The Factors That Influence Beef Cattle Marketing Efficiency and The Behavior Of Pastoralists: A Case Study In Kenya

Stephen G. Mbogoh, Kimpei Munei, Mathew K. Komen, Juma M. Mohammed

Abstract— **This review article shows that the paradigms on the best methods of utilizing the fragile land resources in arid and semi-arid land areas (ASALs) vary, but nomadic pastoralism which is livestock keeping under constant mobility in search of water and pasture often is the main source of livelihoods for the people living in such areas. For Kenya, the ASALs constitute about 80% of the country's land area that is home to about 60% of Kenya's livestock population. However, the ASALs in Kenya suffer frequent droughts with concomitant devastating effects on livestock, and the poverty incidence in these areas is way above Kenya's national average. This situation calls for efforts to explore effective interventions to reduce poverty for pastoralists in the ASALs. Improving marketing efficiency and off-take rates for pastoral livestock to enhance household incomes has been recommended as one of these strategies. However, attempts to implement this strategy have proved ineffective, primarily because even though the pastoralists tend to keep large livestock herds, often they are unwilling to offer much for sale in the market. This study sought to identify and evaluate the factors that influence the pastoralists' beef-cattle marketing behaviour and efficiency in the ASALs of Kenya. The study found that cattle calving rate, cattle purchases rate, off-pastoral income and pastoral household dependency ratio are the main factors that influence pastoral beef-cattle marketing behaviour and efficiency. Contrary to conventional expectations, this study found that pastoral household decisions on beef cattle off-take rate in Kenya are not influenced by market information.**

Index Terms— **ASALs, Pastoralists, Kenya, Evaluate, Factors, Beef-Cattle, Marketing Behaviour and Efficiency.**

I. INTRODUCTION

Paradigms on how to promote best practices in the utilization of the fragile land resources in the arid and semi-arid land areas (ASALs) are variable. Some authorities argue that no issue is more critical to the future well-being of the pastoral populations that inhabit the ASALs than secure land tenure [5]. In this case, the argument is that the herders' access to grazing land and nomadic pastoralism which involves livestock keeping under constant mobility in search of water and pasture poses a great challenge in resource conservation. Often the communal grazing areas become degraded, leading to threats on the survival of nomadic pastoralism. Some other authorities argue that the pastoral areas in any country differ from the other parts of the country in three important respects that are rarely accommodated in national policy or practice [7].

The ASALs in any country differ from the other parts of the country in the following ways [7]: first, in the movement of livestock and people; second, in their demography (as characterized by low population density and high population growth); and third, in their institutions (customary mechanisms for managing natural resources and security which tend to be relatively strong in many pastoral areas, and can thus be an invaluable repository of indigenous knowledge).

Previous studies indicate that nomadic pastoralism is the main source of livelihoods for the pastoralists, these being the people who live in the ASALs or the rangelands. Despite the divergent views on the best methods that should be adopted in the utilization of the fragile land resources in the ASALs, it appears that nomadic pastoralism is generally accepted as an appropriate strategy for the utilization of these fragile resources.

For Kenya, the ASALs constitute about 80% of the country's total land area and are home to about 60% of the country's livestock population. However, the ASALs suffer frequent droughts with concomitant devastating effects, especially on livestock [13], and the incidence of poverty in the ASALs of Kenya is among the highest in the country, being way above the national average poverty index that is about 46% [12]. Therefore, the urgent need to address poverty concerns in the ASALs of Kenya has raised the bar for researchers to explore and come up with more appropriate interventions in these areas.

For many years, studies on pastoral livestock production systems have laid emphasis on the identification and implementation of strategies intended to increase pastoral livestock off-take rate, especially the commercial off-take rate for beef cattle, as a means of addressing poverty in the rangelands ([1]; [2]; [3]; [17]; [20]; and [22]). The off-take rate is simply the percentage of the total livestock population that is offered for market and sold each year. However, these strategies have not proved effective. This review paper attempts to examine and analyze available information on pastoral production and marketing systems and then identify and evaluate the factors that influence the pastoralists' beef-cattle marketing behaviour and efficiency in the ASALs of Kenya.

