

Feed Milling Industries Resilience amid COVID-19 in Nigeria

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ABSTRACT

This study analyzed the resilience strategies for small-scale feed milling industries, learning from the COVID-19 pandemic in Ekiti State, Nigeria. 215 small scale feed mills industries were selected by multistage sampling procedure. Descriptive statistics, gross margin and regression analysis were used for the analysis of data collected. Results revealed that the mean age for the respondents was 40.45 year. In addition, 91.58% of the feed millers were married while 8.42% were single with a mean household size of 6. 13 years was the mean number of years spent in school. With respect to experience, the respondents had 11 years of feed milling experience. Gross margin results indicated that income after COVID-19 is more than during the COVID-19 showing an N168,330.00 significant ($p < 0.001$) difference indicating that COVID-19 had great consequences on the income. The regression result revealed that sex ($p < 0.001$), marital status ($p < 0.010$), household size ($p < 0.001$), education ($p < 0.001$) and experience ($p < 0.005$) were feed mill profitability determining factors in the study area. Constraints faced during COVID-19 are that lockdown due to COVID-19 hindered operational activities of feed mill (65.26%), COVID-19 causes a total increase in the price of inputs (66.32%), reduction in the sales of feeds (69.29%), reduction in work force (65.26%), and loss of raw materials through spoilage (66.32%). The study recommended that feed millers should collaborate with local farmers for the supply of materials at lesser price, rather than buying highcost foreign materials.

Keywords: Feed Mill, COVID-19, Profitability, Gross Margin, Regression Analysis

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1. INTRODUCTION

The global COVID-19 pandemic brought with it a new age of potential and difficulties for many industries, including the feed milling industry. The feed milling industry, a vital link in the agricultural supply chain, experienced hitherto unheard-of difficulties during the COVID-19 pandemic. Feed millers faced numerous obstacles, including shifts in consumer behaviour, lockdowns, and disruptions in the supply chain. In response to these challenges, a number of

techniques were implemented to keep things running effortlessly and boost resilience. To address these challenges, a number of strategies were put in place to ensure that everything ran as smoothly as possible and to aid with the building of greater resiliency. Frequency of poultry and other livestock products is one pointer towards geometric advancement in the rate of population growth. There is a growing population, and as a result, there is always the need for products such as eggs, poultry, and the rest of the livestock products (Huong, 2020). The feed mill industry is a substantial source of feed throughout the global and an important component of livestock and poultry business that has vast contributions towards food chain. The outbreak of the COVID-19 pandemic in Nigeria has been particularly impactful within the feed mill industry. Everyday phenomena of social distance and lockdown measures to slow the virus infection rate also affect the Nigerian animal feed market as well as the country's food chain. The key change arising from the existence of the pandemic on the feed mill business is related to supply interruption of raw materials. As a result of the closures and restrictions specified areas face a shortage of some core raw products, for example, soybeans and maize, which can be used for production of animal feed. Consequently, there has been a rise in the cost of production, in terms of raw materials and feeding regimes. Achmad et al., (2021).

COVID-19 has also impacted the market by reducing the consumption or demand of animal feed because consumers no longer consume meals in lodging facilities, dining establishments, and other catering services. This has affected the feed millers' profitability because there has been reduced demand for livestock products in include: Chicken, beef and pigs. The COVID- 19 pandemic also impacted the general economic condition of Nigeria which in turn decreased the people's standard of living and their ability to consume goods and services. The menace has affected Feed mill industry because consumers are using fewer animal products. The COVID-19 epidemic particularly had a negative impact on Nigeria feed mill business enterprise from which it recorded reduced profitability but increased operational costs. Still, some measures were undertaken to minimize the impact of the given pandemic – for instance, individuals have been trying to find substitute materials and increasing the efficiency of production processes of business entities. The livestock industry has recently grown substantially in Ekiti State which led to the subsequent increased need for feed materials. In an attempt to meet this demand, feed mill sector in Ekiti State has upgraded its production and also adopted modern technology so as to improve the quality of its products. In Ekiti State, there are both large- and small-scale feed mill operators. The majority of small-scale operators are locally owned, but the majority of large-scale operators are held by multinational corporations. The industry is fragmented, with no dominant player, and competition is intense (Afolabi, 2017).

