Profit Efficiency of Paddy Rice Marketing in Kaduna State, Nigeria: Implications for Food Security and Poverty Alleviation

Nijerya'nın Kaduna Eyaletinde Çeltik Pirinç Pazarlamasının Kâr Verimliliği: Gıda Güvenliği ve Yoksulluğun Azaltılmasına Yönelik Etkiler

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ABSTRACT

This study evaluated the profit efficiency of paddy rice marketing in Kaduna State, Nigeria, with implications for food security and poverty alleviation. A multi-stage sampling technique was adopted. A total sample size of 180 paddy rice marketers was selected. Primary data were obtained using a well-structured and well-designed questionnaire. The data were analyzed using descriptive and inferential statistics. The result shows that the mean ages of producers, wholesalers, and retailers that are involved in rice marketing were 46, 44, and 41 years old. Paddy rice marketing is profitable. The producers had the highest marketing margin and the lowest operating ratio of 85.82% and 0.12, respectively. The retailers had the highest marketing efficiency of 20.92%. The rates of return on investment for producers', wholesalers', and retailers involved in paddy rice marketing were 5.54, 4.27, and 3.78, respectively. The purchase price, transportation cost, labor cost, and fees were the significant factors influencing the profit efficiency of the actors involved in paddy rice marketing. The significant socioeconomic factors influencing the profit inefficiency of paddy rice marketing among actors were age, gender, educational level, access to credit, and membership of cooperatives. The mean profit efficiency score for actors was 0.46, leaving a gap of 0.54 for improvement. The study identified transportation, finance, roads, and market infrastructure as the major problems associated with paddy rice marketing. The study recommended that credit facilities should be provided and made accessible; also, investment in market and road infrastructure is necessary to create an enabling environment for effective and efficient marketing.

Keywords: Profit effiency, stochastic profit efficiency frontier model, paddy rice marketing, Nigeria

ÖZ

Bu çalışma, Nijerya'nın Kaduna Eyaleti'nde çeltik pirinç pazarlamasının kârlılık etkinliğini, gıda güvenliği ve yoksulluğu hafifletme açısından değerlendirmiştir. Çalışmada çok aşamalı bir örnekleme tekniği benimsenmiştir. Toplamda 180 çeltik pirinç pazarlamacısından oluşan bir örneklem büyüklüğü seçilmiştir. İlk veriler, iyi yapılandırılmış ve tasarlanmış bir anket kullanılarak elde edilmiştir. Veriler, tanımlayıcı ve çıkarımsal istatistikler kullanılarak analiz edilmiştir. Sonuçlar, pirinç pazarlamanın karlı olduğunu göstermektedir. Üreticilerin pazarlama marjının en yüksek olduğu ve işletme oranının en düşük olduğu (sırasıyla %85,82 ve 0,12) tespit edilmiştir. Perakendecilerin en yüksek pazarlama etkinliğine (%20,92) sahip olduğu belirlenmiştir. Üreticilerin, toptancıların ve perakendecilerin çeltik pirinç pazarlamasına katılanların yatırım getirisi sırasıyla %5,54, %4,27 ve %3,78'dir. Çeltik pirinç pazarlamasında yer alan aktörlerin karlılık etkinliğini etkileyen önemli faktörler arasında alım fiyatı, taşıma maliyeti, işçilik maliyeti ve ücretler yer almaktadır. Çeltik pirinç pazarlamasındaki aktörler arasında karlılık etkinliğini etkileyen önemli sosyo-ekonomik faktörler arasında yaş, cinsiyet, eğitim düzeyi, kredi erişimi ve kooperatif üyeliği bulunmaktadır. Aktörler için ortalama kârlılık etkinlik puanı 0,46 olarak belirlenmiş olup, iyileştirme için 0,54'lük bir boşluk bulunmaktadır. Çalışma, çeltik pirinç pazarlamasıyla ilişkilendirilen ana sorunları taşımacılık, finans, yol ve pazar altyapıları olarak tanımlamıştır. Çalışma, kredi olanaklarının sağlanması ve erişilebilir hale getirilmesi, ayrıca etkili ve verimli pazarlama için uygun bir ortam yaratmak için pazar ve yol altyapılarına yatırım yapılmasını önermektedir.

