

Profitability efficiency of cattle value chain actors in Niger State, Nigeria

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Abstract

This study analyses the profitability efficiency among cattle value chain actors in Niger State, Nigeria. Data collected were analyzed using both descriptive and inferential statistics. A sample of 193 actors in the chain were selected using simple random sampling technique to obtain primary data. Results show that all of the actors were male and within the active age of 20 and above. About 47% of them had no formal education, while 53% have one form of education or the other. The four most important intermediaries of cattle marketers in Niger State were producers, dealers, retailers and brokers. Transportation cost accounted for 74.3%, 60%, 46.2% and 12.1% of Total Variable Cost incurred by producers, dealers, retailers and brokers respectively. Cattle marketing was profitable in the study area with gross margin per head of cattle of ₦24,916.58, ₦18,765.40, ₦8,554.60 and ₦3,313.15 for producers, dealers, retailers and brokers respectively. On the other hand, profitability ratios were 0.50, 0.19, 0.07 and 0.04, respectively. The frequency of cattle value chain actors specific profit efficiency estimates shows that majority (53.37%) had profit efficiency range of 0.10-0.20 and (46.64%) had profit efficiency of 21% and above. The most efficient for this study had a profit efficiency of 0.86 which indicates that 24% of the gross margin is forgone due to inefficiency from the study area. Cattle value chain actors however, operated below economic frontier, giving a low mean profit efficiency and suggestive of a scope for improvement by allocating resources efficiently, and addressing the structural and marketing constraints. Inadequate finance, inadequate market information and double charges were the major problems militating against cattle marketing. Based on these findings, strengthening marketing institutions through capacity building for actors, rail system resuscitation and fixing of bad roads are recommended as steps necessary to enhance the commercialization and performance of cattle marketing.

Keywords: cattle, value chain actors, efficiency

1.0. Introduction

The future of animal husbandry (cattle production) in Nigeria will depend on marketing system in the livestock industry (Amogu, 2010; Lamidi *et al.*, 2012). This can only be achieved through a comprehensive study on economics of livestock production and cattle marketing, which will help in establishing efficient and robust marketing system needed as livestock enterprise approaches industrial level in Nigeria. On the other hand, Oladimeji *et al.* (2014) observed that the average protein intake in Nigeria which is about 19.38g/caput/day is low and far below the Food and Agriculture Organization requirement of 75g/caput/day. The most critical in the global food basket crisis is protein, especially of animal origin, and its source especially meat, is expensive, in short supply and out of reach of majority of the Nigeria population (Ndanitsa, 2014). In order to ensure adequate supply of protein to rapidly growing population, adequate marketing and value addition of cattle products is very important.

Hence, markets and marketing activities are very essential for the distribution of the cattle to the final consumers. Cattle are one of the major components of livestock existing in the state. Aside being multiplied and sold to generate income, it has wider usage thus, help in the production of beef, hide and skin, agricultural manure as well as source of transport for the movement of agricultural products from one location to the other. Similarly, it helps to provide power for the tilling of soil. Cattles are also fattened and sold, cross-bred to improve carcass weight. It also serves as a source of milk and cheese. The bones and blood are also used as part of ingredients needed for the production of chicken feeds among others.

Marketing of cattle is a business activity concerned with the transfer of cattle from the pastoralists to the consumers who are found in both urban and rural areas (Omoruyi, *et al.* 2000). Marketing performs so many roles in any economic system. The roles

include linking buyers and sellers, which makes it possible for exchange relationship as well as enhancing the standard of living.

The fact that areas of cattle production is far from major consuming areas has led to a situation in which there are many intermediaries and stakeholders in the marketing chain. The problem posed by this has been increased transaction costs which will ultimately lead to increased final retail price of cattle and its products. The activities of the intermediaries and stakeholders are capable of making cattle and its products inaccessible to the poor who feed mostly on diets deficient in animal proteins (Mafimisebi, 2011). The fact that cattle is mostly produced in northern Nigeria and mostly consumed in the south has led to a situation in which there is a multiplicity of intermediaries and stakeholders in the marketing chain (Adamu *et al.*, 2005).

