



East Africa Dairy Development

In partnership with



COST OF MILK PRODUCTION IN KENYA

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1. INTRODUCTION

The bulk of milk in Kenya is produced by smallscale producers who supply about 70% of marketed milk (SDP, 2005). This indicates the significance of dairy enterprise in supporting livelihoods in rural areas and has attracted attention of various stakeholders in dairy sector interested in poverty reduction. Success stories have been reported where dairy has been instrumental in provision of food, income and creation of employment to over 1.8 million small-scale farms (Omiti et al, 2006). Continued support geared towards enhancing small-scale competitiveness is therefore vital in the industry.

A number of studies have been conducted to evaluate profitability of dairy enterprise in Kenya and have yielded varying results. Study conducted in Nyeri by Sellen et al (1990) estimated a return of Ksh. 3.1 per litre. Staal et al (2005) estimated cost of production per litre in Kiambu, Nyandarua and Nakuru at Ksh.17.20, Ksh 11.90 and Ksh 13.30 per litre respectively. Since the inception of East Africa Dairy Development (EADD) project, there is inadequate information regarding cost of production and profitability of smallholder dairy enterprises in project sites and therefore there is a need to assess the competitiveness of dairy farming. The study was therefore conducted:

1. To assess the cost of production and profitability of the dairy enterprise
2. To identify which cost components EADD interventions should target in order to enhance profitability of the dairy farms in EADD project sites.

2. METHODOLOGY

Purposive sampling was applied in selection of three hubs from each production system. A list of all farmers was obtained from every hub and farmers stratified according to scale of operation. A random sample of seven small-scale farmers and three medium-scale farmers was drawn per hub¹. Table 1 below defines small-scale farmers and medium-scale farmers as per the study. Twenty two farmers were drawn from extensive system while twenty six were selected from semi-extensive system Table 2.

Table 1: Definition of famers according to scale of operation

¹Initial sampling procedure was to select 3 medium and 7 small-scale farmers per hub, but due to survey limitations, it was achieved only in Longisa. Tanykina and Tindiret had no medium scale farmers while Sirikwa Metkei and Kabiyeet had 5, 7 and 4 medium scale farmers respectively.

Scale of operation	Definition
Small-scale farmers	Small-farmers comprised of farmers owning three cows and less
Medium-scale farmers	Medium-scale farmers comprised of farmers owning four cows and more

The threshold was determined by the mean number of cows owned from the baseline survey report on dairy production and marketing (EADD, 2010). Forty-eight farmers were interviewed as detailed in Table 2 below. Data from four sites was not collected and two sites had not sampled the required number of farmers hence low number of respondents. The four sites will be considered for the second phase of the survey to enable comparison of data between extensive and intensive systems as originally designed.

Table 2: Sample size for cost of milk production survey

	Production Systems ²		Total
	Extensive	Semi-Extensive	
Hubs per system	3	3	6
Small-scale farmers	4	12	16
Medium- scale farmer	18	14	32
Total sample size	22	26	48

Milk production

An estimate of total milk production in the last 3 months preceding the survey was conducted based on recall but using a carefully designed set of questions that captured milk production at lactation, at time of interview and the day prior to the interview. These were collected for every lactating cow to estimate milk yield using the area under the lactation curve. Details are provided in Annex1.

Revenue computation

Revenue was calculated as the sum of milk consumed at home, milk sales as well as cattle sales and milk given to labourers and calves. The milk sold was valued using prices from the various marketing channels but the reported price is the mean from the various market outlets for every hub. Milk consumed at home was valued at respective hub's price.

Cost computation

Costs consisted of variable costs, fixed costs, cattle mortalities, milk spoilage, milk provided to labourers and calves. Cattle mortalities expenses were calculated as value of the herd multiplied by 8.5% which is Kenya's mortality rate calculated from baseline survey data and apportioned for three months period. Fixed costs included depreciation of machines and equipment, buildings and maintenance of buildings. Variable costs comprised hired labour, feeds, animal health inputs, breeding costs, extension and milk transport costs. However, cattle purchases were not included in computing expenses. Details of calculations are provided in Annex 3.

Analytical procedure

² Extensive production systems are defined as systems where cattle rely on grazing with little use of purchased inputs (including feed). Semi-extensive systems are characterized by grazing with some cut and carry and use of commercial feed.

Partial budget analysis was used to compute profits from different hubs. Profits were defined as the difference between all the revenues and all the costs.

Two scenarios were considered: mean revenues were computed using revenue from both milk and cattle sales generated within the last three months. The second approach was to use revenue generated from milk only Table 3. Profitability was compared between hubs, farmers' scales of operation and production systems. Cattle sales are infrequent and therefore comparison of profits with and without cattle sales was done to provide an insight on variation of the enterprise profitability under the two scenarios. Milk given to calves and labourers is an expense but it is also included as revenue since it is a product of the farm. Comparison of mean revenues, costs and profits was done between production systems and scales of operations using t-tests to determine whether the means were significantly different.