Anahtar Kelimeler: Kârlılık etkinliği, stokastik karlılık etkinlik sınır modeli, çeltik pirinç pazarlama, Nijerya

Introduction

Rice (*Oryza sativa*) is a staple food consumed globally by a large population of people, both in urban and rural areas of Nigeria. Nigeria is the largest producer of rice in Africa, and it is the largest consumer, with a consumption per capita of 32 kg. Nigeria's demand for rice is about 7.9 million metric tons per year, out of which an average of about 2 million metric tons are imported; the country has spent between $500 million and $1 billion on rice importation per year since 2002 (Ejoha, 2019). Rice is crucial to the food security of many developing nations, such as Nigeria (Yusuf, 2022). It is one of the multivalue chain crops that plays a significant role in national food security and employment sustenance, generates income, and serves as a source of raw material for agro-allied industries (Ejoha, 2019; Okoro et al., 2015). Rice is an increasingly important crop for Nigeria's economic growth and food security; it is the most common cereal crop in Nigeria (Okello et al., 2019). Rice is grown in virtually all the ecological zones in Nigeria due to its significant importance. Rice paddy production in Nigeria has increased by 2.08%, from 8.17 million tons in 2020 to about 8.34 million tons in 2021 (Rice Farmers Association of Nigeria, RIFAN, 2022). Rice has maintained its position as one of the most promising commercial crops for food security, economic growth, and poverty alleviation (Hounge and Nonvide, 2020). Rice marketing encompasses all the activities involved in moving rice from the point of production to where it is needed by the final consumers in the desired form and at the appropriate time (Abah et al., 2015a; Bassey et al., 2013). Agricultural marketing plays an important role in stimulating production and consumption and in accelerating economic development (Alabi et al., 2020). An efficient marketing system promotes economic development by encouraging specialization and leading to output enhancement (Ejoha, 2019). According to Bassey et al. (2013), increasing production of rice without a corresponding efficient marketing strategy being put in place to ensure its accessibility would not stimulate farmers to embrace practices that would enhance production since the excess would be wasted through post-harvest loses/lower prices. Improving the performance of rice marketing will require proper planning and decision-making that is dependent on adequate empirical knowledge of the market structure and the behavior of the various actors in the marketing system (Ejoha, 2019). According to Abah et al. (2015a), marketing ought to provide, among other things, access to irrigated land, appropriate farm inputs, and market information, including agricultural best practices and pricing needed to transform the Nigerian rice market. Nigeria is the leading importer of rice in Africa (Ojo et al., 2020). Relying on imported rice on global markets not only stimulates domestic inflation but also affects small-scale farmers in Nigeria, displacing their local production and fueling the already rising unemployment rate (Mark et al., 2019). Nigerians' preference for imported rice is a sign of the deteriorating state of nations' agricultural and technological development, inefficiency in profit among farmers and in the use of resources, low production, the use of traditional technology by small-scale farmers, and an inconsistent macroeconomic policy environment.

Objectives of the Study

This study evaluated the profit efficiency of paddy rice marketing in Kaduna State, Nigeria, with implications for food security and poverty alleviation. The specific objectives were:

1. Determine the socioeconomic characteristics of paddy rice marketers.

2. Analyze the prevailing prices, gross margin, and net income of paddy rice marketing.
3. Estimate the marketing margin and marketing efficiency of paddy rice and evaluate the factors influencing the profit efficiency of paddy rice marketing.
4. Evaluate the socioeconomic factors influencing the profit inefficiency of paddy rice marketing.
5. Determine the profit efficiency scores of paddy rice marketers.
6. Determine the constraints facing paddy rice marketers in the study area.