More worrisome is the fact that the country is said to be in a critical and deteriorating national meat supply position in which beef alone accounts for about 70% of total national meat supply (Omoruyi *et al.*, 2000; Umar, 2005; Tibi and Aphunu, 2010), which make it important to examine the marketing system of cattle in Niger State in order to suggest possible ways of improving the system. The aim of this research is determine the profit efficiency among cattle value chain actors in Niger state.

The specific objectives of this study are to:

- i) describe the socio-economic characteristics of cattle marketing intermediaries in the area,
- ii) determine factors that influence the profit efficiency among cattle value chain actors,
- iii) identify the constraints to cattle marketing in the study area.

2.0. Methodology

The Study Area

The study was carried out in Niger State of Nigeria. Niger State is located in the North-Central geographical zone (Middle-belt) region of Nigeria and it is the largest in the country (NAMDA, 2013). The state capital is Minna. It is located between latitudes 3°20' and 7°40'N and longitudes 8° and 11°3'E of the Greenwich Meridian (Tanko *et al.*, 2010). The state is bordered to the North by Zamfara State, to the South by Kogi State, to the South-West by Kwara State, while Kaduna State and the Federal Capital Territory border the state to the North-East respectively. At the North-West, the State shares a common boundary (international) with the Republic

of Benin along Agwara (Babanna) Local Government Area (LGA). This gives rise to common cross-border trade with the state, including cattle trading. The state covers an estimated land area of 86,000 square kilometers (Km²), which is about 10% of the total land area (mass) of the country. About 85% of this land area is arable. Karra, Tungan mallam and Mariga cattle market are situated within Mokwa, Paikoro and Mariga LGAs and they have high concentration of cattle and cattle traders (Musa, Bala and Adoni, 2013).

Method of data collection and sampling technique

Primary data were collected through a well-structured questionnaire administered to the respondents by the researcher with the assistance of trained enumerators from the Niger State Agricultural Development Project, (NSADP). Multi-stage sampling techniques were used for the study. The first stage involved the selection of one Local Government areas (LGAs) namely Mokwa, Paikoro and Mariga purposively from the three Agricultural zones respectively. The major cattle markets are located in these LGAs and marketers from other parts of West Africa and beyond come to these markets for cattle business. A reconnaissance survey and discussion with key informants' prior the fieldwork revealed that there are different types of intermediaries in cattle marketing based on roles and functions and size of operation. In the second stage, three cattle markets, namely Kara, Tungan mallam and Mariga markets, one from each LGAs in the zones were purposively selected. This is because those markets are the major markets in the State for cattle marketing. In the third stage, the respondents were stratified into four strata namely producers, dealers, brokers and retailers. At the fourth stage, Yamane formula was applied to obtain sample size proportionate to size after obtaining the number of operators in the different categories from the leaders of market associations.

Yamane's (1967) formula is giving as,

$$n = \frac{N}{1 + N(e)^2} \quad (1)$$

Where,

n= sample size

N= Finite population

e= the level of tolerable error/precision at the 95 % confident level and

l=constant

Table 1: Summary of the study sample Design

State	Zone	LGAs	Cattle Market	Actors	Sample Frame	Sample Size
Niger	I	Mokwa	Kara	Producers	62	32
				Dealers	42	22
				Retailers	34	18
				Brokers	13	7
				Producers	38	20
	II	Paikoro	Tunga Mallam	Dealers	32	16
				Retailers	28	14
				Brokers	8	4
				Producers	45	23
				Dealers	36	19
	III	Mariga	Mariga	Retailers	26	13
				Brokers	10	5
				Producers	36	19
				Dealers	26	13
				Brokers	10	5
Total				374	193	

Source: Field survey, 2016.

3.0. Method of data analysis

Data collected were analyzed using both descriptive and inferential statistics. The descriptive statistical tools employed were frequency distribution, means/averages, ratios and percentages. Stochastic profit function was used to determine the factors that influence the profit efficiency of value chain cattle marketing actors.

