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Assessing Institutional characteristics, Factors influencing Profitability and Constraints of Millet Farming in Wukari Local Government Area, Taraba State, Nigeria

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Abstract
The study assessed institutional characteristics, factors influencing profitability and constraints of millet farming in Wukari Local Government area of Taraba State. Multistage random sampling technique was employed to select 120 respondents for the study. Results showed that family labour (42.5%) was the major source of labour among millet farmers and the mean cost of labour was N9,615.00. About 43.3% of farmers used the mixed farming system compared to mono-cropping (31.6%) and mixed cropping (25.1%). Majority (89.2%) of the millet farmers used fertilizer (both organic and inorganic) and 63.6% used less than 50kg of fertilizer. About 34.7% used agro-chemicals in their millet farms and the average cost of agro-chemicals purchased and quantity of agro-chemicals used was N 16,706.00 and 47.8kg respectively. Using multiple regression analysis to examine factors influencing profitability of millet farming, educational level, farming experience and age had positive significant coefficients, while household size and labour cost had negative significant coefficients. Using principal component analysis, constraints of millet farming were categorized into three main components: institutional factors, cost factors and economic factors. Results show that millet farming is profitable in the study area. The study recommended policies that will boost millet production and provide solutions to challenges militating against millet farming in the country.

Keywords: Millet, Institutional Characteristics, Profitability, Principal Component Analysis, Constraints

Introduction

Millet is a cereal crop plant belonging to the grass family, Graminae. The term "millet" is used loosely to refer to several types of small seeded annual grasses belonging to species under the five genera in the tribe Paniceae, namely Panicum, Setaria, Echinochloa, Pennisetum and Paspalum, and one genus, Eleusine, in the tribe Chlorideae (FAO, 2001). There are many varieties of millet. The four major varieties are Pearl millet (*Pennisetum glaucum*), which constitutes 40% of total world production, Foxtail millet (*Setaria italica*), Proso millet or white millet (*Panicum miliaceum*), and Finger millet (*Eleusine coracana*) (Yang *et al*., 2012). According to Dube *et al*. (2018), the urge to route for millet and sorghum instead of maize and other major crops in recent years is derived from the fact that these grains are ecologically well-matched with semi-arid areas because of their ability to tolerate drought. They are considered tough crops in terms of growth requirements as they withstand harsh climatic factors such as unpredictable climate and nutrient-depleted soils (Sharma and Ortiz, 2000). It is grown mostly in marginal areas under agricultural conditions e.g. limited rainfall, unsuitable for the cultivation of other cereals such as maize, wheat and rice (Adekunle, 2012). Pearl millet is believed to have originated from sub-Saharan Africa, and finger millet from the sub-humid uplands of East Africa (Gari, 2020). Millet is rich in carbohydrate and protein, as well as calcium, dietary fibre and polyphenols (Devi *et al*., 2014). In addition, it has been reported that millet has many other nutritional and medicinal properties and functions (Obilana and Manyasa, 2002; Yang *et al*., 2012). Millets are nutritionally comparable to major cereals and serve as good source of protein, micronutrients and phytochemicals (Saleh *et al*., 2013). Millet contain fewer cross-linked prolamins, which may be an additional factor contributing to higher digestibility of the millet protein (Dayakar *et al*., 2017). Millet also is a significant source of thiamine, niacin, and riboflavin (Taylor, 2004).