The COVID-19 pandemic emphasizes how interconnected we are as a global society. Starting in a single location, it quickly expanded to 188 countries and infected 30 million people by September 18, 2020. The impact of COVID-19 on the food supply chain, and particularly livestock production, was unexpected despite decades of modeling the pandemic. Clusters of cases among workers in meat processing plants quickly evolved to affect human, animal, and environmental welfare in several countries. Livestock farmers cannot function without feeding their animals on a regular basis; feed mills are essential to the survival and profitability of the livestock industry. They frequently rely on feed from the feed mill sector to ensure both the longevity of their livestock and the profitability of their output. It is impossible to overstate the significance of feed ingredients (resources) used in feed mill businesses, particularly maize, which makes up over 60% of the total amount of feed formed. However, the feed mill industry's manufacturing methods and outputs are impacted by the lack of resources. Because livestock owners must constantly feed their animals, this will also result in a deficit of profitability for the feed mill industry. Livestock producers are thus directly impacted by the feed mill industry's economic efficiency, since feed can account for up to 75% of production costs. It is quite important because the price of purchasing the animal, Oladejo, (2012).

Nigeria's industry for animal feed is still in its infancy, partly because of its expensive manufacture. The majority of aquaculture, poultry, and other animal enterprises spend 70% of

their operating expenditures on feed. With a market value of over \$2 billion, the animal feed industry continues to draw substantial local and international investment in large-scale feed mill operations. A brand-new 720,000 metric tonne (MT) per year feed milling facility run by Singapore-based OLAM International was put into service in late 2016 and produces pelleted feeds and heat-treated mash. Its state-of-the-art hatchery provides farmers with reasonably priced day-old layers and broilers. The company also has a factory that makes fish feed. The cost of producing feed will go down in Nigeria if these large-scale, contemporary feed mills operate more efficiently. Despite this, growth in the chicken feed industry has slowed in the previous two to three years as a result of lower consumer income following Nigeria's economic downturn and significant currency devaluation in 2016. Nigerian feed milling companies are expanding. The majority of the feed produced by the country feed mills is for poultry, which includes, among other birds, quails, guinea pigs, ducks, and chickens. Other livestock classes that depend on the feeds made by feed milling companies include fish, rabbits, goats, cattle, sheep, and pigs. According to market prospects, one of the industries in Nigeria that is now flourishing is the feed mill sector. There is a relationship between the geometric growth in population and the rate of consumption of chicken and other livestock products. The production of poultry and other livestock products is in great demand due to population growth.

Rising cost of feed ingredients especially Corn, Soya, Fish meal etc has affected the production of feed mills, foreign or imported feeds competing with locally produced animal feed. Scarcity of feed ingredients because of the effect of COVID-19 and cattle herdsmen ravaging the farmers leading to unnecessary hike in price of available feed ingredients. Low interest fund are scarcely available for feed millers to upscale production. Very erratic electric power supply (energy), As energy costs have risen nationwide, it's become an increasingly large factor in the overall cost of manufacturing feed for poultry and livestock integrators, feed manufacturing companies and agriculture cooperatives. These (Scarcity of feed ingredients because of the effect of COVID-19 and cattle herdsmen ravaging the farmers leading to unnecessary hike in price of available feed ingredients) has largely affects the profitability of feed mill industries in Nigeria and in the study area.