Stochastic profit frontier for this study is similar to the one used by Ogbanje (2013) and Okewu and Ibeanacho (2015). The standard profit function assumes that cattle market is perfectly competitive. Given the price of cattle marketing activities (W) and the sales vector (P), marketers maximize profit adjusting the price of marketing activities and sales. Therefore, the profit function can be implicitly stated as shown in equation

$$\Pi = f(P, W, V, U) \quad (2)$$

Stated in the logarithms forms, the function is specified as in equation 2

$$\ln(\Pi + \Theta) = \ln(P, W) + (V+U) \quad (3)$$

Where:

Θ = a constant added to the profit of each marketer in order to attain positive value so as to treat the factors logarithmically. The exogenous nature of prices in this concept of profit efficiency assumes that there is no market power on the marketer's side. The marketers assume the possibility of imperfect competition given only the sales vector and not that of price rather than taking price as given. Therefore, alternative profit function is expressed as in equation 4.

$$\Pi = f(Y, W, V, U) \quad (4)$$

Profit efficiency in this study refers to the profit obtain from operating on the profit frontier

considering prices of specific marketing transactions and the other factors. The actual normalized profit assumed to be well behaved is the marketer's profit measured in terms of Gross Margin (GM) which is the difference between the Total Revenue (TR) and the Total Variable Cost (TVC) as specified in equation 5.

$$GM(\Pi) = \Sigma(TR - TVC) = \Sigma(PQ - WX) \quad (5)$$

Gross margin is then divided on both sides of the equation 5 by P which is the market price of the cattle sold by the marketers so as to normalize the profit function.

$$\Pi/P = \Sigma(TR - TVC)/P = \Sigma(PQ - WX_i)/P = Q - W X_i/P = f(X_i, Z) - \Sigma P_i X_i \quad (6)$$

Where:

TR = total revenue (₦)/cattle

TVC = total variable cost (₦)/cattle

P = price of cattle sold (₦)/cattle

X = minimized price of marketing transaction

Z = price of fixed market transaction

$P_i = W/P$ which represents normalized price of marketing transactions

$F(X_i, Z)$ = production function

Following the work of Ogbanje (2013), the stochastic profit frontier, using Cobb-Douglas functional form can be expressed as in equation 12:

$$\ln \pi = \ln \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + \beta_7 \ln X_7 + \beta_8 \ln X_9 + (v_i - u_i) \quad (7)$$

Where:

Π = average total marketing profit (₦)/cattle/year.

X_1 = average cost of feed (₦)/cattle/year,

X_2 = average cost of housing (₦)/cattle/year,

X_3 = average purchase price of cattle (₦)/year,

X_4 = average cost of labour (₦)/cattle/year,

X_5 = average cost of transportation (₦)/cattle/year,

X_6 = average cost of medication (₦)/cattle/year and

X_7 = average cost of market charges (₦)/cattle/year.
 $X_1 - X_7$ are factors assumed to affect the level of profit efficiency of the marketer and
 β_0 = constant,
 $\beta_1 - \beta_8$ = are maximum likelihood estimates to be measured, \ln is natural
 Logarithm, v_i and u_i = composite errors
 The inefficiency model (u) for the stochastic profit frontier can be defined as in equation 8

$$U = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_5 Z_5 + \delta_6 Z_6 + \delta_7 Z_7 + \delta_8 Z_8 + (v_i - u_i)$$
 (8)

Where:

Z_1 = Age of the marketers (years),

4.0. Results and Discussion

Socio-economic characteristics of cattle value chain actors

The result in Table 2 showed that the average age of cattle value actors was 42 years. This implies that, most of the sampled cattle marketers were still in their economic active age. This is in agreement with the findings of Afolabi (2014) and Ndanitsa (2014) who in their separate studies reported an average age of 41 years each and that age of cattle merchants contribute to many qualities associated with the traders. Majority (43.50%) of the actors had no formal education while the average number of years spent in formal schooling was five (5) years. However, 56.50% of the cattle marketers had one form of formal education or other. The level of formal education will for instance have an implication on the extent to which cattle marketers will be pro-active in marketing and receptive to new technologies, which can increase profitability (Oseni, 2010).

