfare parameters on dairy farms

Welfare parameter	Mean value (μ)
Sufficient space	4.707
Expression of natural behaviour	4.485
Access to pastures	4.694
Good relationship with farm workers	4.747
High-quality and appropriate feeding	4.951

Source: Own research.

Purchasing behaviour

According to Figure 3, the majority of the respondents (40%) consumed dairy products every day and 53% had never thought about the conditions of keeping cows when making purchases. 56% of the respondents with a vocational education thought about the living conditions of animals compared to 46% of the respondents with a higher education. At the same time, consumers who had visited a dairy farm more often thought about the living conditions of cows when shopping compared to the respondents who had never visited a farm (51 and 40%, respectively). Also, the largest percentage of respondents who thought about the living conditions of the animals (55%) were people living in rural areas (<5,000 population). For comparison, this indicator for people living in a big city (>500,000 population) is 44%.

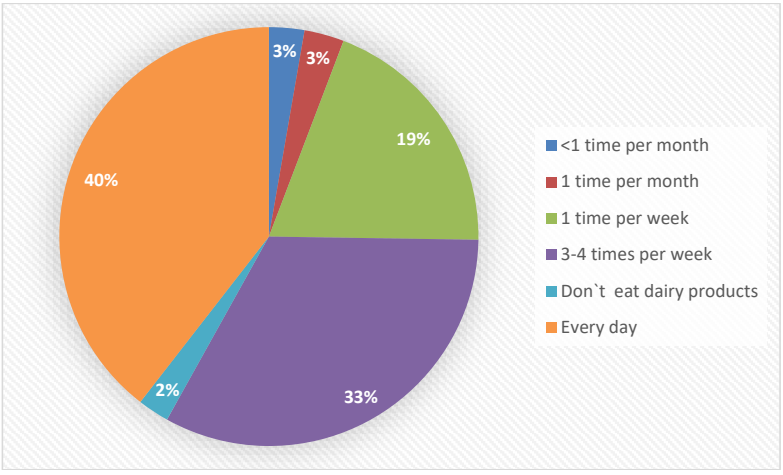

Fig. 3. How often respondents consume dairy products

Source: Own research.

87% of the respondents did not notice products with animal welfare labels. When asked whether they would trust the label 'from animals with a high level of welfare', 49% of the respondents chose the option 'Difficult to answer', 38% would trust it, and 13% would not trust the label advertising a high level of cow welfare.

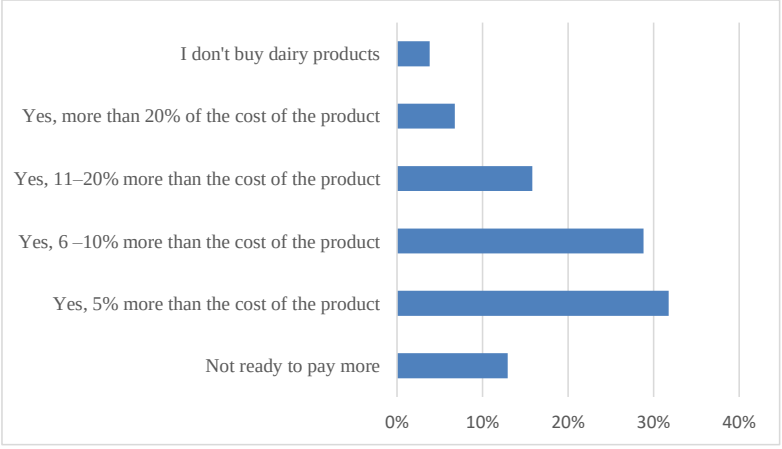

Fig. 4. Willingness to pay more for products from animals with a high level of welfare

Source: Own research.

Most consumers (90%) agree with the statement that dairy products from animals with a high level of welfare are better and more useful for humans. Regarding the willingness to pay more for products from animals with a high level of welfare (Figure 4), 32% of the respondents are ready to pay 5% more for the product, while 13% are not ready to pay more.

Regarding the correlations with income, 11% of people with an average monthly income of >45,000 hryvnias/month are ready to pay 20% more for the product, while 29% of people in this group are ready to pay 11–20% more. In the group of respondents who receive 36–45,000 hryvnias/month, the 'leading' indicator is the willingness to pay 6–10% more (36% of respondents). The respondents (34%) who receive 13–10,000 and 21–35,000 hryvnias/month are ready to pay 5% more. However, among the respondents whose average monthly income is <12,000 hryvnias/month, 36% are ready to pay 5% more and 24% of respondents 6–10% more for products from animals with a high level of welfare.