Methods

This research study was conducted in Kaduna State, Nigeria. Kaduna State lies between longitudes 06° 15′ and 08° 50′ east of the prime meridian and latitudes 09° 02′ and 09° 02′ north of the equator. The state has a total land area of 4.5 million hectares. The population of Kaduna as of 2021 was 8.9 million people. They are involved in agricultural activities. Crops grown include pepper, maize, ginger, sorghum, rice, yam, cassava, millet, and tomatoes. Animals reared include cattle, goats, sheep, rabbits, and poultry. A descriptive cross-sectional research design was employed in this study. A multistage sampling technique was adopted for this study. Sampling frame of 213 paddy rice marketers wcomprising 71 producers of paddy rice marketers, 71 wholesalers of paddy rice marketers, and 71 retailers of paddy rice marketers. A proportionate and simple random sampling technique was used to select the desired sample size of 180 paddy rice marketers (60 paddy rice marketers each). This study employed the formula advanced by Yamane (1967) in the determination or estimation of the sample size. The formula is stated thus:

$$n = \frac{N}{1 + N\left(e^2\right)} = 180 \tag{1}$$

where

n = desired sample size.

N = finite size of the population.

e = maximum acceptable margin of error as determined by the researcher.

Method of Data Analysis

The data for this study were collected through the use of a well-structured and well-designed questionnaire. Data were analyzed using econometric tools in addition to descriptive and inferential statistics as follows:

Gross margin analysis: The gross margin and net farm income analysis of paddy rice marketing were estimated using the models as follows:

$$GM = \sum_{i=1}^{n} P_i Q_i - \sum_{j=1}^{m} P_j X_j \tag{2}$$

$$NFI = \sum_{i=1}^{n} P_i Q_i - \left[\sum_{j=1}^{m} P_j X_j + \sum_{k=1}^{k} GK \right]. \tag{3}$$

where

P_i = Price of paddy rice ,

Q_i = quantity of paddy rice (Kg),

P_j = price of variable inputs ,

X_j = quantity of variable inputs (units),

TR = total revenue obtained from sales of paddy rice (N),

TVC = total variable cost (N),

GK = cost of all fixed inputs (Naira),

NFI = net income (Naira),

The gross margin analysis was used to analyze the profitability of paddy rice marketing as stated in specific objectives two (ii) and three (iii).

Financial analysis: According to Alabi et al. (2020), gross margin ratio is defined as follows:

$$\text{Gross margin ratio} = \frac{\text{Gross margin}}{\text{Total revenue}}. \tag{4}$$

According to Olukosi and Erhabor (2015), operating ratio is defined as follows:

$$\text{Operating ratio} = \frac{TVC}{GI} \tag{5}$$

where

TVC = total variable cost (Naira),

GI = gross income (Naira),

The rate of return per Naira invested (RORI) in paddy rice marketing is stated as follows:

$$RORI = \frac{NI}{TC} \tag{6}$$

where

NI = net income from paddy rice marketing (Naira),

TC = total cost (Naira),

The financial analysis was used to analyze the profitability of paddy rice marketing as stated in specific objectives two (ii) and three (iii).

Marketing Margin
Marketing margin (MM) according to Olukosi and Erhabor (2015) is defined as follows:

$$MM \, in \, (\%) = \frac{PR_t - FP_t}{PR_t} = \frac{SP - PP}{SP} \tag{7}$$

where

PR_t = retail price (Naira),

FP_t = farm gate price (Naira),

SP = selling price (Naira),

PP = purchasing price (Naira),

This was used to estimate MM of paddy rice marketing as stated in specific objective three (iii).

Marketing Efficiency
Marketing efficiency (ME), according to Olukosi and Erhabor (2015), Babatunde and Oyatoye (2005), is defined as follows:

$$ME = \frac{VAM}{CMS} \times 100 = \frac{TC}{TR} \times 100 = \frac{TC - TR}{TC} \times 100 \tag{8}$$

where

VAM = value added by marketing (Naira),

CMS = cost of marketing services (Naira)

TC = total cost incurred (Naira)

TR = total revenue (total value of products sold) (Naira)

This was used to estimate the ME of paddy rice marketing as stated in specific objective three (iii).