There have been several studies on feed mill industries some of which are Joana et al., (2012) who conducted a study on economics analysis of feed mill industry in Lagos state, Nigeria., Adetifa et al.,(2015) conducted a study on characterization of small scale feed mills, a productivity outlook for a multi-criteria animal feed formulation problem: a case study of Nigerian Feed Mill Industry study conducted by Olalere et al., (2015), The assessment of corn quality as feed ingredients received at an animal feed mill by Achmad et al., (2021) and so on. As feed millers grapple with the aftermath of the pandemic, there is a pressing need to assess the strategic adaptations and resilience measures undertaken to ensure the continued viability and profitability of feed milling operations. This research embarks on a comprehensive investigation, delving into the intricacies of post-COVID-19 feed milling economics, exploring the effectiveness and challenges of specific strategies adopted by feed millers to enhance resilience post-COVID-19 in Ekiti State, Nigeria. Specifically, the study described the socioeconomic characteristics of feed millers, examined the profitability of feed mill production during and after COVID-19, evaluates the factors that determine profitability of feed mill production and described constraints countering feed mill productions in the study area

2. METHOD

The study was conducted in Ekiti State, Nigeria. The entirety of Ekiti State is located in a tropical region. It lies between latitudes 70°15' and 80°51' north of the Equator and longitudes 40°51' and 50°451' east of the Greenwich meridian. With a total land area of 5887.890 square kilometres, it is bordered to the east and south by Ondo State and sits south of Kwara and Kogi State, east of Osun State. There are sixteen Local Government Councils in Ekiti State. The population of Ekiti State was 1,647,822 according to the 1991 Census, and it was anticipated to

be 1,750,000 when it was established on October 1st, 1996, with Ado-Ekiti serving as the capital. Ekiti State had 2,384,212 residents according to the National Population Commission's 2006 population census. 21 to 28 degrees Celsius are experienced along with considerable humidity. Large amounts of cereals like rice and maize, as well as food crops like yam and cassava, are farmed. Other noteworthy crops that are grown commercially include fruit variety and kola nuts. (Owoeye, 2017).

Multistage sampling techniques were used for the selection for the study. In the first stage, three Local Governments known for feed mill business in Ekiti State was purposively selected, which are Ado Ekiti, Ikere Ekiti and Ikere Ekiti. Secondly, ten (10) communities within the Local Governments that have feed milling enterprises were randomly selected. The last and the final stage entail snowballing of 22 feed millers from communities earlier selected. At the end of the data collection, 215 questionnaires were found useful while the remaining five were discarded due to incomplete information.

Descriptive statistics including frequency tables, percentages, and means, as well as multiple regression analysis and gross margin analysis, are among the analytical methods applied to the data. The enterprise's profitability was examined through the application of budgetary analysis. In this study, the total revenue (TR) less the total variable cost (TVC) of production was used to calculate the gross margin. Total Cost (TC) was subtracted from TR to determine profit. Regression analysis was employed to calculate the variables that impact feed mill production profit.

a. Common feeds available in the study area

The common feeds produced by the feed millers in the study areas are for broilers, layers, cockerel, pig, fish, and ruminants feeds, Table 1.

Table 1. Common feeds available in the study area

s/n	Livestock	Feeds	s/n	Livestock	Feeds
1	Broiler	Starter	13	Fish	Extruded Pellet (starter)
2		Grower	14		Grow out (2mm, 4mm, 6mm)
3		Finishers	15	Ruminants Cattle, Sheep and Goat	Palm kernel cake, Wheat offal
4	Layers	Starter	16		
5		Grower			
6	Finishers				
7	Cockerel	Starter			
8		Grower			
9		Finishers			
10	Pig	Starter			
11		Grower			
12		Finishers			

Source: Field Survey, 2023

Model Specification

The model used to estimate cost and return per hectare and each respondent is implicitly indicated by the cost and return equation.

$$GM = TR - TVC$$

Where:

TR = Total Revenue in ₦aira/annum

TC = Total Costs in ₦aira/annum

GM = Gross Margin ₦aira/annum

TR = Total Revenue in ₦aira/annum

TVC = Total Variable Costs/annum

$$NFI = \sum_{i=1}^n P_{yi}Y_i - \sum_{j=1}^m P_{xj}X_j - \sum_{k=1}^k F_k$$

NFI = Net Farm Income

Y_i = Gross Output (litres)