Considering the level of dairy consumption, 13% of the respondents who consume dairy products <1 time per month are ready to pay 20% more for the product, while 33% of the respondents who consume dairy products daily are ready to pay 5% more, 29% by 6–10%, 16% of respondents by 11–20%, and 12% of the respondents who consume dairy products daily are not ready to pay more for products from cows with a high level of welfare.

The sum up, we can observe that consumers with a higher level of income are ready to pay more for products from animals with a high level of welfare, with the vast majority of the respondents ready to pay more by at least 5% of the cost of the product.

Discussion

The purpose of this study was to determine the level of knowledge and interest of Ukrainian consumers on the topic of the dairy cow welfare on farms and to assess their willingness to pay more for products from cows with a high level of welfare. We are the first in Ukraine to study the opinions of consumers specifically around the welfare of dairy cows. Therefore, in this case, we did not have the opportunity to compare our results with previous Ukrainian studies.

The high percentage of women in the sample confirms the socio-cultural indicators that are characteristic of Ukraine. According to the latest research, 83% of respondents agree with the statement that the most important task of a woman is to take care of the home and family. Regarding household issues, men quite often noted that it was a 'women's' matter or shared this responsibility Rating Sociological group (2020). On the other hand, women were significantly more likely than men to say that these are their responsibilities at home. That is, given these statistics, we can assume that the high percentage of women in the sample is a result of the fact that women are more likely to lead the household and make food purchasing decisions. It is also necessary to take into account the fact that Ukraine is currently under wartime and many men are doing military service.

For a better understanding of the results of the survey question concerning additional payment for products from animals with a high level of welfare, it is worth noting that the average annual salary in Ukraine for 2023 is 171,696 hryvnias per year (an average of 14,308 hryvnias per month) (Pension Fund of Ukraine, 2023).

Understanding public concern for animal welfare must begin with an understanding of the role of knowledge in shaping attitudes towards animal welfare (Cornish et al., 2016). The

average score of awareness among Ukrainian consumers was 2.8 (out of 5) and is a rather low indicator that, in general, reflects the results of studies in other countries. For example, Kjærnes et al. (2007) asked European consumers about their knowledge of farm animal welfare and a significant proportion of the respondents answered 'Don't know', which may indicate too low a level of knowledge for respondents to draw certain conclusions.

Despite the low level of knowledge, the majority of Ukrainian consumers (83.3%) gave the highest score, 'very important', to maintaining high standards of welfare on dairy farms.

An absolute majority of Europeans (94%) believe that it is important to protect the welfare of farm animals. More than half of respondents (57%) consider it 'very important', and 37% consider it 'somewhat important'. Only a very small proportion (4%) of respondents do not consider the welfare of farm animals to be important (Eurobarometer, 2017). Among Ukrainian consumers, only 0.2% consider welfare on dairy farms to be 'not important at all'.

Schröder and McEachern (2004) argue that food consumption is often divorced from food production, and the general public has very little, if any, direct experience with farmers and production animals. As a result, consumers seem confused and misinformed about farm animal welfare and farming practices. For example, studies show that only 36% of Italian respondents have visited a farm where farm animals are kept at least once (Pasquale et al., 2014). According to the Eurobarometer (2005), 69% of Europeans have visited such farms. As for Ukrainian consumers, dairy farms were visited by 63.5% of consumers, which is a relatively high indicator.

In addition, many consumers actively avoid learning about the conditions imposed on farm animals or remain in 'willful ignorance' (Cornish et al., 2016).

At the same time, an absolute majority of Ukrainian respondents are sure that consumers are not provided with sufficient information about the level of dairy cow welfare. Similarly, a vast majority (82%) of those interviewed want to receive more information about the conditions of keeping and the level of welfare. Almost two-thirds of Europeans (64%) indicated that they would like to receive information about the conditions of treatment of farm animals (Eurobarometer, 2017).

Similarly, a Canadian study (Spooner et al., 2014) showed that most respondents expressed a desire to gain additional knowledge about animal husbandry practices.