Depreciation of Assets
The straight-line depreciation of assets according to Olukosi, Erhabor, and Isitor (2015) is stated as follows:

$$D = \frac{P - S}{n} \tag{9}$$

where
D = straight-line depreciation (Naira).

P = purchasing price (Naira).

S = salvage value (Naira).

n = number of years of life of the assets.

Stochastic Profit Efficiency Frontier Model
The stochastic profit efficiency frontier model according to Alabi et al. (2022); Sadiq and Singh (2015); and Ejoha (2019) is stated as follows:

$$Ln\pi^* = \beta_0 + \sum_{j=1}^{6} \beta_i lnX_{ij} + \beta_k lnX_k + v_j - \mu_i. \tag{10}$$

where

π^* = normalized profit (Naira),

X_i = vector of variable input prices faced by ith marketers (Naira/kg),

X_k = vector of fixed factors of the ith marketers (Naira/unit),

ln = natural log,

$\beta_0 - \beta_6$ and β_k = parameters to be estimated,

X_1 = purchase price of paddy rice (Naira/kg),

X_2 = transportation cost (Naira),

X_3 = labour cost (Naira),

X_4 = rent (Naira),

X_5 = fees (Naira)

X_k = cost of land and machines (Naira),

V_i = statistical disturbance term (two-sided random error),

U_i = profit inefficiency effects of the *i*th marketers (one-sided half normal error).

$$U_i = \alpha_0 + \alpha_1 Z_1 + \alpha_2 Z_2 + \alpha_3 Z_3 + \alpha_4 Z_4 + \alpha_5 Z_5 + \alpha_6 Z_6 + \alpha_7 Z_7. \quad (11)$$

where

Z_1 = age (years),

Z_2 = gender (dummy: 1, male; 0, otherwise),

Z_3 = level of education (years),

Z_4 = household size (number),

Z_5 = access to credit (1, access; 0, otherwise),

Z_6 = memberships of cooperative association (1, membership; 0, otherwise),

Z_7 = years of experience (years),

α_0 = constant term,

$\alpha_1 - \alpha_7$ = parameters to be estimated, and

U_i = error term due to technical inefficiency.

This was used specifically to achieve objectives four (iv), five (v), and six (vi).

Principal Component Analysis
The constraints facing paddy rice marketers were subjected to the principal component model. This was used to specifically achieve objective seven (vii).

Results, Discussion, Conclusion and Recommendations

Socioeconomic Characteristics of Paddy Rice Marketers
The summary statistics of the socioeconomic profiles of paddy rice marketers under consideration were age, gender, marital status, level of education, household size, and marketing experience (Table 1). The mean ages of paddy rice marketers for producers, wholesalers, and retailers were 46, 44, and 41 years old, respectively. This implies that paddy rice marketers are active and within the productive workforce. This result is in line with the findings of

Ben-Chendo et al. (2017). In terms of gender analysis, about 80% of rice producer marketers were male, while 20% were female. Also, 42% of wholesalers were male, while 58% were female. Furthermore, 35% of paddy rice retailers were male, while 65% were female. This shows that women were the main participants in the wholesale and retail of paddy rice in the study area. This shows that women play a greater role in rice marketing since the majority of men are mainly involved in farming. About 85.93% of the producers, 60.97% of the wholesalers, and 58.50% of the retailers were married. This is in Amolegbe and Adewumi (2016), who observed that the majority of the actors in the rice value chain were married. Averagely, rice paddy producers', wholesalers', and retailers' marketers had 12, 13, and 12 years of education, respectively. This

Table 1.
Summary Statistics of Socioeconomic Profiles of Paddy Rice Marketers

Variables	Summary Statistics		
	Producer	**Wholesaler**	**Retailer**
Age (years)	46	44	41
Gender (% male)	80.00	42.00	35.00
Marital status (% married)	85.93	60.97	58.50
Level of education (years)	12	13	12
Household size (number)	6	5	5
Marketing experience (years)	10	12	11
Sample size (*n*)	60	60	60
Source: Field Survey (2022).			