P_y = Unit Price of Product Y_i in ₦aira

X_j = Quantity of variable input (where j = 1,2,3,4,5n)

P_{xj} = Price per unit of variable input in ₦aira

F_k = Cost of fixed inputs K (where K = 1, 2, 3, k fixed inputs)

b. Data Analysis Technique

1) Regression analysis

Regression analysis, an inferential analytical technique, was employed to ascertain the link between income earned and manufacturing costs. To determine the factor influencing output, the link between the variables was established using linear regression analysis.

Instrument Feasibility Test

2) Model Specification

In this study, factors that affect the output (income) as stated implicitly included age, sex, marital status, religion, household size, education, grating amount, experience, cooperative membership, grinding amount, pressing amount.

Independent / explanatory variables (X), while the output is called the dependent variable (Y)

$$Y_i = (\beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + e_i)$$

Y₁ = Income

X₁ = age (years), X₂ = sex (male = 0, female = 1)

X₃ = marital status (Single, married, widowed or divorced)

X₄ = religion (Christian, Islam or Others)

X₅ = household size

X₆ = education

X₇ = grating amount

X₈ = experience (years)

X₉ = membership of a cooperative society

X₁₀ = grinding amount

X₁₁ = pressing amount

e_i = error terms

3. RESULTS AND DISCUSSION

The results presented in Table 1 revealed that most of the feed millers (76.84%) were male while (23.16%) of the feed millers were female. This result indicated that majority of the feed millers in the study areas were male. This implies that male dominated the feed milling business in the study area. This may likely be due to the fact that feed milling business is a tasking activity. This result is in agreement with the study of Adetifa, 2015, on characterization of small scale feed mills in a developing country stating that 68% of the workers are predominately male. The result also revealed that the mean age of the respondents is 40.5 years. This confirms the findings of Akerele et al., (2016). Additionally, the results showed that 91.58%

of the feed millers were married while 8.42% were single. This shows that a better percentage of the farmers were involved in feed mill processing in the study areas were married with a mean household size of 6. This means that there is a possibility that a larger percentage of married people in the research area may have a positive impact on the amount of feed processed in feed milling enterprises in a sense that family members may assist by providing a domestic workforce as highlighted by the current studies, Salawu et al. ,(2017) and Theophilus et al. ,(2020) and this because the higher the number of persons in a given household the more likely for the person to participate in poultry feed marketing for the survival of the family as well in the study area. Furthermore, the result in the Table showed that 1.05% of the respondents completed their primary school education, 8.42% respondents completed secondary school education, 36.84% completed ordinary national diploma and National Certificate in Education, while 53.68% of them completed Higher National Diploma and University. Thirteen years were spent in education on average.

Knowledge and skills that educated farmers possess help them maximise crop yields and make better use of resources. They also boost technical and economic efficiencies and undoubtedly aid in decision-making, particularly when it comes to effective resource allocation, technological advancements, and market knowledge. An educated person could be easily transformed because he/she is trainable. This finding is consistent with a research conducted in Ogun State, Nigeria by Adetutu et al., (2017) on the profitability and elasticity of production in poultry egg farmers' feed milling systems which indicated that the mean years of education and experience in poultry farming were 15 and 18 years respectively. This suggests that the most of the local farmers were knowledgeable and well-read. Education increases labour quality and the inclination to accept new technologies. This result is in support with the study Okunola, (2020) on the study Feed mills operation and feedstuff safety in Oyo zone, Nigeria, that majority of the respondents had tertiary education. With respect to experience, the respondents had 11 years of feed milling experience. This suggests that the farmers are expected to produce more because they can be considered experienced. This is consistent with a research by Theophilus et al. (2020) on the performance analysis of chicken feed marketers in Delta State, Nigeria, which found that the longer feed traders have been in the business, the more experience they have and the little tricks to knowing the ins and outs of the trade.