Table 2 further revealed that over 94 percent of the cattle marketers in the study area had mean family size of 9. This agrees with the findings of Abdullahi

Z_2 = Marital status (dummy variable: Married = 1 and Single = 0,

Z_3 = Educational level measured in number of years Spend in formal school,

Z_4 = Household size (number of persons),

Z_5 = Cattle Marketing experience (years),

Z_6 = major occupation (dummy variable: cattle = 1 and Otherwise = 0,

Z_7 = membership of cattle marketer association and

Z_8 = Amount of capital available for cattle marketing (₦).

δ_0 = constants

$\delta_1 - \delta_8$ = composite error

and Tsowa (2012) and Ndanitsa (2014) who in their separate studies found average family size of 9 and 11 respectively. This implies that the cattle marketers had fairly manageable family sizes which may assure marketers of extra helping hands in their cattle marketing business while not consuming all the income made from cattle trade and will be able to save and invest eventually in the venture. Majority (76%) of the cattle marketers had been in cattle marketing business for more than ten years with mean of 8 years. This finding corroborates that of Mafimisebi *et al.*, (2013) that 73% of the cattle marketers have cattle marketing experience of more than ten years but in contrary to that of Ebevore and Idoge (2013) who observed that 70% of the respondents have been in the business for less than five years. The implication is that the years of marketing experience had a direct relationship with the age of the household head. Their long years of marketing experience will enable them to overcome constraints faced in cattle marketing and also mastered the skills required for success in their cattle marketing business.

Table 2: Socio-economic characteristics of the cattle value chain actors

Variables	Frequency	Percentage	Mean
Age in year			
21-30	07	03.60	
31-40	59	30.60	
41-50	83	43.00	
51-60	29	15.00	42
>60	15	7.80	
Educational Attainment			
No formal Education	84	43.50	
Adult Education	8	4.10	5
Primary Education	37	19.20	
Secondary Education	56	29.00	
Tertiary Education	8	4.10	
Family size			
1-5	31	16.10	
6-10	108	56.00	9
11-15	43	22.30	
>15	11	5.70	
Cattle marketing experience			
1-10	46	23.80	
11-20	70	36.10	
21-30	59	25.90	8
31-40	12	6.20	
>40	15	7.80	

Source: Field survey, 2016

Profitability ratio, efficiency ratio and return on investment

The profitability ratio, efficiency ratio and return on investment of the major actors in cattle marketing are presented in Table 3. The profitability ratio for producers, dealers, retailers and brokers were 0.50, 0.19, 0.07 and 0.04 respectively. All the ratios were greater than zero this implies that the different categories of actors in the study area has great potential for increasing rural income. The profitability ratio was highest among the producers closely followed by the dealer, then retailers while the brokers had the lowest ratio. An enterprise is regarded as operationally efficient or inefficient as the efficiency

ratios is greater than one or less than one, respectively. In this case, efficiency ratio of 1.99, 5.22, 14.40 and 27.92 were obtained for producers, dealers, retailers and brokers, respectively. Since the entire ratio were greater than one (1), it is an indication that the marketing enterprise was operationally efficient at different marketer's categories with the cattle brokers being the most operationally efficient closely followed by the retailers, dealers and the producers. Consequently, the return on investment of 1.50, 1.19, 1.07 and 1.04 was obtained for producers, dealers, retailers and brokers, respectively. This signifies that for every ₦1 spent on cattle marketing ₦ 1.50, ₦ 1.19, ₦ 1.07 and ₦ 1.04 was realized as profit for producers, dealers, retailers and brokers, respectively.

