squared variables have not been utilized up to their optimal economic efficiency levels. Coefficients of interaction between labour x medication, labour x feeds, labour x fattening animals, labour x depreciation, labour x water, labour x transportation, medication x feeds, medication x fattening animals, feeds x transportation, fattening animals x depreciation, fattening animals x water and depreciation x water showed a strong relationship at 1% level of probability and fattening animals x transportation and depreciation x transportation showed significance at 5% levels while water utilized x transportation is significant at 10% levels. This means that increasing a unit of these interaction terms for positive coefficients would lead to a corresponding increase in weight gain while increasing a unit of these interaction terms for negative coefficients would lead to a corresponding decrease in economic efficiency.

Profit Efficiency Estimates

Table 2 shows the predicted profit efficiency of sheep fatteners ranging between 0.10 and 0. 66 with a mean of 0.23. The minimum efficiency of 0.10 shows gross under-utilization of resources while the best economically efficient fattener operated barely above average frontier. There is a wide gap between the economic efficiency level of best and the worst fatteners. To bridge the gap, the average fattener needs a cost saving of 65.15 percent that is (1-0.23/0.66%) to attain the frontier level of the most economically efficient fattener in the study.

Table 2: Distribution of sheep fatteners according to profit efficiency indices, Kebbi State, Nigeria

Technical Efficiency index	Frequency	Percentage (%)
< 0.20	86	53.75
0.21-0.30	40	25.00
0.31-0.40	18	11.25
0.41-0.50	12	7.50
0.51-0.60	3	1.87
0.61 and above	1	0.63
Total	160	100.00
Mean Economic efficiency	0.23	
Standard Deviation	0.12	
Minimum Economic efficiency	0.10	
Maximum Economic efficiency	0.66	

Source: Computer printout of Frontier 4.1

The least economically efficient fattener will however, experience efficiency gain of about 84.85 percent that is (1-10/0.66%) to be able to attain the level of the most economically efficient fattener in the study. Given the fact that none of the sheep fatteners operated on the frontier (efficiency ratio is less than one), it depicts that more than the profit maximizing level of the input was employed (Onyenweaku and Fabiyi 1991; Ohajianya and Onyenweaku, 2000).

Determinants of Profit Efficiency

The result in Table 3 indicates that the coefficient of age (0.006) is positive and statistically significant at 5% level. This is in consonance with the apriori expectation that the older a fattener becomes, the more his efficiency drops. This tally's with the findings of Idiong *et al* (2009) as well as Tanko and Jirgi (2008) in their various investigations.

Table 3: Maximum likelihood estimates of the determinants of profit efficiency in sheep fattening enterprise, Kebbi State, Nigeria.

Variable	**Parameter**	**Coefficient**	**Standard error**	**t-ratio**
Intercept	Z_0	-0.246	0.054	-4.594***
Age	Z_1	0.006	0.003	2.040**
Level of education	Z_2	0.002	0.004	0.443
Fattening experience	Z_3	-0.004	0.003	-2.602***
Household size	Z_4	-0.010	0.002	-1.019
Herd size	Z_5	-0.113	0.017	-6.756***
Credit access	Z_6	-0.047	0.053	-2.896***
Membership of cooperative	Z_7	-0.060	0.036	-2.047**

Source: Computer printout of Frontier 4.1

***, **, * are significant levels at 1, 5 and 10% respectively.

Fattening experience (-0.004) has a negative coefficient but statistically significant at 10% level. The implication is that sheep fatteners with more years of experience achieve higher level of profit efficiency than the less experienced fatteners. This is in agreement with studies from Umar

et al. (2014) while in disagreement with studies by Moses (2017) who obtained positive and significant coefficients of years of experience in his different studies.

The coefficient of membership of cooperative (0.060) is negative and significant at 1% level of probability as expected. The result is in consonance with that of Umar *et al.* (2014) while it disagrees with studies by Moses (2017) who found positive coefficient for membership of cooperative. Farmers' membership of associations or cooperatives affords them the opportunity of interacting with others and thereby exchanging information on improved technology in sheep fattening. Results also revealed that the coefficient of herd size and credit access were negative implying that provision of credit and increasing herd size increase the level of profit efficiency. This agrees with the study by Umar *et al*. (2014) while in disagreement with studies by Moses (2017).

4. Conclusion

Based on the revealed results of the study it can be concluded that the fatteners were not maximizing profit. An estimated mean profit efficiency of 23% suggests that the best profit maximizing fattener operated barely above average frontier. The results suggested that profit will be enhanced with increase in fattening experience, herd size, credit access and membership of cooperative.

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