The results of a study by Fonseca and Sanchez-Sabate (2022) show that only 46.6% of consumers agree or somewhat agree that higher animal welfare standards are easier to implement on small farms. Most respondents believe that animals feel more comfortable on small farms. Regarding our results, Ukrainians do not see a relationship between the size of the farm and the level of animal welfare. As for the influence on welfare, Ukrainian consumers believe that the biggest influence is actually the farmer and the workers; they do not consider themselves, as consumers, capable of influencing welfare on farms. According to Pasquale et al. (2014), Italian respondents believe that their purchasing choices do not affect welfare either. Also, consumers believe that the main responsibility for welfare lies primarily with farmers and secondly with politicians and veterinarians. A relative majority of European respondents believe that the welfare of farm animals should be resolved jointly between enterprises and state bodies (43%). However, there is a high proportion of respondents who believe that this is the business of all citizens and should be regulated by the government (40%) (Eurobarometer, 2017). A US study (Wolf et al., 2016) shows that consumers believe the USDA and dairy farmers have had the greatest influence on the welfare of dairy cattle.

An absolute majority (52%) of Europeans pay attention to animal welfare labels when buying products. In general, EU respondents believe that there is not enough choice in shops and supermarkets of food products with appropriate labelling regarding the protection of animal welfare (47%) (EC, 2016), while 37% of respondents never or very rarely look for a label and one in ten Europeans (10%) did not know that such a label even existed. As for labelling in Ukraine, an absolute majority (87%) of consumers have never come across a product with labelling that carries information about the level of the cows' welfare. According to Fonseca and Sanchez-Sabate (2022), many people believe that animal welfare labels are trying to deceive them, so the level of trust is generally low. As for Ukrainian consumers, only 13% definitely would not trust the labelling, with the majority (49%) choosing the option 'Difficult to answer', which, in principle, demonstrates a certain lack of trust and uncertainty regarding such labelling.

The importance of animal welfare to consumers is not limited to ethical considerations. Regan et al. (2018) in Ireland showed that a high level of welfare is a sign that a given product is healthier, safer and of better quality. Similarly, in our study, the majority of Ukrainian consumers agree with the thesis that dairy products from cows with a high level of welfare are more useful for people.

Regarding the willingness to pay more, an absolute majority of the Ukrainian respondents (61%) were ready to pay 5 to 10% more for dairy products from animals with a high level of welfare. Only 13% of the respondents were not ready to pay more, while 7% of the respondents were ready to pay 20% more for the product. More than half of Europeans are willing to pay more for products obtained from friendly animal production systems (59%). More than a third of respondents (35%) are willing to pay up to 5% more, and only a small minority (3%) are willing to pay more than 20% more. However, more than a third of EU citizens (35%) are not ready to pay more (Eurobarometer, 2017).

Conclusions

The purpose of the study was to assess the level of knowledge of Ukrainian consumers regarding cows' welfare on dairy farms, to learn about their views, interest and willingness to pay more for products from cows with a high level of welfare. This is the first study on the welfare of dairy cattle conducted in Ukraine.

Our research shows that today's consumers value and understand the importance of achieving a high level of cow welfare on dairy farms. An absolute majority of the respondents believe that consumers are not sufficiently informed about the living conditions of animals on farms and want more information about the level of animal welfare. For consumers, the development of labelling of dairy products regarding the level of welfare, which they can trust, is relevant.

According to the study, Ukrainian consumers not only understand the importance of such aspects of welfare as the expression of natural behaviour, high-quality feed, good relations between man and animal, sufficient space for the animal, and access to pastures, but are also ready to pay more for dairy products from cows with a high level of welfare. Regardless of the state of war, the economic situation in the country and inflation, 84% of respondents are willing to pay more for this.

In the future, it is relevant to conduct a survey among farmers on the welfare of cattle on dairy farms, because it is them and farm workers who are considered by the surveyed consumers to have the greatest influence on animal welfare on dairy farms.

These results can become the foundation for further research aimed at studying the opinions of consumers who are interested in products from animals with a high level of welfare in order to build quality strategies for the development of the dairy industry in Ukraine. We also hope that this study will be useful during the creation and implementation of the certification and labelling of dairy products with regard to cow welfare.

Conflicts of interest and sources of funding

The authors declare no conflicts of interest or sources of funding for the work presented here.