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II. METHODOLOGICAL APPROACH

A. Background

This review paper draws heavily from some studies that the authors have undertaken in the past, some of whose findings have generally not been published. However, some findings are partially reflected in references [11], [12], [14], [15] and [19]. From this perspective, some experiences gained by the corresponding author while serving as a Business and Market Development Advisor for the ASAL-based Livestock and Rural Livelihoods Support Project in the Ministry of Livestock Development in Kenya [15] and some unpublished findings from two studies undertaken by graduate students under the supervision of the corresponding author ([11] and [19]) are fairly invaluable. Culturally, the pastoralists tend to keep large livestock populations and often are unwilling to offer much for sale in the market, except in the eleventh hour when drought conditions become life-threatening and the livestock start to lose their body condition ([11]; [15]; and [19]).

The details of the theoretical frameworks and the analytical models that were employed to generate the results that are presented and discussed in this paper can be accessed in the above referenced studies. However, the main ingredients of these theoretical frameworks and analytical models are briefly presented and reviewed in this paper to facilitate the understanding of the findings discussed in the paper.

B. Cattle marketing efficiency study

Beef cattle constitute the largest component of the livestock population in Kenya (about 17 percent) and are owned by the highest proportion of Kenya's households who keep livestock (about percent) ([4]; [8]). To evaluate beef marketing efficiency issues, a case study was conducted on livestock markets in Kajiado District of Kenya in which about 70 percent of the people depend on livestock and livestock products for their livelihoods. Although livestock and livestock products are considered high value commodities in Kajiado District and are expected to fetch reasonably attractive prices, this has not been the case. Therefore, it was considered appropriate to study the efficiency of the cattle marketing system in Kajiado District with the objective of generating information on the factors that influence the pricing of beef cattle and associated products and whether the marketing margins wholly reflected the marketing costs. Such parameters are important in indicating areas where marketing improvements can be undertaken for the benefit of both producers and consumers [19].

Both correlation and regression analyses were applied to determine the significance of the factors that had been hypothesized to influence efficiency in cattle marketing. Such factors included: cattle live weight, sex, age, market location, reasons for selling and when to sell. The following multiple regression model was estimated, based on the data collected in the study:

$$S = \alpha + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \varepsilon$$

…………………… Equation 1

where, with respect to cattle and the model:

S = Price; X_1 = Live weight; X_2= Sex; X_3 = Age; X_4 = Market location; X_5 = Reasons for selling; X_6 = What determines when to sell; α = Constant term; β_1, β_2, β_3 and β_4 = OLS estimators; and ε = Error term.

In order to calculate marketing margins, average beef cattle prices on the basis of live weights, age, sex and market location were calculated for each market. Beef cattle were grouped into three age categories for ease of computation, namely: (i) cattle below age two years, (ii) those between ages 2 and 3 years, and (iii) those above age 3 years. Cattle were also grouped on the basis of their sex. Margins were also calculated for both slaughter and trekked cattle.

Marketing efficiency was determined from both marketing margins, profit margins and marketing costs. The following equations were used to calculate marketing and profit margins for the various levels in the marketing chain:

$$M=RP–FGP$$...Equation 2
$$PM=MM–(LC+MF+HC+TC)$$..........................Equation 3

where, and with respect to Kenya Shillings (Kshs) per kilogram (kg):

MM = Marketing margin; RP = Retail price or market price; FGP = Farm gate price ; PM = Profit margin; LC = Labour cost; HC = Handling charges; TC = Transport cost; and MF = Market fee).