Almost all branches of economics embrace the notion that firms attempt to maximize profits. Nevertheless,

some firms are substantially more profitable than others even though most earn only a competitive rate of return. Given those facts, it is not surprising that economists from various sub-disciplines have developed models that predict which firms will earn high rates of return and how those rates can be sustained in a world in which profits attract entry. There are different dimensions to the profitability theory, one that originates in the field of industrial organization (IO), one that comes from financial economics, and one that has its origins in the economics of exhaustible resources. Each of these dimensions single out a different factor as the principal determinant of profitability (Slade, 2003). The relative impacts of production constraints on yield loss are the primary criterion on millet research prioritization (Izge and Song, 2013). The most important constraints farmers face in millet farming as pointed out by research include; lack of farm tools, low soil fertility, lack of financial resources to purchase inputs, high prices of the inputs (especially fertilizers and seed), and low technical know-how. Others are pests and diseases, vagaries of weather, unavailability of inputs, inadequate credit facilities, inadequate agricultural extension services and poor marketing of both inputs and outputs. Also an important limitation to millet production identified by researchers is lack or inadequate use and application of improved seeds varieties **(**Rouamba, 2021).

Several studies have been carried out on factors influencing profitability and constraints of millet farming. Manideep and Reddy (2020) studied 'Factors influencing millet farming: An Empirical Analysis in Guntur District'; Tikon *et al*. (2021) assessed 'Economics of millet production in Wukari Local Government Area, Taraba State, Nigeria'; and Das and Rakshit (2016) examined 'Millets, their importance and production constraints in Nepal'. However, majority of these studies used multiple regression models to analyze profitability and descriptive statistics to examine constraints of millet farming. None of the studies used principal component analysis to analyze the challenges of millet farming enterprise. Hence, the need to fill this knowledge gap in literature. In order to further ascertain the extent of respondents' participation in millet farming, their institutional characteristics were taken into consideration. In this study, the institutional characteristics considered include; source and cost of labour, types of farming system, common types of millet cultivated, types and quantity of fertilizer used, cost and quantity of agro-chemicals used. It is against this background that this study provided answers to the following research questions: What are the institutional characteristics of the farmers in the study area? What are the factors influencing profitability of millet farming in the study area? What are the constraints faced by millet farming enterprises in the study area? The broad objective of this study was to assess institutional characteristics, factors influencing profitability and constraints of millet farming in Wukari local government area of Taraba State, Nigeria.

Methodology

The study was conducted in Wukari local government area of Taraba State, Nigeria (Figure 1). It covers an area of 4,308 km² and it is located between latitude 7°52'17.00″N and longitude 9°46'40.30″ E and 152 meters above sea level. Demographic study put the population of Wukari LGA at 318,400 people (NPC, 2016). There are ten (10) wards in Wukari LGA: Akwana, Avyi, Bantaje, Chonku, Hospital, Jibu, Kente, Puje, Rafin Kada and Tsokundi. It is bounded in the north by Gassol LGA, in the east by Donga LGA, in the south by Benue State, and in the west by Nasarawa State and Ibi LGA of Taraba State. It is predominantly inhabited by the Jukun people.

The study employed a multi-stage sampling technique in the selection of the respondents. In the first stage, Jibu, Bantaji, Puje, Kente, Tsokundi and Rafin-kada were purposively selected due to high prevalence of millet farming in the wards. In the second stage, four (4) villages each were purposively selected from each of the selected six (6) wards. In the final stage, five (5) farmers were selected from each of the twenty-four (24) villages, giving a total of 120 respondents. Data were collected using well-structured questionnaire administered to the respondents. Descriptive statistics such as means, percentages and frequency tables was used to describe the institutional characteristics of millet farming enterprises. Multiple regression was used to analyse the factors influencing profitability of millet farming enterprise, while Principle Component Analysis (Kaiser's criterion, Scree test, and Total variance were used to determine the number of components) was employed to examine constraints affecting the millet farming in the study.