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Seed Storage Practices and Cultivation Techniques: A Survey in Gajuri Rural Municipality, Nepal

Abstract. The production, selection, and storage of the seeds used for cultivation in Nepal are done in two ways: traditional and modern. Conventional ways of storing and reusing seeds depend on indigenous and traditional techniques, whereas modern techniques depend on the different agencies performing scientific agricultural breeding and storage techniques. The study aimed to determine the major varieties and sources of seed used for cultivation, to what extent the cultivated varieties are stored, and whether the stored seeds are cultivated. The study surveyed 171 households by systematic random sampling in the Jarebagaiccha and Milanatar villages of ward 6 in the Gajuri Rural Municipality, Nepal. The study was constructed utilising a literature review and in-depth interviews. The researcher used SPSS version 26 for analysing and illustrating the findings of the 11 cultivated crops, i.e., Rice, Maize, Millet, Wheat, Mustard, Potato, Beans, Black lentil, Cowpea, Soybean, and Rice beans. The findings determined that the majority of the farmers cultivated local varieties of crops by using informal sources of seed and stored the seeds in their own homes. The study further highlighted that only four local varieties (soybean, cowpea, potato, mustard) were acquired from agro-vets by a minority of the farmers. The hybrid varieties that were cultivated had formal sources, and none of the hybrid varieties were stored. The farmers stored nine local varieties using the traditional method of cultivation.

Keywords: agriculture, seed storage, traditional practices, cultivation, survey, Nepal

JEL Classification: Q12, Q16, E23

Introduction

Nepal's economy is driven mainly by agriculture, making it one of its most important industries. Agriculture provides a resilient livelihood by offering diverse income sources, ensuring food security, contributing to local economies, and fostering adaptability to environmental changes. It also plays a vital role in cultural preservation, rural development, global stability, and climate resilience, making it a cornerstone of sustainable livelihoods worldwide. Only 21% of Nepal's land is cultivated, and 65% of the population works in agriculture, which is their main occupation (Joshi et al., 2020). The agriculture industry employs approximately 8 million people, two-thirds of the country's total labour force

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(Gyawali & Khanal, 2021). It provides livelihoods for about 70% of the population and accounts for around 30% of the National GDP (Dhakal, 2022). However, there is insufficient investment even in rice research, even though it is a major crop in Nepal (Pandit et al., 2020). Importantly, such research on the seeds of rice and other crops is imperative for many reasons. Seeds are one of the most essential requirements in the agriculture industry. The quality and availability of seeds are pivotal for achieving resilient livelihoods in agriculture. High-quality seeds are fundamental as they contribute to enhanced crop yields, pest resistance, and high-quality produce (De Falcis et al., 2022; Jones et al., 2018). Conversely, subpar seed quality can lead to crop failures and reduced income, increasing vulnerability to external factors.

Seeds used for sowing and cultivation can be obtained from various seed production sources. These sources can be local (neighbours, family, friends), regional (community seed banks, cooperatives, etc.), national (national seed companies, extension agencies, etc.), or even international (such as a multinational seed company or an international gene bank) (Puskur et al., 2021). More than 90% of cereal seed supply in the local context of Nepalese farming is informal (Paudel et al., 2013).

By 2030, the Sustainable Development Goal (SDG) 2: End hunger, seeks to end hunger, achieve food security, enhance nutrition, and promote sustainable agriculture and food systems. SDG 2.3 aims to double the agricultural productivity and incomes of small-scale food producers by 2030 through secure and equal access to productive resources, among other means. SDG 2.4 calls for implementing resilient agricultural practices that increase productivity and production (UNDP, 2015).

Nepal has legislation in place to address seed quality and availability. The Seeds Act, 2045 (1988) came into force on 26th October 1988 (Nepal Law Commission, 2018). It has undergone several amendments, including the Seeds (First Amendment) Act, 2058 (2002), and the Republic Strengthening and Some Nepal Laws Amendment Act, 2066 (2010) (Nepal Law Commission, 2018). The act established a National Seed Board to formulate and implement seed-related policies and advise the government on seed-related matters. The Seed Act 2010 provides a legal framework for seed production, processing, certification, marketing, import/export, research, and development (Nepal Law Commission, 2018; Gauchan, 2019). The Seed Vision 2013–2025 aims to ensure quality seed availability for farmers through a well-functioning seed sector (SQCC, 2013). It outlines a long-term strategy to enhance seed production and distribution, explicitly improving seed quality and availability (SQCC, 2013). This vision aligns with global goals, particularly SDG 2, by promoting food security and poverty reduction through improved seed systems.