Table 2.
Marketing Margin, Marketing Efficiency, and Profitability Analysis of Paddy Rice Marketing for Producers

Items	Amount (Naira)	% of Total Cost
Production cost		
Seeds	7343.87	05.95
Fertilizers	35,716.43	28.94
Herbicides	6129.17	04.97
Insecticides	4694.18	03.80
Labour	24,813.37	20.10
Total production cost (TPC)	78,697.02	63.76
Marketing Cost	14,463.14	11.72
Processing	5224.26	04.23
Packaging	9872.10	07.99
Transport	2309.23	01.87
Storage	2094.67	01.70
Loading and off-Loading	1087.96	0.88
Cost of empty jute bags, sacks, thread, sowing	35,051.36	28.40
Total marketing cost (TMC)	113,748.38	92.16
Total variable cost (TVC)	7667.43	06.21
Fixed cost	2004.21	01.62
Land cost	9671.64	07.84
Depreciation	123,420.02	100.00
Total fixed cost (TFC)	32.3409	
Total cost (TC)	24,957.29	
Yield/100 kg/ha	807,141.22	
Selling price/100 kg	683,721.2	
Total revenue (TR)	693,392.84	
Net income (NI)	920,243.09	
Gross margin	0.86	
Gross income (estimated from survey)+gift+home consumption	0.12	
Gross margin ratio (GMR)	5.54	
Operating ratio (OR)	85.82	
Rate of Return on investment (RORI)	15.29	
Marketing margin (MM) (%)	86.07	
Marketing efficiency (ME) (%)		
Producer share (%)		
Source: Field Survey (2022).		

result agrees with the findings of Abah et al. (2015b), who reported that paddy rice producers and marketers have attained some level of formal education and can read and write.

Marketing Margin, Marketing Efficiency, and Profitability Analysis of Rice Paddy

Marketing for Producers

Table 2 presents the marketing margin, marketing efficiency, and the various costs and returns involved in paddy rice marketing for producers. The various costs involved and revenue obtained were based on the prevailing market price at the time of the survey. The result shows that the farmers obtained 683,721.20 Naira as total revenue from sales of paddy rice per hectare. This shows that paddy rice marketing for producers was profitable. The operating ratio of 0.12 implies that the farmers used 12.0% of the total revenue to offset the operating cost of producing and marketing paddy rice per hectare. The rate of return on investment was estimated at 5.54; this implies that the farmer earned over 5.5 Naira per 1.00 Naira invested in paddy production and marketing per hectare. This result is in line with the findings of Osawe et al. (2017). The producers received a marketing margin of 85.82%, which implies that the farmer earns 0.85% from marketing paddy rice. The coefficient of marketing efficiency for the farmers was 15.29; this signifies that 15.29% of the sales revenue of the producers' marketers is taken up by costs. This result is in line with the findings of Ejoha (2019). The producer's share among actors along the rice value chain was estimated at 86.07%.

Marketing Margin, Marketing Efficiency, and Profitability Analysis of Paddy Rice

Marketing for Wholesalers and Retailers
Table 3 presents the marketing margin, marketing efficiency, and the various costs and returns involved in paddy rice marketing for wholesalers and retailers. The various costs involved and revenue obtained were based on the prevailing market price at the time of the survey. The total revenue obtained from sales of paddy rice for wholesalers and retailers was 8816,547.56 Naira and 6,166,700.54 Naira, respectively. The wholesalers got an average gross margin of about