Model Specification

Multiple Regression

The implicit function is presented as follows.

$$Y=\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_{4+}+\beta_5X_5+\beta_6X_6+\beta_7X_7+\beta_8X_8+\beta_9X_9+U\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\quad (1)$$

Where;

Y_i = Quantity of millet output (kg)
X_1 = Age of respondents (years)
X_2 = Sex (dummy variable; 1=male, 0=female)
X_3 = Marital status (dummy variable; 1= married, 0=otherwise)
X_4 = House hold size (Number of persons)
X_5 = Educational level (years)
X_6 = Farming Experience (years)
X_7 = Income (Naira)
X_8 = Labour cost, both family and hired labour (Naira)
X_9 = Cost of seed (Naira)
U_i = Error term
β_0 = Intercept
$\beta_1-\beta_9$ = Regression coefficients

Principal Component Factor Analysis

$$Y_1 = a_{11}X_1 + a_{12}X_2 + * \ * * + a_{1n}X_n$$
$$Y_2 = a_{21}X_1 + a_{22}X_2 + * \ * * + a_{2n}X_n$$
$$Y_3 = a_{31}X_1 + a_{32}X_2 + * * * + a_{3n}X_n$$

$* = \quad *$

$* = \quad *$

$Y_n = a_{n1}X_1 + a_{n2}X_2 + * * * * + a_{nn}X_n$

Where:

$Y_1, Y_2 \ldots Y_n$ = observed variables/constraints

$X_1, X_2 \ldots X_n$ = unobserved underlying factors

Results and Discussion

Institutional characteristics of millet farming enterprises

This section discussed the institutional characteristics of the respondents in the study area. Table 1 shows family labour (42.5%) as the major source of labour among millet farmers, while a small proportion (26.7%) used hired labour as compared to (23.3%) that employed both family and hired labour with mean cost of labour as N9,615.00. About 43.3% of farmers used the mixed farming system, 31.6% employed mono-cropping, while 25.1% used mixed cropping system of farming with pearl millet (25.8%) as the most cultivated. Majority (89.2%) used fertilizer; especially organic fertilizers (47.6%) compared to inorganic fertilizers (35.5%) and a high proportion (63.6%) used less than 50kg of fertilizer. About 65.3% did not use agro-chemicals in their millet farm, whereas 34.7% did. The average cost of agro-chemical purchased and quantity of agro-chemical used was N 16,706.00 and 47.8kg respectively. A large proportion of farmers did not use agrochemicals due of their level of awareness, procurement cost, hazards or other negative consequences associated with the use of agro-chemicals.

Factors influencing profitability of millet farming enterprise in Wukari LGA, Taraba State, Nigeria

This section addressed factors that influenced the profitability of millet farming enterprise in the study area. The result in Table 2 shows that household size was negative and significant at 5% level. This implies that the profitability of millet farming decreases with household size because the greater the household size, the more millet farming enterprise divert their resources and income towards the upkeep of their families rather than towards the business, and this would in turn indirectly affect the profit of the business in the study area. According to Orebiyi (2000) smaller household size will have high tendency to save which may lead to a positive effect on the profit of millet farming and hence positive economic expansion in the State. The level of education was positive and significant at 5% level. This implies that as the level of education increases, the profit of millet farming is expected to increase. Ogundari and Ojo (2007) posited that, the higher the level of literacy, the better the prospect of profit maximization. The millet farmers' experience was positive and significant at 1% level of significance. This implies that increasing millet farmers experience would increase the profitability of the millet farming enterprise since the farmers know the nitty-gritty of the business. Therefore, a higher productivity, proper loan utilization, and high production yield is expected. This corroborates the findings of Obike *et al*. (2016) that increasing farming experience enhances farmers' labour productivity for running an enterprise. The age of farmers was positive and significant at 1% level. This implies that the older the farmer, the greater the tendency for the millet farming enterprise to have a high output value and hence more profit. This is in agreement with Tikon *et al*. (2021) who stated that as the age of millet farmers' increase, their experience increase and thus their output also increase, as long as they have a ready supply of labour to supplement the decline in their ability to engage in physical work. Labour cost was negative and significant at 5% level. This means that a decrease in labour cost would increase profit made in the millet farming enterprise. This finding corresponds to those of Okam *et al*. (2016) and Islam *et al*. (2017).