Table 4: Profitability ratio, efficiency ratio and Return on investment of marketers

Category	Total Revenue (TR) ₦	Total Variable Cost (TVC) ₦	TR-TVC, Gross Margin	π/TC , Profitability Ratio	TC/TR, Efficiency Ratio	TR/TC, Return on Investment
Producers	134,648,003	94,104,916.3	47,342,509.	0.50	1.99	1.50
Wholesalers	49,396,000	41,458,275	7,935,225	0.19	5.22	1.19
Retailers	21,341,993	19,956,148	1,385,845	0.07	14.40	1.07
Brokers	3,830,001.40	3,697,600.00	132,401.40	0.04	27.92	1.04

Source: Field survey, 2016

Determinants of profit efficiency of cattle value chain actors

The stochastic frontier profit function estimates of the sampled cattle value chain actors in the state are presented in Table 4. The results indicate that, the estimated coefficient for labour (0.1623) was positive and significant. This means that an increase in labour output will result in an increase in profit efficiency. However; transportation costs (0.9672) variable was negative and significant at ($P < 0.01$). It means decrease in transportation costs increases profit efficiency at different levels accordingly. This might be due to the fact that transport costs are usually bore by the various actors in the chain. On the other hand, the inefficiency factors affecting profit were age of the

actors and their major occupation. The age the actors was significant and negative; this means that the older an actor the more efficient they become.

The gamma (γ) value was 0.1283 and significant at $P < 0.01$ is an indication that 13 percent variation in profit level of cattle marketers is attributed to profit inefficiency. It also confirms the presence of the one sided error component in the model, thus rendering the use of the ordinary least squares (OLS) estimating technique inadequate in representing the data. The sigma-square (δ^2) on the other hand was 0.1387 and significant at $P < 0.01$, indicating a good fit and the correctness of the specified assumptions of the distribution of the composite error term

Table 5: Maximum likelihood estimates of the stochastic frontier profit function of cattle marketers.

Variables	Parameters	Estimated Coefficients	T-ratio
	β_0	8.7772	8.9397***
Constant	β_1	-0.0211	-0.2282
Feed (X_1)	β_2	-0.0321	-0.3674
Housing (X_2)	β_3	0.0504	0.3478
Purchased price (X_3)	β_4	0.1623	8.5316***
Labour (X_4)	β_5	0.9672	-5.0357***
Transportation (X_5)	β_6	0.1477	1.3782
Medication (X_6)	β_7	0.0104	0.1019
Market Charges (X_7)			
Inefficiency function	δ_0	0.8369	5.4976***
Constant	δ_2	-0.5976	-5.0402***
Age (Z_1)	δ_1	-0.4182	-1.2288
Marital status (Z_2)	δ_4	0.0085	0.2046
Education (Z_3)	δ_5	0.0198	0.4856
Household size (Z_4)	δ_6	0.0124	0.8569
Cattle marketing experience (Z_5)			
Major Occupation (Z_6)	δ_7	0.1161	2.2166**
Membership of Association (Z_7)	δ_8	-0.2238	-0.7639
Amount of Capital (Z_8)	δ_9	0.0000	1.6759
Sigma-Squared	σ^2	0.1387	7.4762***
Gamma	Γ	0.1283	0.7572
Log likelihood	Llf	-299.172	
	LRT	14.0372	

Note: ***and ** implies statistically significant at 1%, and 5% respectively.

Source: Data analysis, 2016.

Profit efficiency levels of cattle value chain actors

The distribution of respondents according to technical efficiency rating of the farmers is presented in Table 5. As depicted in Table 5 the estimated profit efficiency ranges from 0.10 for the least efficient

marketer to 0.86 for the "best" practice farmer, with a mean profit efficiency of 0.21. The efficiency distribution shows that, over 46 percent of the cattle marketers attained profit efficiency of 21% and above.

Table 6: Distribution of cattle value chain actors' level of profit efficiency

Efficiency class	Frequency	Percentages
0.10-0.20	103	53.37
0.21-0.30	72	37.31
0.31-0.40	10	05.18
0.41-0.50	03	01.55
0.51-0.60	02	01.04
>0.61	02	01.04
Total	193	100
Mean	0.21	
Minimum	0.10	
Maximum	0.86	

Source: Field survey, 2016

Constraints to cattle value chain actors

The distribution of respondents with regards to the problems militating against the attainment of the full potentials of cattle marketing in the study area is presented in Table 6. The result revealed that over 67 percent of the respondents complained of inadequate finance as most severe problem militating against cattle marketing and that is why majority of them only operate on small scale, i.e no enough capital to expand their cattle business. This problem of inadequate finance ranked first among the most severe problems of cattle marketing. This suggests that, with availability and accessibility of capital a good number of people would enter into cattle marketing activities and thus perform effectively, being a profitable venture.