7385,194.61 Naira, for the period under examination, while the net income stood at 7,143,710.98 Naira. The gross margin accrued to the retailers was 4,999,851.53 Naira, and the net income amounted to 4,876,546.04 Naira. This shows that paddy rice marketing by wholesalers and retailers was profitable. The operating ratio shows that the retailers spent about 19% of their total revenue on the operating costs of retail rice marketing, while the wholesalers spent 16% of their revenue on the operating costs. Every one Naira invested in wholesale paddy marketing yields about 4.27 Naira in returns, while retailers earn about 3.78 Naira per one Naira invested in paddy rice marketing. The wholesalers and retailers share amounted to 10.48% and 03.45% among the actors across the rice value chain, respectively. This result is in consonance with the findings of Chidi et al. (2015) and Nwibo et al. (2013). The wholesalers and retailers got 10.74% and 03.44% marketing margin per 100 kg bag of paddy rice; this implies that the wholesalers and retailers received 0.11 and 0.03 Naira, respectively, for every one Naira spent on 100 kg bag of paddy rice. The coefficients of marketing efficiency for wholesalers and retailers were 18.97% and 20.92%, respectively. This signifies that 18.97% and 20.92% of the sales revenue of the marketers were taken up by the costs. This result is in consonance with the findings of Okwo (2009).

Table 3.
Marketing Margin, Marketing Efficiency, and Profitability Analysis of Paddy Rice Marketing for Wholesalers and Retailers

Items	Wholesalers		Retailers	
	Amount (Naira)	% of Total Cost	Amount (Naira)	% of Total Cost
Purchasing price (100 kg)	24,990.10		27,998.27	
Transport	333,567.81	19.94	252,236.66	19.55
Labour	285,219.671	17.05	184,382.21	14.29
Processing	–	04.38	68,775.32	05.33
Packaging	73,257.628	08.91	116,168.55	09.00
Storage	149,072.864	09.39	126,337.80	09.79
Fees	157,073.94	21.58	241,741.60	18.73
Handling	361,067.92	09.27	124,460.70	09.65
Loading and offloading	155,112.76	04.43	52,746.17	04.09
Cost of empty bags, thread, sowing	74,054.22	85.56	1,166,849.01	90.44
Total marketing cost	1,431,352.95	13.99	117,787.53	09.13
Fixed cost	234,126.36	00.44	5517.96	0.43
Land/shop rentals	7,357.27	14.43	123,305.49	09.56
Depreciation cost	241,483.63	01.67	28,996.57	90.44
Total fixed cost (TFC)	27,996.15	0.02	212.67	100.00
Supply price (100 kg)	314.92	85.56	1,166,849.01	
Number of bags sold (100 kg)	1,431,352.95	100.00	1,290,154.5	
Total variable cost (TVC)	1,672,836.58		6,166,700.54	
Total cost (TC)	8,816,547.56		4,876,546.04	
Total revenue (TR)	7,143,710.98		4,999,851.53	
Net income (NI)	7,385,194.61		6,020,213.01	
Gross margin	8,821,228.29		0.81	
Gross income (estimated from	0.84		0.19	
survey)+gift+home	0.16		3.78	
Consumption	4.27		03.44	
Gross margin ratio (GMR)	10.74		20.92	
Operating ratio (OR)	18.97		03.45	
Rate of return on investment (RORI)	10.48			
Marketing margin (MM) (%)				
Marketing efficiency (ME) (%)				
Wholesaler/retailer share (%)				
Source: Field Survey (2022)				

Estimates of Stochastic Profit Efficiency Frontier Model of Paddy Rice Marketing

The maximum likelihood estimates of the stochastic frontier function of the factors influencing the profit efficiency of paddy rice marketing in the study area are presented in Table 4. The estimated coefficients of the parameters of the normalized

Table 4.
Maximum Likelihood Results of the Stochastic Profit Efficiency Frontier Model