Constraints affecting millet farming enterprise in Wukari Local Government Area

This section addressed some of the constraints affecting millet farming enterprise in the study area. According to the result in Table 3, the KMO measure of sampling adequacy is 0.811 (above 0.6) and Bartlett's test is 0.000 (significant because $p<0.05$). These results prove factorability and, hence, the principal component analysis was appropriate for the data set. Seven components were extracted with factor loadings greater than 0.4 (Table 4). The Varimax rotation method helps to understand the pattern of loadings without changing the number of components (Pallent, 2005). The statements were arranged in the order of component loading in each factor. The extracted three main components were labeled by considering the statements belonging to them and each had at least three items in which the loadings were greater than 0.4.

Component one: Institutional factors

Marketing problem as a result of market price fluctuation is one of the major problems facing the millet farming enterprise in the study area. This might have occurred not because the supply is in excess but because of uncoordinated market programme. Many farmers sell their millets to middle-men at very low prices. Lack of processing and storage facilities also constitutes a major constraint for the millet farming enterprise in the study area. The common reason for processing or storage is to take advantage of rise in prices later in the season. This practice is very difficult in the area due to high cost of processing and storage facilities, which most of the millet farming entrepreneurs could not afford. Other major problems identified were poor site, drought problems, and poor road networks.

Component two: Cost factors

Lack of capital/credit facilities is one of the major challenges affecting millet farming in the study area. Many millet farming enterprise lacked adequate capital to either operate their farms profitably or expand them. This might be due to unwillingness of financial institutions to give grant or loans to the farmers or high interest rate to pay when loans are given. High cost of inputs, like seed, is also a constraint faced by millet

farming enterprise in the study area. This increases their cost of production and reduces their profit margin. The findings corroborate with Rouamba *et al*. (2021) who reported that poor access and high cost of seeds is a major constraint to millet farming in Nigeria. Another constraint under this component is increase in the cost of local seed production.

Component three: Economic factors

In this component, negative government interference and poor government assistance in the form of implementation of national agricultural policies are major constraints faced by the millet farming enterprise in the study area. According to FAO (2001) to promote agricultural development and achieve national goals, many programmes were put in place at one time or the other by the government, some of which include: The National Accelerated Millet Production; Integrated Rural Millet Development, Millet Seed Multiplication Project; Pilot Millet Farm Project etc. However, most of these programmes failed due to poor policy formulation and implementation, misplaced priority, financial mismanagement, lack of motivation among extension officers, and lack of feasible time frame within which to accomplish stated policy objectives. Land acquisition is another constraint being faced by the millet farming enterprise in the study area. The inability of some farmers to purchase land for millet production due to high cost of land compelled them to either lease or rent land in which they pay monthly or annually. The implication of this is that it might disturb the future progression and expansion of the millet farming enterprise which in turn will have impact on the level of efficiency and dedication to farm profitability based on the fear of uncertainty from the land owner on the usage of the land vis-à-vis revocation, and review of land rent fee on the rented land. Other constraints in this component include: low technical know-how, market competition, and unstable price of output.

Conclusion

The study investigated institutional characteristics (collective cultural practices and activities), factors influencing profitability and constraints of millet farming in Wukari local government area of Taraba state. Family labour (42.5%) was the major source of labour and the mean cost of labour was N9,615.00. The farmers employed predominantly mixed farming system, majority (89.2%) of them used fertilizer (both organic and inorganic) while (63.6%) of them used less than 50kg of fertilizer. About (34.7%) of them used agro-chemicals in their millet farms; the average cost of agro-chemicals purchased and quantity of agro-chemicals used was N16,706.00 and 47.8kg respectively. Household size, educational level, farming experience, age and labour cost significantly influenced the profitability of millet farming enterprise in the study area. Constraints of millet farming were identified to belong to three main components: institutional factors, cost factors and economic factors. Millet farming is profitable in the study area. The study recommended policies that will boost millet production and provide solutions to challenges/constraints militating against millet farming in the country.