C. Pastoralists' market behaviour: Supply response analysis

For this study, the Nerlovian Supply Response (NSR)[1] model was used. Assuming that the main determinant of the supply of a product is its own price, reference[21] developed his model based on two important assumptions. First, that producers are always trying to bring the actual level of output to some desired level (the partial adjustment hypothesis)--this assumption may be represented as follows:

$$Y_t–Y_{t-1}=\beta(Y_t^*–Y_{t-1})(0<\beta>1)$$...............................Equation 4

which indicates that the change in output between the current (t) and previous (t-1) periods is only a proportion of the difference between the optimum level (Y_t^*) and the previous year's output (Y_{t-1}) . β is the adjustment coefficient, which lies between zero and one. The restriction placed on the parameter ß in Equation 4 is both intuitive, and theoretically sound. If ß = 1, it implies that producers are able to fully adjust to supply and demand shocks in one period and Yt* = Yt. If ß = 0, it implies that there is no adjustment and Y_t = Y_{t-1}. An estimate of ß close to one implies almost immediate adjustment, a low ß implies a very slow adjustment to changes in exogenous variables [6]. The second assumption is that the current producers' expectations derive from and are modified by previous expectations in the light of current experience [10]--this price expectations hypothesis can be captured as follows:

$$P*_t–P*_{t-1}=ß(P_{t-1}-P*_{t-1})ß.[0,1]$$..............................Equation 5

where P*t is the price expected this year, P*t-1 is the price expected the previous year, and Pt-1 is the actual price during the previous year, and ß is the proportion of the error, a constant, by which the farmers revise their expectations and lies between zero and one (see Equation 5). Therefore, the expected price P*t is a weighted moving average of the past prices, as indicated in Equation 6:

$$P*_t=ßP_{t-1}+(1-ß)ßP_{t-2}+(1-ß)\beta P_{t-3}$$…..............Equation 6

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[1] The NSR model, referred to, was developed by Marc Leon Nerlove in 1956 [21].

In theory, all past prices should be included during the estimation of farmers' supply response. However, the fact that the weights decline over time implies that in practice prices in the very distant past can safely be ignored [21]. Based on this price expectations hypothesis, Equation 7 can be derived as indicated below:

$$Y_t = \alpha_0 + \alpha_1 P^*_t + \varepsilon_t, \dots\dots\dots\dots\dots\dots\text{Equation 7}$$

where: Y_t = output; P^*_t = price of output Y expected this year; and ε_t = random residual term. Equation 7 shows that the farmers revise their expectations by a proportion of the error that they make in their price predictions.

Since one cannot observe P^*_t, Equation 7 cannot be estimated. Therefore, one must represent P^*_t in terms of observable variables.

Equation 7 implies that one can write any expected price P^*_t as a linear function of the output Y_t. In particular, the previous year's expected price P^*_{t-1} can be represented by the previous year's output Y_{t-1}. Hence the expected price this year is a function of last year's actual price and the last year's actual output. Consequently, one can replace last year's expected price in Equation 5 by a linear function of last year's output. By substituting the expected new expression for the expected price into the output response function as given in Equation 5, one obtains a new relationship between the output this year and the last year's actual price and output which can be expressed as follows [21]:

$$Y_t = \beta_0 + \beta_1 P_{t-1} + \beta_2 Y_{t-1} + \beta \varepsilon_t, \dots\dots\dots\dots\text{equation 8}$$

The standard structural model for supply response analysis can then be summarized as follows:

$$Y_t = \beta_0 + \beta P_{t-1} + P_{t-2} Y_{t-1} + \beta \varepsilon_t, \dots\dots\dots\dots\text{Equation 8}$$
$$P^*_t = \beta P_{t-1} + (1-\beta)\beta P_{t-2} +$$
$$\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\text{Equation 6}$$
$$Y_t = \beta_0 + \beta\, P_{t-1} + \beta\,(Y_t^* - Y_{t-1})\ (\ 0 < \beta > 1) \dots\dots\dots\dots\text{Equation 9}$$

The reduced form equation relating to output and prices is used to solve Equations 8 and 6 above in terms of observable variables yields:

$$Y_t = \beta_0 + \beta P_{t-1} + \beta Y_{t-1} \dots\dots\dots\dots\dots\text{Equation 10}$$