The cultivation of seeds and their storage play direct and indirect roles in achieving these goals. There is demand at the local, regional, national, and worldwide levels for community seed banks and field gene banks that contain seeds and plants with greater genetic diversity and stress tolerance to biotic and abiotic factors (Gautam, 2017). Community seed banks are necessary financial instruments for farmers (Falcis et al., 2022) as they provide economic benefits for the farmers to improve their livelihood (Shrestha et al., 2007).

Thus, the storage mechanisms of seeds are essential. If the seeds' storage management is not done appropriately, it leads to storage losses. Storage losses are fairly high (up to 10%) for several crops (Paneru et al., 2018). Nepali farmers mostly use traditional storage

methods (Subedi et al., 2009). However, conventional methods are not sufficient to prevent storage loss and traditional methods are inefficient for protecting seeds from insects (Kandel et al., 2021).

Despite the significance of understanding farmers' practices in seed cultivation, storage, and utilisation in the Gajuri Rural Municipality, there remains a notable gap in the existing literature. Some studies have examined seed management and agricultural practices in rural settings. For example, the study of Joshi et al. (2011) examined using improved seed varieties to improve productivity. Likewise, Kandel et al. (2021) detailed the challenges in the Bagmati province of Nepal, such as insects in seed storage, and suggested improved storage methods. Similarly, Sharma and Tiwari (2020) suggested improved storage methods, such as metal bins, to preserve bins. However, few studies have specifically focused on the practices of farmers in the Gajuri Rural Municipality regarding seed cultivation, storage, and utilisation. This research emphasises the practices of the farmers of the Gajuri Rural Municipality in the cultivation and storage of seeds and their sources for plantation. This study aimed to determine the major seed varieties and sources farmers use for cultivation, the extent to which the cultivated varieties are stored, and whether or not the stored seeds are used for cultivation in the study area.

Methodology

Study Area, Population, and Sample

The area of study was the Gajuri Rural Municipality of Dhading. There are eight wards in this rural municipality with a total area of 138.88 sq. km. (Government of Nepal, 2021). Out of these eight wards, Ward 6 was chosen for the study, as it provides a critical conduit for transportation logistics within the agricultural landscape. The total population of the Gajuri Rural Municipality is 27,074, whereas the population of Ward No. 6 is 4,565 (MOFALD, 2021). The probability sampling technique was intended to be used in this study. Here, the researchers chose systematic random sampling, and households were selected systematically. According to CBS 2012, there are 300 households in the villages of Jarebagaichha and Milantar. The sample size was calculated from the population (300) by applying the sampling formula of Yamane (1967).

$$N_0 = \frac{N}{1 + N \times \alpha^2}$$

Where:

N_0 = Sample size;

N = Total population = 300;

α = Level of significance = 0.05.

Then, the interval of the selection of the house would be the total number of households divided by the sample taken, i.e., 300/171, which is approximately 2. Therefore, the researcher chose respondents from every second house. After the sample was determined, a questionnaire was prepared with the help of an expert and supervisor in the English language and later translated into Nepali for the convenience of the respondent. The questionnaire was piloted among 17 farmers, approximately 10% of the total sample. The survey took 5–8 minutes for each participant and was completed in 15 days. The received data was coded using SPSS software version 26.

Results and Findings

Males aged 56 and older made up the most significant proportion of the respondents within the study population, whereas the females were aged 26–35, which illustrates that the total number of female respondents was more than that of the males.

Table 1. Age and Gender of the Respondents

Serial Number	Age Range	Gender		Total
		Male	Female	
1	20–25	4 (2.3%)	6 (3.5%)	10 (5.8%)
2	26–35	18 (10.5%)	27 (15.38%)	45 (26.3%)
3	36–45	13 (7.6%)	23 (13.5%)	36 (21.1%)
4	46–55	17 (9.9%)	17 (9.9%)	34 (19.9%)
5	56–above	29 (17.0%)	17 (9.9%)	46 (26.9%)
	Total	81 (47.4%)	90 (52.6%)	171 (100%)

Source: Own calculation.

The demographic data were analysed, revealing the ethnic composition of the surveyed population. The majority of the respondents were Brahmins and Chhetri (62.6%). They make up more than 50% of the total respondents. There was also significant representation from the Janajati (25.1%) and Dalit (11.7%) communities, alongside a small fraction of 'others' (0.6%).