The findings also revealed that over 53% of respondents reported Inadequate market information as the second most severe problem faced by cattle marketers in the study area, these range from marketing information on prices, cost of production, which are vital determinates in price setting are not available cattle marketers double charges is another

most served problems in this study; over 48.20% of the respondents in the study area. These double charges include: taxes collected by Local, State and Federal Governments. Other unethical charges are levies by crooked officials, especially those along the produce checking points from one Local Government Area to another. This drastically reduces the profit of cattle marketers.

Furthermore, inadequate market facility, credit facility, high cost of transportation and medication (46.10% each) are other constraints to cattle marketing in the study area. Inadequate marketing facilities such as improper housing, absence of portable drinking water, unit of measurement, lighting points, and also security of the market, are major problems confronting cattle marketers. Most of the marketers do not have access to credit facilities, because of high interest rate collateral, absence of collateral security, improper record keeping by the marketers which is demanded by lending agencies. This finding is similar to the one obtained by Iheanacho and Ali (2010).

Table 7: Constraints to cattle value chain actors

Problems	Very severe	Severe	Slightly severe	Not severe
Inadequate market information	103 (53.40)	30 (15.50)	28 (13.50)	34 (17.80)
High cost of transportation	89.(46.10)	38 (19.70)	24 (12.40)	42 (21.80)
Cost of acquisition	35 (18.10)	40 (20.7)	61 (32.10)	56 (29.00)
High cost of medication	89 (46.10)	54 (28.00)	37 (19.20)	13 (6.70)
Double Tax	93 (48.20)	47 (24.40)	33 (17.10)	20 (10.40)
Inadequate credit	89.(46.10)	38 (19.69)	25 (12.95)	41 (21.20)
Bad roads	64 (33.20)	60 (31.10)	47 (24.40)	22 (11.40)
Inadequate market facilities	89.(46.10)	51 (26.40)	20 (10.40)	37 (19.20)
Inadequate Finance	130 (67.40)	32 (16.60)	14 (07.30)	17 (08.80)

Source: Field survey, 2016.

Figures in parentheses are percentages

Conclusion and recommendations

Conclusion

The study revealed that in spite of the abundant potentials of cattle marketing in the study area, available resources were not fully tapped. The respondents in the area were generally small-scale that depend on their meager resources at their disposal to finance cattle business venture.

Evidence from the study indicates that cattle marketing is a profitable business in the study area for producers, dealers, retailers and brokers respectively. This means that the area has great potential to increase cattle marketing and marketer's income. Cattle value chain actors were operating below economic frontier, giving a low mean profit efficiency and suggestive of a scope for improvement by allocating resources efficiently, and addressing the structural and marketing constraints. The study also showed that body condition, age of cattle and occasions/festivals were the major determinants of cattle prices in the study area. Based on the findings of this study, the following recommendations were made.

1. In order to ensure adequate supply of animal protein to rapidly growing population, adequate marketing of cattle/cattle products is very important; one will expect cattle marketers in the study area to devote

more of their resources to cattle marketing. Here, the role of extension education becomes indispensable. Extension educationists need to step out to beef-up the awareness level of the marketers in terms of market information with particular reference to prices of cattle so as to increase their profit margin.

2. Government and non-governmental organizations should encourage fresh graduates to venture into the business by stimulating students' interest in cattle marketing while they are still in school, link agriculture students with dealers during their SIWES programme this will give them opportunity to understudy dealers and take to cattle marketing business after graduation.

3. The need for intervention by the government so that cattle marketers should have access to credit at single digit interest rate as well as subsidized agricultural inputs like feeds, drugs to increase their profit margin.

4. Marketers should be encouraged to form cooperative society to enable them pool their resources together and also have easy access to assistance from government and credit from financial institutions this will strengthen their cattle marketing business.

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