From the reduced form Equation 10, reference [21] was able to obtain estimates of both the elasticity of output to expected price and the coefficient of expectation. However, reference [21] restricted himself to the simple case, in which the output devoted to a given product is a linear function of the expected relative price of that product alone. Nevertheless, following reference[24], the above supply response modelling is applicable in the analysis of the factors that influence cattle marketing off-take rate at the household level. In the current study, the objective was to analyse such factors in the case of the livestock market sheds of Isiolo and Garissa in Kenya using the following model:

$$Y_i = \Sigma(X_i, Z_j) \dots\dots\dots\dots\dots\dots\dots\dots\text{Equation 11}$$

where: Y_i = the beef cattle commercial off-take rate of the ith household; X_i = the ith household characteristics; and Z_j = the jth cattle production dynamics.

The household characteristics that were postulated to influence commercial livestock off-take were: household size, educational status, household dependency ratio, non-pastoral income, wealth, and the household knowledge and use of market information. The cattle production dynamics included cattle calving rate, mortality rate, home cattle slaughters and cattle purchase rate. The actual multivariate regression model that was used to analyze the factors that influence the beef cattle commercial off-take rate for the sampled pastoralist households was specified as follows:

$$Y_i = \Sigma\beta_i X_i \dots\dots\dots\dots\dots\dots\dots\dots\dots\text{Equation 12}$$

where: Y_i = the ith household beef cattle commercial off-take rate and X_i = ith household's cattle dynamic variable to be estimated. With the relevant variables inserted, this model thus translated into:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \varepsilon \dots\dots\dots\dots\dots\text{Equation 13}$$

where: Y = household beef cattle commercial off-take rate; $\beta_0, \beta_1, \beta_2, \dots, \beta_{11}$ = regression coefficients; ε = the random term; X_1 = livestock market information as used by the households; X_2 = dependency ratio of the household (household size divided by the number of household members between the ages 18 and 65 years); X_3 = wealth variable (using the total livestock units (TLU)2 possessed by the ith household); X_4 = education level of the household head or the decision maker in five level categorical variables; X_5 = household size (number of household members); X_6 = non-pastoral annual income in Kenya Shilling (Kshs.); X_7 = age of household head in years; X_8 = price of the beef cattle (Kshs.); X_9 = beef cattle calving rate; X_{10} = beef cattle home slaughter rate; X_{11} = beef cattle purchase rate.

A few key variables are worth commenting on. The study expected, among other things, that there is a positive relationship between beef cattle commercial off-take rate and the use of market information. This particular hypothesis was tested at two levels: first, on whether the pastoralists were enthusiastic about knowing previous market price information and, second, on whether they made use of this information when making cattle marketing decisions. The dependency ratio was calculated as the ratio of the household size divided by the total number of actively working adults between the ages 18 and 65 years. This is expected to have a positive relationship with beef cattle commercial off-take rate because households with more dependants who do not work need to raise more cash from cattle sales to meet basic household needs.

III. RESULTS

A. Marketing efficiency study

This study indicates that the marketing margins increased along the marketing channel and that the traders' profit as a percentages of the marketing margin was higher for trekked cattle than for the cattle that are slaughtered, dressed and then transported as beef carcasses. The producers' share of the final market price was also higher for trekked cattle than for the cattle that are slaughtered, dressed and then transported as beef carcasses. Returns to invested capital were estimated at 54 percent for the butchers and were also found to be higher at the butchers' level than at any other level in the marketing chain. For the two markets examined in Kajiado District, the returns to invested capital varied between 5 percent for

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[2] TLU is a convenient way to sum livestock quantities across species. One TLU is equivalent to one head of cattle, 10 goats, 11 sheep or 0.7 camels [22]. To get the per capita TLU we divide the TLU by the household size [23].

transported beef and 20 percent for trekked cattle, suggesting greater competition at the beef retailing end.

The high profit margins and return to invested capital for butchers indicated that most of the consumer's share of the marketing margin was taken up by the market intermediaries rather than the cattle producers, which suggests the existence of some inefficiencies in the marketing system.