Table 2. Ethnicity of the respondents

S.N	Ethnicity	Frequency	Percent
1	Brahmin, Chhetri	107	62.6
2	Janajati	43	25.1
3	Dalit	20	11.7
4	Others	1	0.6
	Total	171	100.0

Source: Own calculation.

All the respondents' primary source of income was agriculture, with a secondary source of income being reported by 136 (79.5%), and 14 (8.2%) reported having a tertiary source of income.

Table 3. Occupations and Source of Income of the Respondents

S.N	Source of Income	Primary Source		Secondary Source		Tertiary Source	
		N	%	N	%	N	%
1	Agriculture	171	100%				
2	Job			39	22.8		
3	Business			9	5.3	1	0.6
4	Remittance			22	12.9	2	1.2
5	Wages			27	15.8	5	2.9
6	Others			39	22.8	6	3.5
	Total	171	100%	136	79.5	14	8.2

Source: Own calculation.

All the respondents had their own land and a few respondents had rented, 'Adhiya' land (the farmer pays half of the harvest from the rented land as payment for using the land) along with their own land.

Table 4. Types of Land of the Respondents

S.N	Types of Land (N=171	N	%
1	Own	171	100.0
2	Own and Rented	3	1.8
3	Own and Adhiya	11	6.4
4	Own, Rented and Adhiya	2	1.2

Source: Own Calculation.

Eleven crops were cultivated by the farmers, among which maize was the most cultivated crop (N=166, 97.1%). Out of the 11 crops, local varieties of 10 were cultivated except the wheat variety. Of them, they chose to produce the local variety of cowpea, making it a highly cultivated local variety. Maize was the preferred hybrid crop, and it was grown by 93 farmers (56.02%).

Table 5. Cultivation Status of the Crops

		Cultivation		Variety		
S.N	Crops		Total cultivated	Local	Hybrid	Both (Hybrid + Local)
		N	N (%)	N (%)	N (%)	N (%)
1	Rice	171	105 (61.4%)	20 (19.04%)	13 (12.38%)	72 (68.57%)
2	Maize	171	166 (97.1%)	40 (24.09%)	93 (56.02%)	33 (19.87%)
3	Millet	171	111 (64.9%)	111 (100%)	-	-
4	Wheat	171	13 (7.6%)	-	13 (100%)	-
5	Mustard	171	102 (59.6%)	102 (100%)	-	-
6	Potato	171	101 (59.1%)	95 (94.05%)	6 (5.9%)	-
7	Black lentil	171	102 (59.6%)	102 (100%)	-	-
8	Cowpea	171	112 (65.5%)	112 (100%)	-	-
9	Soybean	171	78 (45.6%)	78 (100%)	-	-
10	Beans	171	21 (12.3%)	21 (100%)	-	-
11	Rice beans	171	32 (18.7%)	32 (100%)	-	-

Source: Own calculation.

The source of all the hybrid varieties of seeds was an agro-vet. The home was the primary source of seed for the crop millet, where out of 171 respondents, 111 were millet cultivators, and out of 111 cultivators, 99% of millet cultivators' seed source was their own home, and 1% of farmers' source of seed was their neighbour. Among the local varieties, beans were shared in the neighbourhood in the highest number (90.47%).

Table 6. Varieties of seed by their source

S.N	Crops	Seeds from							
		Home		Neighbours		Agro-vet		Others	
		N	%	N	%	N	%	N	%
1	Rice	20	100	-	-	-	-	-	-
		-	-	-	-	13	100	-	-
		72	100	-	-	72	100	-	-
2	Maize	31	77.5	9	22.5	-	-	-	-
		-	-	-	-	93	100	-	-
		33	100	-	-	33	100	-	-
3	Millet	110	99	1	1	-	-	-	-
		-	-	-	-	-	-	-	-
4	Wheat	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	13	100
5	Mustard	38	37.62	15	14.85	48	47.52	-	-
		-	-	-	-	-	-	-	-
6	Potato	-	-	-	-	95	100	-	-
		-	-	-	-	6	100	-	-
7	Black lentil	100	98	2	2	-	-	-	-
		-	-	-	-	-	-	-	-
8	Cowpea	92	82.14	7	6.25	13	11.60	-	-
		-	-	-	-	-	-	-	-
9	Soybean	67	85.89	4	5.12	7	8.9	-	-
		-	-	-	-	-	-	-	-
10	Beans	2	9.5	19	90.47	-	-	-	-
		-	-	-	-	-	-	-	-
11	Rice beans	32	100	-	-	-	-	-	-
		-	-	-	-	-	-	-	-

Source: Own calculation.