Variables	Parameters	Coefficient	Standard Error	Z-Value
Constant	β_0	0.8702***	0.0069	125.09
Purchase price	β_1	−1.3304***	0.0091	−147.07
Transportation cost	β_2	−0.4206***	0.1081	−3.89
Labour cost	β_3	2.1704***	0.1807	12.01
Rent	β_4	−1.3075	0.7387	−1.77
Fees	β_5	3.4201***	0.6151	5.56
Inefficiency component				
Constant	α_0	−5.7034**	2.2279	−2.56
Age	α_1	−0.0723**	0.0354	−2.04
Gender	α_2	−0.8230**	0.3995	−2.06
Educational level	α_3	−0.0452**	0.0199	−2.27
Household size	α_4	0.0209	0.0535	0.39
Access to credit	α_5	−0.5609***	0.1833	−3.06
Membership of cooperatives	α_6	−0.4509	0.4335	−1.04
Years of experience	α_7	−0.4509***	0.1523	−2.96
Diagnostic statistics (variance parameters)	σ^2	0.002117		
Total variance	γ	0.8409***		
Variance ratio $\left(\dfrac{\sigma_u^2}{\sigma^2}\right)$		1056.90		
Log-likelihood		0.0000		
Prob > Chi		97.07***		
F-test value				

Source: Data Analysis (2022)
Note: *Significant at $p < .10$. **Significant at $p < .05$. ***Significant at $p < .01$.

stochastic profit frontier function were negative, as expected, except for the cost of labor and fees. This implies that a unit decrease in the purchasing price, transportation cost, labor cost, and rental values will lead to an increase in the normalized profit realized from the marketing of paddy rice. The coefficients of purchasing price, transportation cost, labor cost, and fees were statistically significant at ($p < .01$). With respect to the inefficiency component of the model, the signs and significance of the estimated coefficient have important economic implication on profit efficiency of the paddy producers and marketers. The variables with positive signs are those for profit inefficiency, while the coefficients with negative signs are those for profit efficiency. The result on level of the education shows an expected negative sign. The level of education was statistically significant at $p < .05$. This implies that education contributes positively to profit efficiency; an increase in the number of years of education brings about a decrease in inefficiency and increases the chances of enhancing profit efficiency. This could be due to the effect of education in exposing marketers and producers to modern technologies. Marketers and producers who can write and read have the likelihood of being aware of productivity-enhancing technologies, and they are also likely to take advantage of opportunities that improve the lives of many marketers and producers, such as participation in training programs and the formal credit market. Years of experience had a negative coefficient and was statistically significant at $p < .01$. Farming and marketing experiences enhance the human capital of marketers and producers by equipping them with the

required skills and knowledge, which increase the efficiency of production and marketing. This result is consistent with the findings of Ogundari (2016), Alabi et al. (2020), Amesimeku and Anang (2021), and Yusuf (2022). The estimated value of gamma (γ) of 0.8409 was statistically significant ($p < .01$). This signifies that inefficiencies exist in the rice production marketing in the study area. The result implies that 84.09% of the variations in profit level among the producer marketers were due to differences in farmers' and marketers' practices, and 15.91% of the variations in the

Table 5.
Summary Statistics of Profit Efficiency Scores

Efficiency Score	Frequency	Percentage
0.00–0.20	57	31.67
0.21–0.40	32	17.78
0.41–0.60	27	15.00
0.61–0.80	19	10.56
0.81–1.00	45	25.00
Total	180	
Mean	0.46	
Standard deviation	0.3194	
Minimum	0.08	
Maximum	0.96	

Source: Field Survey (2022)

Table 6.
Principal Component Model of Constraints Encountered by Paddy Rice Marketers

Constraints	Eigenvalue	Difference	Proportion	Cumulative	Rank
Lack of credit facilities	2.9957	0.7873	0.1709	0.1709	First
Lack of storage facilities	2.2074	0.299	0.1506	0.3215	Second
Grading and standardization	1.9084	0.0178	0.1609	0.4824	Third
Lack of power infrastructure	1.8906	0.1701	0.1661	0.6485	Fourth
Poor market infrastructure	1.7205	0.1599	0.1669	0.8154	Fifth
High transportation cost	1.5606	0.2004	0.1005	0.9159	Sixth
Bartlett test of sphericity					
Chi-square	934.09***				
Kaiser-Meyer-Olkin	0.8802				
Rho	1.00000				
Source: Field Survey (2022), ***Significant at 1% Probability Level					

level of profit among the producer marketers were due to random shocks outside the producers' and marketers' control. The variance parameters were statistically significant ($p < .01$), which means that the data are a good fit.