B.   Descriptive Analysis

Pastoralist household socio-economic characteristics

This section presents the findings on the socio-economic characteristics of the pastoralists and beef cattle marketing dynamics for the part of the study that covered Garissa and Isiolo districts of Kenya. Out of a total of 135 pastoralist households that were interviewed, 78 were from Garissa District and 57 were from Isiolo District.

Table 1 presents the key findings on the factors that had been hypothesized to influence the commercial off-take rate for beef cattle at the household level and shows that the mean household size in the two pastoral districts was just slightly over 10 people. Isiolo District had an average household size of 10.5 while Garissa District had an average household size of 10.4. The results also show that the mean dependency ratios in the two cattle marketing sheds were slightly different, being 1: 3.4 in Garissa and 1:3.9 in Isiolo.

Table 1: Socio-economic factors that influence Beef cattle commercial off-take rate at the household level
Source: Author's survey, 2005

Narrative	Percentage per district	
	Isiolo (N=57)	**Garissa (N= 78)**
Household size		
5 and Below	14 %	8 %
6- 10	44 %	44 %
11-15	28 %	41 %
16 and above	14 %	7 %
Mean household size	10.5 persons	10.4 persons
Dependency ratio		
Below 3	74 %	51 %
3.1- 6	24 %	38 %
Above 6.1	2 %	10 %
Mean dependency ratio	3.4 ratio	3.9 ratio
Education Level		
0= illiterate	52 %	39%
1=adult/religious 'madras")	16 %	10 %
2=primary level	27 %	41 %
3=secondary level	5 %	10 %
4=above secondary level	0	0
Mean education level	0.08	1.3
Age		
Below 18	1 %	0 %
18- 35	13 %	35 %
36- 49	46 %	38 %
50- 60	28 %	18 %

61 and above	12 %	9 %
Mean age in years	48	39
Wealth in TLUs		
0-35	69 %	60 %
36-45	13 %	21%
46-60	10 %	3 %
61 and above	8 %	15 %
Mean wealth in TLUs	31	89
Off –pastoral Income (Kshs..)		
0- 10,000	32 %	78 %
10,000 – 50,000	14 %	10 %
50,000- 100,000	29 %	6 %
100,000- 200,000	15 %	2 %
200,000- 500,000	4 %	0 %
Above 500,000	6 %	4 %
Mean off-pastoral income (Kshs.)	Kshs.261,000	Kshs.160,000

Generally, the dependency ratio reflects the household obligations in term of cash requirements to meet basic needs, and especially for current consumption purposes, and partly reflects the wealth status in the sense that wealthier households would have lower dependency ratios. Therefore, Garissa District would appear to be wealthier than Isiolo District.

Education is expected to enhance the household's technical and managerial competence in decision making. The literacy level in pastoral areas is generally low, as reflected by literacy levels. The study found that 52 and 39 percent of the household heads in Isiolo and Garissa respectively were illiterate. However. most educated pastoralists were found in Isiolo where 10 percent of the household heads had completed secondary school education. However, this study found that education did not appear to play a key role in the determination of the level of off-pastoral income. This is because even though Isiolo was found to have a higher level of illiteracy than Garissa, off-pastoral income was higher in Isiolo than in Garissa. This result appears to contradict the well held assertion that there is a positive relationship between off-pastoral income level and literacy level.

Age is expected to reflect the level of accumulated experience in beef cattle keeping. The pastoralist household heads were found to be slightly older in Garissa than in Isiolo, but the mean age for the household heads in both districts was about 44 years and somewhat lower than expected. The wealth variable shows that the average TLU holding is 45, but there was a big variation between pastoralists in the two districts. Garissa pastoralists were twice as wealthier than those in Isiolo. The pastoralist households with higher off-pastoral income were found to have less wealth in terms of TLUs. The results show that the mean household off-pastoral income for both Isiolo and Garissa was Kshs. 218,763 per year, but it was found that less than 10 percent of the pastoralists actually received this level of income. About

78 percent and 32 percent of the households from Garissa and Isiolo respectively earned less Kshs.10, 000 per annum.