Out of 11 cultivated crops and their local varieties, nine local types were stored using a primitive method. 100% of local rice, maize, millet, and black lentil cultivators stored the seed using primitive methods. The farmers stored none of the hybrid varieties.

Table 7. Varieties of seed by source

S.N	Crop	Method of Storage			
		Primitive		Modern	
		N	%	N	%
1	Rice	92	100	0	0
2	Maize	73	100	0	0
3	Millet	111	100	0	0
4	Wheat	0	0	0	0
5	Mustard	98	96.05	0	0
6	Potato	0	0	0	0
7	Black lentil	102	100	0	0
8	Cowpea	98	87.5	0	0
9	Soybean	72	92.30	0	0
10	Beans	2	9.5	0	0
11	Rice beans	32	100	0	0

Source: Own calculation.

Only nine crops of local varieties were stored for cultivation. The local varieties of millet, black lentil, cowpea, soybean, beans, and rice beans were stored and cultivated. Likewise, not all the farmers checked the quality of all seeds before cultivation. Soybean was the crop whose quality was checked in the highest amount (88.46%).

Table 8. Cultivation after Storage and Quality Check

S.N	Crop	Quality check of stored seed		Cultivation after Storage	
		N	%	N	%
1	Rice	81	88.04	90	97.82
2	Maize	58	79.45	68	93.15
3	Millet	85	76.57	111	100.00
4	Mustard	79	80.61	97	98.97
5	Black lentil	90	88.23	102	100.00
6	Cowpea	72	73.46	98	100.00
7	Soybean	69	88.46	78	100.00
8	Beans	2	100.00	2	100.00
9	Rice beans	2	6.25	32	100.00

Source: Own calculation.

The participation of female respondents was more than that of male respondents by 5.2%. According to a preliminary report of the Central Bureau of Statistics (CBS, 2022), the ratio of females (51.04%) is greater than that of males (48.96%) in Nepal. The majority of the respondents belonged to the Brahmin and Chhetri communities. All the respondents had their own land and used it for farming and shelter. Some respondents (1.8%) also rented land for farming, and Adhiya (1.2%) was also taken for farming.

All the respondents were engaged in farming, and agriculture was the main occupation in that area, making it the primary source of income. Out of 171 respondents, 137 respondents had a secondary source of income, and 14 respondents had a tertiary source of income apart from agriculture. According to Maharjan et al. (2013), farmers spend less on low-productivity subsistence crop farming and livestock when remittances are relatively large and instead favour the non-farm sector or use remittances more for leisure and consumer items.

There were 11 crops: rice, maize, millet, wheat, mustard, potato, black lentil, cowpea, soybean, beans, and rice beans. Maize was cultivated by the highest number (N=166, 97.1%) of respondents, and wheat was cultivated by the lowest (N=13, 7.6%). The second most cultivated crop was cowpea (N=105, 61.4%).

Farmers cultivated local, hybrid, and both (local & hybrid) varieties of rice and maize. Wheat was the only crop whose hybrid variety was cultivated. Millet and cowpea were the highly cultivated local varieties. The farmers produced only the local varieties of millet, mustard, black lentil, cowpea, soybean, beans, and rice beans. Nearly 96% of farmers used unauthorised sources, including harvest, to obtain rice seeds (Gauchan et al., 2014; MoAD, 2015).

The farmers used local and hybrid seed varieties for cultivation, and the seeds were acquired from informal (home, neighbourhood) and formal (agro-vet) seed sources. In this research, cultivating local varieties is more likely to be from informal and, at a minimum, formal sources. In support of this, McGuire & Sperling (2016) stated that a study conducted in Africa on 9,660 observations of 40 crops showed that farmers acquired 90.2% of their seed from informal sources. Almost 82% of farmers rotate their seeds at regular intervals for cultivation, acquired from the formal and informal sectors (Baniya et al., 2005). Another study on rice and millet showed that the Kaski, Bara, and Ghanpokhara used informal sources of seed supply, including their own, neighbours, and relatives, and Switzerland used only formal seed supply to cultivate rice and millet (Wyss et al., 2016). The most cultivated hybrid crop in the research area was maize, and of the cultivated hybrid seed source for 93 (100%) was an agro-vet (formal seed supply). The study was conducted in Chitwan, Dadeldhura, Dang, Khotang, Lalitpur, and Sindupalchwok; overall, the formal seed for maize makes up 75%, and informal seed makes up around 25% (Gairhe et al., 2021).