Distribution of Profit Efficiency Scores among Actors of Paddy Rice Marketing
Table 5 depicts the profit efficiency scores among the actors in paddy rice marketing, which include the producer marketers, the wholesalers, and the retailers. The results show that 49.45% of paddy rice marketers had a profit efficiency score of less than 40%, while 50.55% had a profit efficiency score above 40%. The mean profit efficiency score was 46%, with a minimum profit efficiency score of about 8% and a maximum profit efficiency score of 96%. The mean profit efficiency score of 46% shows that the paddy rice producer marketers will be able to increase profit further by 54% by adopting improved techniques and technology to attain the profit efficiency level of 1. The producer marketers' inability to attain 100% profit efficiency could be attributed to limited usage of available technology and also to external shocks such as poor environmental conditions that affect efficiency and productivity. This result is in line with the findings of Yusuf (2022) and Anang and Shafiwu (2022).

Constraints Associated with Paddy Rice Marketing Activities in the Study Area
The constraints facing paddy rice producers' marketers were subjected to analysis using the principal component model (Table 6). Constraints with eigenvalues greater than 1 were retained by the model. Lack of credit facilities (eigenvalue = 2.9957) was ranked first, and this explained 17.09% of all constraints retained by the model. Lack of storage facilities (eigenvalue = 2.2074) was ranked second, and this explained 15.06% of all constraints retained by the model. Grading and standardization (eigenvalue = 1.9084) was ranked third, and this explained 16.09% of all constraints retained by the model. This is based on the perceptions of the actors along the rice value chain. The constraints retained by the model explained 91.59% of all constraints included in the model. The chi square value of 934.09 and the Kaiser-Meyer-Olkin (KMO) value of 0.8802 were statistically significant ($p < .01$). This confirmed the justification of the data for the principal component analysis.

This study has established that the paddy rice marketing among the actors was profitable. The majority of the paddy rice marketers were young, energetic, and within the active age group. The wholesale and retail marketing of paddy rice was dominated by females. The shares of the producers are higher than those of wholesalers and retailers along the rice value chain. The profit margin of the producer marketers is relatively higher than that of the wholesalers and retailers. The operating ratio of producer marketers is higher than that of wholesalers and retailers. The wholesalers and retailers have higher operation ratios due to various marketing functions performed by them in the course of paddy rice marketing. The farmers got the highest marketing margin, while the retailers got the lowest marketing margin. The producers are more efficient than the wholesalers and retailers in paddy rice marketing. Farmers have the highest rate of return per Naira invested in paddy rice production and marketing compared to wholesalers and retailers. Purchase prices, transportation costs, labor costs, and fees were significant factors influencing the profit efficiency of paddy rice marketing among actors along the value chain. Age, gender, educational level, access to credit, and years of experience were significant factors influencing the profit inefficiency of paddy rice marketing among actors along the value chain. The mean profit efficiency score for paddy rice producers' marketers was 46%, leaving an inefficiency gap of 54%. The recommendations are as follows:

(i) Agricultural empowerment programs of the government should be focused on the youth, particularly young women, being active participants in the rice value chain.

(ii) Actors along the rice value chain should form cooperative organization; through cooperative organization, they can have easy access to credit facilities, share ideas and knowledge, buy farm inputs in groups, and sell their rice produce in bulk.

(iii) There is a need for efficient transport and market infrastructure, which includes the massive construction and maintenance of feeder roads. This will enhance efficient and effective movement of paddy rice to nearby markets.

(iv) Actors of paddy rice marketing need proper training on handling, packaging, storage, and marketing along the rice value chain.

(v) Credit facilities should be provided and easily accessible at a low interest rate to actors of paddy rice marketing along the rice value chain.

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