C. Beef-cattle herd dynamics

According to reference [20], beef cattle herd dynamics is defines as a reflection of all the events that affect the herd numbers (births, purchases, slaughters and mortality) over time. In this study, the cattle herd dynamics was evaluated for the period from December 2004 to November 2005. This period was selected to assure a one-year's production period while it was recent enough to allow for easy recall of the events under consideration by the pastoralist respondents. Table 2 gives a summary of this study's findings on herd dynamics in the sample districts.

Table 2: Mean beef cattle dynamics in the market sheds of Garissa and Isiolo in December 2004- November 2005.

Variable	Garissa	Isiolo	Overall mean
Herd size			
Total number of cattle	58	28	41.09
Male cattle	10	7	8.88
Female cattle	48	20	31.86
Purchases			
Total Number of cattle purchased	1.7	2.1	1.8963
Males	1.1	0.57	.9179
Female	0.56	1.7	1.0746
Cattle purchase rate	0.048	0.1665	.0982
Mortality			
Number of cattle mortalities	13	12.4	12.6148
Male cattle	4	3.9	4.1579
Female cattle	8	8	8.5489
Mortality rate of cattle	0.329	0.318	.3247
Reproduction			
Number of cattle calves	10.5	17.8	13.6370
Male cattle calves	3.37	7.9	5.2481
Female cattle calves	5.5	9.8	7.3233
Calving rate	0.52	0.3833	.4624
Home Slaughters			
Home slaughters	.023	.8	.4741
Male cattle	.15	.65	.3609
Female cattle	.07	.18	.1203
Household home slaughter rate	0.0118	0.0131	.0124
Transfers			
Number of cattle given out	.5	.8	.6296
Male cattle given out	.14	.18	.1579
Female cattle given out	.35	.72	.5113
Number of cattle received	.35	.26	.3185
Male cattle received	.15	.125	.1418
Female cattle received	.20	.14	.1791
Sales			
Total sales	4	6	4.9926
Male	2	4	3.3233
Female	1.4	1.7	1.5682
Commercial beef cattle off take rate	0.132	0.105	.1209

Source: Author's Survey, 2005

Overall, the pastoralist households owned an average of 41 head of cattle. The mean beef cattle number was 58 and 28 in Garissa and Isiolo respectively. In general, the herd had a ratio of 1:4 for males: females. The ratio was slightly higher in Garissa than in Isiolo. This finding corroborates those of the other studies in pastoral areas [20].

Table 2 shows that the overall cattle purchase rate is 9.8%, with female animals forming a higher proportion of the purchases. On average the households purchased 1.1 female cattle compared to 0.9 male cattle. About 61 percent of the beef cattle purchased were mature; young cattle accounted for 33 percent while the remaining 5 percent were immature animals. Compared to sales, it can be seen that more young cattle were purchased than those sold. The purposes of purchasing beef cattle were cited as restocking, resale, ceremonial and festivities. These purposes in terms of percentages were 61 percent, 23 percent, 11 percent, and 5 percent respectively. It is worth noting that 70 percent of the respondents stated that they did not purchase any cattle.

Mortality is defined as death or loss of livestock due to factors other than slaughtering. Table 2 shows that the households lost an average of 12 animals in a year. Most of the losses are mainly female. It was also observed that 77 percent of these mortalities are mature class, while 16 percent

are young animals and 7 percent are immature. The main cause of cattle mortality was drought, accounting for 76 per cent. Others are attributed to cattle disease (10 percent), wildlife (3.2 percent), floods (6.5percent), and theft (3.2 percent). The overall mortality rate observed in the study area, as indicated in Table 4.2 is 32.5 percent. There was a slight variation in mortality rates in the two districts of Garissa and Isiolo.