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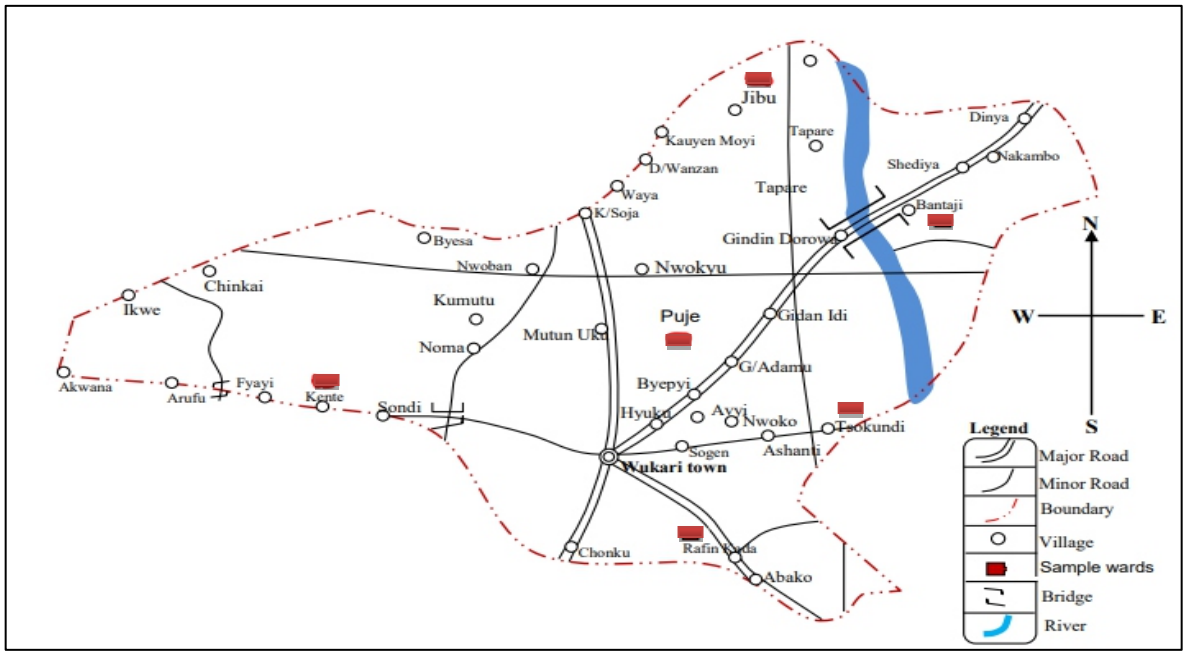

Figure 1: Map of Wukari Local Government Area showing sampled wards
Source: Adapted from Odiba et al. (2017)

Table1: The distribution of the respondents according to their institutional characteristics

Institutional characteristics	Frequency	Percentage	Mean
Source of labour			
Family labour	51	42.5	
Hired labour	32	26.7	
Family and hired labour	28	23.3	
Exchange labour	9	7.5	
Total	120	100	
Cost of labour			
Less than 5000	18	27.0	
5001 – 10,000	62	25.3	
10,001 -15,000	12	22.0	
15,001– 20,000	19	17.8	
20,001 and above	9	7.9	₦9,615.00
Total	120	100	
Types of farming system			
Mono-cropping	38	31.6	
Mixed farming	52	43.3	
Mixed cropping	30	25.1	
Total	120	100	
Common types of millet cultivated			
Sorghum (Jowar)	14	11.7	
Pearl millet (Bajra)	31	25.8	
Foxtail millet (Kangni)	27	22.5	
Finger millet (ragi)	8	6.7	
Barnyard millet	15	12.5	
Kodo millet	7	5.8	
Little millet	13	10.8	
Proso millet	5	4.2	
Total	120	100	
Fertilizer use type *			
None	13	10.8	
Used	107	89.2	
Organic	51	47.6	
Inorganic	38	35.5	
Both organic and inorganic fertilizer	31	16.9	
Quantity of fertilizer used (N=107)			
Less than 50kg	68	63.6	
51 – 100kg	16	14.9	
101 – 200kg	23	21.5	44.7kg
Use of agrochemicals			
Use	41	34.7	
Non-use	79	65.3	
Total	120	100	
Cost of agro-chemicals used (₦)			
Less than 15,000	52	53.6	
15,001 – 20,000	40	24.3	
20,001 and above	28	22.1	16,706 Naira
Total	120	100	
Quantity of agro-chemical used (Kg)			
Less than 50kg	56	63.4	
51 – 100kg	43	31.7	
101 – 200kg	21	4.9	47.8Kg
Total	120	100	