Table 3: Revenue and cost components included in calculations, per option

	Revenues included in calculations	Costs included in calculations
Option 1	<ol style="list-style-type: none"> 1. Milk sales 2. Milk consumed by household 3. Milk given to calves and labourers 4. Sale of animal 	Variable Costs Fixed costs Milk given to calves and labourers Milk spoilage Mortality
Option 2	<ol style="list-style-type: none"> 1. Milk sales 2. Milk consumed by household 3. Milk given to calves and labourers 	Variable Costs Fixed costs Milk given to calves and labourers Milk spoilage Mortality

Note: Given the survey limitations, non-marketed benefits such as draught power, manure used in the farm and benefits derived from cattle as form of savings and insurance were not included in computation of revenue.

3. RESULTS ON PROFITS PER LITRE ACROSS HUBS

Table 4 presents results from Option 1 (see Table 3) while Table 5 presents results from Option 2.

Profit per litre from milk and cattle revenue combined

The Option 1 analysis found when comparing means between extensive and semi-extensive production system. On average all hubs recorded profits although some individual farms recorded losses. Tanykina was the best performing hub in terms of profitability as a result of higher revenue from cattle sales.

Table 4: Average total revenues and costs across hubs

KSh. per Litre	Extensive hubs						Semi-extensive hubs					
	Sirikwa	N	Sot	N	Tindiret	N	Metkei	N	Kabiyet	N	Tanykina	N
Price per litre	24.5	9	22.7	10	30.3	9	25.8	10	24.5	6	27.3	6
Milk revenue	24.1	10	22.4	10	27.7	10	25.8	9	23.7	5	27.3	7
Cattle revenue	1	10	11.6	10	11.6	10	5.1	9	1.7	5	16.5	7
Total revenue	25	10	34	10	39.3	10	30.9	9	25.4	5	43.8	7
Variable cost	5.1	10	11.4	10	4.5	10	3.7	9	7.5	5	7.2	7

Fixed cost	0.5	10	0.6	10	0.8	10	0.4	9	0.3	5	1.1	7
Milk given out	0	10	2.1	10	0.8	10	0	9	1	5	0.8	7
Calf milk	3.3	10	0.5	10	3.2	10	2	9	0	5	0	7
Mortalities	1.5	10	6.4	10	1.7	10	2	9	6.1	5	1.6	7
Milk spoilage	0	10	0	10	0	10	0	9	0	5	0	7
Production cost	10.3	10	21	10	11	10	8.1	9	14.9	5	10.8	7
Profit per litre	14.6	10	13	10	28.2	10	22.8	9	10.8	5	33	7

Profit per litre from milk revenue only

Farmers from Sot, Tindiret and Tanykina experienced drastic reduction in profitability when revenue was calculated from milk sales only (Table 5) depicting the significant contribution of cattle sales to profitability of dairy enterprise in these three hubs, therefore cattle sales is an important determinant of profitability in dairy.

Table 5: Average milk revenues and costs across hubs

KSh. per Litre	Extensive hubs						Semi-extensive hubs					
	Sirikwa	N	Sot	N	Tindiret	N	Metkei	N	Kabiyet	N	Tanykina	N
Milk revenue	24.1	10	22.4	10	27.7	10	25.8	9	23.7	5	27.3	7
Production cost	10.3	10	21	10	11	10	8.1	9	14.9	5	10.8	7
Profit per litre	13.7	10	1.4	10	16.6	10	17.7	9	8.8	5	16.5	7

Percentage contribution of milk and cattle sales to dairy enterprise

Figure 1 below shows the distribution of cattle and milk revenues across the hubs. Sirikwa was the hub where cattle sales were contributing least to dairy enterprise revenue.

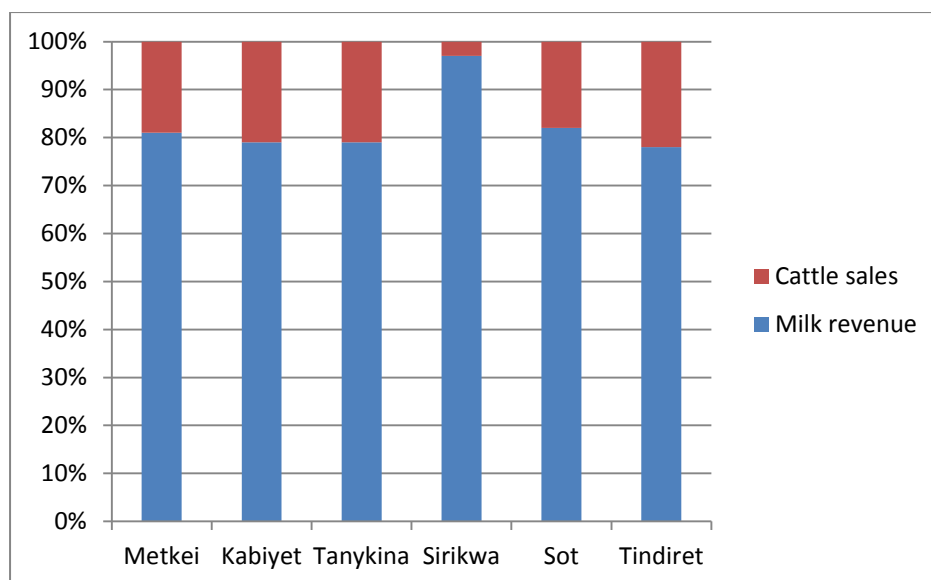


Figure 1: Percent contribution of cattle sales and milk sales across hubs

4. COMPARISON OF PROFITS BETWEEN DIFFERENT TYPES OF FARMERS AND PRODUCTION SYSTEMS

a. Comparison of revenue, costs and profits between the small-scale and medium-scale farmers