Table 4.2 shows that the mean beef cattle calving rate observed in the surveyed area was 14 calves. On average, the households recorded 5 male and 7 female calves born during the year. In the pastoral areas, uncontrolled breeding was practiced. Gestation period for indigenous cattle is estimated in the range of 285.5 to 297.7 days. Most of the calves were born during the long rainy season. Calving in pastoral areas is mainly determined by body condition of the female animals, which largely depends on pasture and water availability. The study observed an average calving rate of 46%. Survey data on calving pattern with Garissa having 52 percent whereas Isiolo had 38 percent. This difference can be explained in that Garissa had a high female numbers than Isiolo, that is, 48 and 20 respectively.

Home slaughters refer to those cattle that were slaughtered by the household during the year. Table 2 indicates that, on average the households slaughtered one beef cattle in 2 years. The households reported slaughtering twice as many male animals as female animals. The study also observed that the pastoralists slaughter more mature than young cattle. The overall average slaughter rate observed in the study was 1.2 percent. This corroborates with findings by reference [20].

The transferring animals by pastoral communities are risk mitigating mechanisms used against drought and other disasters [18]. Although the numbers involved are small, it however plays an important part in the maintenance of the herd structures in the pastoral areas. Table 2 indicates that, on average, the households gave out 0.6 cattle and received 0.3 cattle. More female cattle were transferred than males.

With regard to cattle sales, Table 2 indicates that more males were sold than females. On average the pastoralist households sold 5 animals per year. These sales were 90% for the beef cattle of mature class, followed by 8% for young class and 2% for immature class. The sales were done for purposes of meeting household food needs, educational needs, medical attention, and the buying of other livestock on the basis of 47%, 46%, 5% and 2% respectively.

In this study an overall commercial off-take rate of 12 Percent was observed for the entire sample of households in Isiolo and Garissa. Garissa had slightly higher rate of 13.2 percent when compared with 10.5 percent for Isiolo, and the results are consistent with the commercial off-take rate observed in other studies [20]. However, a few studies have observed higher rates (e.g. 19 percent in the case of Datoga pastoralists of Tanzania [23]).

IV. ECONOMETRIC ANALYSIS OF FACTORS INFLUENCING COMMERCIAL OFF-TAKE RATE FOR BEEF CATTLE

They survey data was used to analyzed the factors that influence household beef cattle off-take rate using empirical model specified in equation 3.13. Table 3 presents the result of the regression model. The model had R-square value of 0.702, meaning that 70 percent of the factors that influence the household beef cattle off-take rates are explained by variables in the model. The resulting coefficients had the expected signs and F-ratio statistic was highly significant for the model. The combinations of these factors suggest goodness of fit for the model.

The empirical results in Table 3 revealed that livestock marketing information coefficient in the two levels examined was not statistically significant at $p > 0.05$. This suggests that market information does not necessarily influence producers to increase the sales of beef cattle.

Table 3: Regression results for commercial beef cattle off-take rate in market sheds of Garissa and Isiolo in 2005

Narrative		Standardized Coefficients		
X	Variable	Beta	t-value	Significance
	(Constant)		.737	.463
1	Dependency ratio*	.218	3.961	.000
2	Off-pastoral income.	.119	2.235	.027
3	Herders knowledge of market prices	.039	.694	.489
4	Household size	.069	1.295	.198
5	Mortality rate of cattle	-.060	-1.034	.303
6	Calving rate of cattle*	.751	8.474	.000
7	Beef cattle price	-.049	-.831	.408
8	Wealth	.027	.513	.609
9	Cattle purchase rate*	.247	3.782	.000
10	Cattle slaughter rate	-.098	-1.017	.311
11	Use of Market information in price determination	.014	.264	.792

Dependent Variable: Commercial beef cattle off take rate; X = 1,2,….,11 = Independent variables;

R Square 0 .702; F- ratio 0. 26.372; * p>0.05.