Table 2. Socioeconomic Characteristics of the Respondents

Sex	F	%	Educational	F	%
Male	73	76.84	Primary	1	1.05
Female	22	23.16	Secondary	8	8.42
Age			OND/NCE	35	36.84
21-40	58	61.05	HND/University	51	53.68
41-60	35	36.84	Education	F	%
61-80	2	2.11	< = 6	11	11.58
Religion			7-12	14	14.74
Christianity	66	69.47	>12	70	73.68
Islamic	21	22.11	Experience	F	%
Traditional	8	8.42	<=10	60	63.16
Marital Status			11-20	26	27.37
Single	8	8.42	21-30	8	8.42
Married	87	91.58	31-40	1	1.05
Household Size					
< = 10	94	98.5			
11-20	1	1.05			
Total	95	100			

Source: Field Survey, 2023.

1) Effects of COVID-19 on Income of Palm Oil Processors

The results in Table 2 indicated that income after COVID-19 is more than during the COVID-19 showing an N168,330.00 difference indicating that COVID-19 had a great consequences on the income. Though, the cost of production was a bit on the rise during COVID-19. Fixed assets, the mixing machine, grinders, sieve, etc were depreciated using the declining balance method of estimation at 25%. This result confirms the findings of Benjamin, et al, (2018) which establish that credit improves the gross margins of the smallholder farmers.

Table 3. Feed Mill Profitability

Variables		During COVID-19 (₹) 2020	Post COVID-19 (₹) 2023	p-value
Total Revenue (TR)		3,979,545.00	6,037,160.00	
Electricity Bill		1,158,330.00	1,727,300.00	
Fuel		30,995.00	62,260.00	
Repair		819,400.00	1,908,150.00	
Labour		166,300.00	258,600.00	
Transportation		157,000.00	265,000.00	
Total variable cost		2,332,025.00	4,221,310.00	
Fixed cost	Depreciated @ ten years	500,000.00	500,000.00	
(Milling Machine)				
Total cost		2,832,025.00	4,721,310.00	
Gross Margin		1,647,520.00	1,815,850.00	
Profit		1,147,520.00	1,315,850.00	
t-statistics	Mean	18509.51 (344.5936)	28079.81(355.0981)	0.0000*

Source: Author's Computation. Figure in parenthesis is the standard error.

Depreciated using declining balance method @ 25%, *** represents 1% significant level

2) Factors that Determine Profitability of Feed Mill in the Study Area

Result in Table 3 showed the significant variables included sex, years spent in school used at 5%. The coefficient of determination, R^2 figures of 0.5246 shows that 52.46% of the distinction in the value of feed mill production income is explained by sex, sex, household size, marital status, education, membership of cooperative, equipment repair cost, labour, electricity bill. The result in the Table findings on the factors determine the profitability of feed mill in the study area demonstrate that sex ($p < 0.001$), marital status ($p < 0.010$), household size ($p < 0.001$), education ($p < 0.001$) and experience ($p < 0.005$) have positive coefficients. This suggests that more male are into feed mill business than female. In addition, the size of the household was significantly positive (1%). This implies that a unit increase in family size led to an increase in feed mill earnings. This implies that a rise in household size will result in a rise in labour availability, which will raise output due to a labour increase. This implies that a unit increase in family size led to an increase in feed mill earnings. This implies that a rise in household size will result in a rise in labour availability, which will raise output due to a labour increase. Education background of the feed millers and experiences plays a significant role in the performance and expertise within the industry. Throughout the study, it become evident that feed millers with higher level of education, particularly those with tertiary education exhibited a deeper understanding of the complexity involved in feed production. It is anticipated that education will raise the feed millers' productivity level. This outcome is consistent with Nwaobiala and Ogbonna's (2014) findings. The age was significant and negative which suggests that the profit

diminishes with ageing. Cost of repairs was significant but negative which agrees with apriori expectations. Increased production expenses result in higher repair costs, which lower the company's profit margin. Additionally, experience is important and has a positive coefficient that is consistent with apriori assumptions. This means that an increase in experience years will have a favourable effect on production. Cost of electricity has a positive coefficient and significant.