Out of 11 cultivated floras, nine local varieties were stored using the primitive method; the potato was the only crop that was not stored using any of the methods. The respondents also reported not having any community seed banks in the area. The local varieties of millet, black lentil, cowpea, soybean, beans, and rice beans were stored and cultivated. According to the data, the stored varieties are used for cultivation, and their quality was checked using unscientific and traditional methods.

Farmers are utilising the seeds they have on their own farms and storing some for future cultivation. However, the quality of these stored seeds varies, as there is no application of scientific methods to assess their quality. It is essential to combine the farmers' traditional knowledge with scientific techniques to improve seed storage, ensure better cultivation outcomes, and ensure seed security.

The agricultural community in the Gajuri Rural Municipality predominantly relies on traditional seed storage methods, indicating a strong adherence to age-old practices. While rooted in local wisdom, this reliance raises concerns about a potential compromise in the

quality and viability of stored seeds. The absence of modern techniques for assessing seed quality suggests a critical gap in the preservation process, impacting the long-term agricultural sustainability of the region.

A notable absence in the region is the lack of community seed banks. These communal repositories play a pivotal role in collective conservation efforts. Their non-existence represents a significant gap in safeguarding agricultural biodiversity and seed security. Community seed banks could serve as vital centres for preserving indigenous crop varieties, ensuring genetic diversity, and providing a safety net against crop failures. Particularly for crops such as potatoes, which were not stored traditionally, and crops like maize, which were stored, the establishment of community seed banks becomes paramount. These banks could actively promote seed diversity and provide a strategic resource for farmers, contributing to sustainable agricultural practices in the community.

The stored seeds lacked quality assessment through scientific methods, indicating the need to integrate traditional wisdom with modern agricultural techniques. Scientific evaluation methods could ensure the viability and quality of stored seeds, enhancing overall agricultural productivity. The study underscores the importance of ensuring seed security. Combining local knowledge with scientific advancements enhances seed quality and contributes to long-term agricultural sustainability and resilience against environmental challenges.

Implications of the Study

The findings of this study present a robust foundation for future research endeavours, particularly within the unique context of the Gajuri Rural Municipality. The implications outlined below provide a roadmap for scholars, policymakers, and practitioners seeking to deepen their understanding of seed cultivation, storage, and conservation practices in similar rural settings. This data can be used to inform farmers of the source and variety of seeds they are cultivating and the techniques they use for storage. Such awareness will help the farmers choose the seed for cultivation wisely to improve the yield. Additionally, understanding where to improve and what kind of seed is beneficial for them and seeking suggestions from the experts can be done by the farmers. Likewise, the findings from this research will help entrepreneurs understand the cultivation status and behaviour of the farmers so that they can produce seeds that meet the farmers' requirements. Similarly, this research has explored the sources used by the farmers in acquiring seeds, along with the cultivation and storage status. For instance, policymakers can make provisions for the preservation and quality control of seeds that are being used. Likewise, the local government can help the farmers by establishing a community seed bank to preserve the varieties. The community seed bank can be established by merging the scientific method with the traditional method that the farmers are now using in the area. Finally, this research provides a robust foundation for further studies, contributing substantially to preserving crop diversity, enhancing agricultural productivity, and formulating farmer-oriented policies. By addressing these critical areas of inquiry, researchers can profoundly impact the agricultural landscape in the Gajuri Rural Municipality and similar agrarian regions, fostering holistic and enduring advancements in agriculture.

Conclusions

This study covered the major cultivated crops, their varieties, sources, the status of storage, and cultivation after storage in the study area. The gaps in genotype, name of varieties, total cost for cultivation, harvesting after cultivation, etc., are essential to be examined further. Another important aspect indicated by this study is the need to conduct more research using social science perspectives. Although there are studies on seeds, fundamental research indicating the status of cultivation and storage is rare. Notably, the farmers need to know the type, the importance of the varieties, seed conservation, seed security, and their rights.

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