Source: Author's Work, 2005

The results showed that cattle calving rate was a significant factor influencing the commercial livestock off-take rate. Cattle production can be increased by increasing the size of the breeding herd. Therefore, pastoralists hold onto animals especially females for future beef production. The above results show that calving rate contribute up to 0.751 in commercial beef cattle off-take rate. This implies that with the assurance of an increase of cattle numbers, the pastoralists are willing to sell off some of their livestock. These findings corroborate the findings of references [20] and [22] where it was reported that biology remains the dominant regulator of pastoralist herd size even in the most market oriented sites in northern Kenya.

Purchase rate was also an important factor in influencing the level of beef cattle off-take rate. The results show that cattle off-take rate was increased by 0.247 with an increase of 1 % of purchase rate. This implies that the pastoralists who purchase more in the market tend to have higher off-take rate than those who purchase few.

The results of the survey indicate that beef cattle commercial off-take rates among Isiolo and Garissa pastoralists are also affected positively (0.218) by the dependency ratio. The economic postulation is that household off-take rate decisions are influenced by the number of dependants in the household. This is plausible given that with increased number of members to feed coupled with other individual needs, households must sell more of its animals. This is further support by descriptive results which shows household with high dependency ratios had low off-pastoral income, meaning livestock selling was mostly the source of livelihood.

The survey results also reveal that off-pastoral income has a significant positive response on commercial beef cattle off-take rates. This can be explained in that with more off-pastoral income, households may have more money at their disposal to buy drugs and have assurance of survivability of their cattle. This will enhance planned sale of cattle. Such households will also dispose off their cattle in case of an approaching disaster. Moreover, they can restock their herd when conditions are favorable. This is possible given the fact that those pastoralists with more off-pastoral income are able to purchase cattle either for resale or for restocking.

From the above findings, it is evident that incentives to increase off-take rate should take care of these significant factors, which focus on; increasing calving rate, off-pastoral income, purchase rate and, and dependency ratio.

V. CONCLUSION, POLICY IMPLICATION AND RECOMMENDATION

The study found that livestock market information does not significantly influence commercial beef cattle off-take rates in household level both in two levels tested; awareness of market prices and utilization of the price information. The livestock off take decisions was established to be influenced by; beef cattle calving rate, off-pastoral income, household dependency ratio and household purchase rate. A plausible explanation of this conclusion is that household beef cattle off-take decision were done mainly on household food needs and education which was found to constitute about 91 % of the reasons why household sell their animals (for the descriptive statistics). Another explanation could be that the information received arrived into the isolated villages too late when it was no longer relevant or accurate. There was a strong indication of a weak flow of information in the study area during the survey period [9].

Since livestock market information was found to have not influenced beef cattle off-take rate, interventions directed towards achieving high off-take rate should focus on increasing calving rate, off-pastoral income, purchase rate and household dependency ratio rather than investing on provision of price information. This, however, does not mean that provision of market information is not important rather it may not be useful only in increasing beef cattle off-take.

The role of market information needs to be further explored. In order to clearly disentangle the contribution of market information to the welfare of the pastoral communities, the study recommends that more research be done on the composition of marketing costs, and the proportion of the costs that is associated with lack of livestock market information.

To address the problems of low beef cattle off-take rate at the household level the study recommend an increased diversification of sources of income for the pastoral communities, improving beef cattle breeds, and improving pastures.

To increased calving rate, the study recommends that pastoralists adopt and keep beef cattle breeds with high calving rates. To sustain such superior breeds in pastoral areas, strategies must be put in place to support this intervention. Practical strategies include provision of increased veterinary services, including compulsory vaccination of livestock and reviving of cattle dips for disease control, which have been lacking or are rare and poorly distributed in pastoral areas. Provisions of extension services geared towards improved pasture through promotion of sound range management practices in pastoral areas would also support this cause. The use of LEWS weather reports by pastoralists should also be encouraged; this should be coupled with the promotion of emergency sales of livestock in good time to avert losses occasioned by drought. The revival of Kenya Meat Commission (KMC) as a major market and the proper management of the Agricultural Development Corporation (ADC) to serve as an emergency outlet with livestock feedlot facilities towards playing a leading role in this aspect.

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