Table 3. Regression Result

Variable	Coefficient	Std. Err.	p-value	Mfx
Age	-0.000588	0.000134	0.000*	0.000
Sex	4.558	1.335	0.001*	0.001
Marital Status	3.801	2.281	0.098***	0.096
Household Size	1.625	0.286	0.000*	0.000
Education	0.624	0.170	0.000*	0.000
Experience	0.186	0.09077	0.043**	0.041
Cooperative Membership	0.299	1.33	0.823	0.822
Equipment repair cost	-0.000202	0.0000774	0.010***	0.009
Labour	-0.000992	0.000902	0.274	0.271
Electricity Bill	0.000297	0.000121	0.015**	0.014
Constants	37.457	8.302	0.000	
Number of Observation	215			
Prob>F	0.0000			
R-squared	0.5246			
Adj. R-squared	0.4878			
Root MSE	6.1941			

*, ** and *** Represents 1%, 5% and 10% significant levels respectively

Std.Err. – Standard Error, mfx – marginal effect after regression

3) Constraints Countering Feed Mill enterprise in the Study Area

The respondents' distribution based on the challenges they experienced during COVID-19 on the profitability of feed mill industries is presented in Table 4. The result shows that lockdown due to COVID-19 hindered operational activities of feed mill (65.26%), COVID-19 causes a total increase in the price of inputs (66.32), reduction in the sales of feeds (69.29%), reduction in work force (65.26%), experience loss of raw materials through spoilage (66.32%), thereby reducing the production of feed mill in the study area.

Table 4. Constraints Countering Feed Mill Productions in the Study Area

	SA	A	D	SD
Lockdown due to COVID-19 hindered operational activities of feed mill.	62 (65.26)	16 (16.84)	9 (9.47)	8 (8.42)
COVID-19 causes a total increase in the price of inputs.	63 (66.32)	10 (10.53)	17 (17.89)	5 (5.26)
Reduction in the sales of feeds.	66 (69.26)	17 (17.89)	7 (7.37)	5 (5.26)
Reduction in work force.	62 (65.26)	19 (20.00)	12 (12.63)	2 (2.11)
Experience loss of raw materials through spoilage	63 (66.32)	11 (11.58)	18 (18.95)	3 (3.16)

Source: Field Survey, 2023. Figure in Parenthesis are the Percentages

SA = Strongly Agree, A = Agree, D = Disagree, SD = Strongly Disagree

4. CONCLUSIONS AND SUGGESTION

a. Conclusions

The study examined feed milling industries resilience amid COVID-19 in Ekiti State, Nigeria. Analyzing the responses from 215 feed millers, the study concluded that COVID -19 had significantly impacted the feed mill industries across the globe. The pandemic brought forth a series of challenges that affect production, leading to potential setbacks in the profitability, meeting the nutritional needs of livestock and poultry and labour shortage most especially in Ekiti State, Nigeria. The study therefore concluded that fostering collaboration, understanding profit determinants, and addressing operational challenges are essential for building resilience in Ekiti State's small-scale feed milling industries and Nigeria as a whole.

b. Suggestion

This study recommend based on the findings that feed millers should collaborate with local farmers for the supply of materials at lesser price, rather than buying high cost foreign materials, they should also create a platform where customers can place orders online, this reduces physical visits and enables seamless business transaction and the need for contactless interactions. Feed millers should also utilize predictive analytics to anticipate potential disruption in production process, by doing this feed milers can predict supply shortages or equipments breakdowns, allowing for timely preventive measures. Investing in capacity buildings through training for feed mill operators and knowledge equipping on crisis management, supply chain optimization, and adaptive strategies by all necessary stakeholders will enhance resilience.

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