Source: Computed from field survey data, 2021. * Multiple responses

Table 2: Multiple regression of factors that influence profitability of millet farming enterprise in the study area

Variable	Linear	+Semi-log	Double log	Exponential
Constant	40026.79**	10.6702***	10.64696	40772.39
	(2.56)	(28.19)	(7.03)	(0.72)
Age	47.17911	0.0020214***	0.0517509	360.3438**
	(0.22)	(3.37)	(0.22)	(2.04)
Sex	1041.209	-0.0431575	0.717837	1955.989
	(0.27)	(-0.45)	(0.48)	(0.35)
Marital status	-1811.528*	-0.0386736	-0.1166812	-5303.224
	(-1.985)	(-0.71)	(-1.04)	(-1.21)
Household size	-531.3864	-0.0240934**	-0.227908**	-5303.224
	(-1.44)	(-2.54)	(-2.96)	(-1.21)
Educational level	-290.023*	0.007837**	-0.0400574	-1130.855
	(-0.65)	(2.68)	(-0.39)	(-0.29)
Farming Experience	-227.9709	0.0069224***	-0.067258	-2188.201
	(-0.89)	(3.05)	(-1.31)	(-1.13)
Monthly income	-0.0110547	-7.08e-08	-0.0089839	-286.141*
	(-0.10)	(-0.02)	(-0.10)	(-1.90)
Labour cost	-1113.699	- 0.026033**	-0.1513438	-6806.363
	(-1.13)	(-2.03)	(-1.08)	(-1.29)
Cost of seed	40026.79	0.0031051	0.0811032	2743.207*
	(0.81)	(0.82)	(0.73)	(1.66)
F-value	1.92*	3.61***	1.18	2.43**
R^2	0.6570	0.8354	0.6215	0.2075
Adjusted R^2	0.5679	0.8131	0.6199	-0.0303

Source: Computed from field survey data, 2021

***, **,*: Indicate those variables are statistically significant at 1%, 5%, and 10% respectively. Figures in parenthesis are t-ratios in the table. + = lead equation

Table 3: KMO and Bartlett's test of Sphericity for constraints affecting millet farming enterprise in Wukari, Nigeria

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.811
Bartlett's Test of Sphericity	Approx. Chi-Square	328.192
	Degree of freedom	290
	Sig.	.000

Source: Computed from field survey, 2021

Table 4: Rotated Component matrix for constraints affecting millet farming enterprise in Wukari, Nigeria

Parameters	Component						
	1	2	3	4	5	6	7
Lack of market, storage and processing facilities	0.728						
Poor site	0.621						
Drought problems	0.590						
Lack of capital/Credit facilities		0.819					
Increase in cost of input		0.590					
Increase in the cost of local seed production		0.453					
Poor government assistance			0.832				
Land acquisition			0.625				
low technical know-how			0.554				
Market competition			0.522				
Erosion				0.800			
Problem of middlemen				0.508			
Substandard and adulterated inputs					0.753		
Natural disasters					0.620		
Negative government interference						0.630	
Lack of managerial skills						0.611	
Disorganized farmers' association						0.452	
Civil unrest							0.483
Unstable price							0.472
Farmer-Fulani herdsmen clashes						.	0.898

Source: field survey, 2021

Extraction Method: Principal Component Analysis,Rotation Method: Varimax with Kaiser Normalization