Revenues

Small-scale farmers were generating higher revenue from milk sales than medium scale farmers; this was also the case when revenue was calculated from cattle sales Table 6. Small-scale farmers recorded higher frequency of cattle sales than medium scale farmers.

Costs

There was no significant difference in variable, fixed and other costs between the small and the medium scale farmers as shown in Table 6.

Profits

Smallscale farmers were making higher profits, when revenue was calculated from combined milk and cattle sale (Option 1 in Table 3). There was however no significant difference in profit per litre when revenue was calculated from milk sales only (Option 2 in Table 3).

Table 6: Mean revenue, costs and profits in medium- and small-scale farms

KSh. per litre	Small-scale	N	Medium-scale	N	T-test
Consumed milk	4.9	33	4	18	-1.1092
Milk sales	18.2	33	17.9	18	-0.2426
Total Milk revenue	25.6	33	24.3	18	-2.2995**
Cattle revenue	10.6	33	3.4	18	-1.8064*
Total Revenue	36.2	33	27.7	18	-2.0737**
Variable cost	6.1	33	7.3	18	0.4849
Fixed cost	0.6	33	0.58	18	-0.1178
Milk given out	0.78	33	0.75	18	-0.0707
Milk to calves	1.8	33	1.6	18	-0.1615
Milk spoilage	0	33	0	18	
Mortalities	2.6	33	3.9	18	1.0433
Total Cost	12	33	14.2	18	0.6262
Profit from milk only ³	13.8	33	10.1	18	-0.9698
Total Profit ⁴	24.3	33	13.5	18	-2.0592**

b. Comparison of revenue, costs and profits between the extensive and semi-extensive production systems

Revenues

Farmers from the extensive production system were generating significantly higher revenues from cattle sales than farmers from semi-extensive production system Table 7. There was however no significant difference in revenue from milk sales.

Costs

Farmers from the extensive production system were incurring higher costs from milk given to labourers and mortalities than those from semi-extensive production system, while farmers from

³ Revenues used in calculation do not include cattle sales

⁴ Revenues used in calculation include sale of milk and cattle

semi-extensive production system were incurring higher costs from milk given to calves. Nevertheless, there was no significant difference in total production cost per litre Table 7.

Profits

There was no significant difference in profits when revenue was calculated using sales from milk and cattle combined (Option 1 in Table 3) and when revenue was calculated from milk sales only (Option 2 in Table 3) as shown in Table 7.

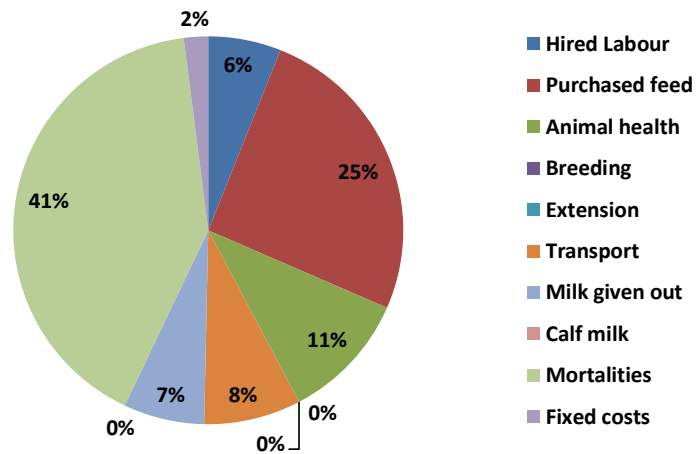
Table 7: Mean revenue, costs and profits in extensive and semi-extensive production systems

KSh per litre	Extensive	N	Semi-extensive	N	T-test
Consumed milk	5.1	23	4.5	25	-0.8588
Milk sales	16.7	23	18.2	25	1.1748
Total Milk revenue	24.3	23	25.4	25	1.6742
Cattle revenue	11.1	24	3.3	25	-1.8857*
Total Revenue	35.4	23	28.6	25	-1.5658
Variable cost	7.3	23	5	25	-1.0786
Fixed cost	0.4	23	0.7	25	1.2863
Milk given out	1.4	23	0.4	25	-2.2738**
Milk to calves	0.9	23	2.3	25	1.9227*
Milk spoilage	0	23	0	25	-
Mortalities	3.9	23	2	25	-2.2738**
Total cost	14	23	10.3	25	-1.1997
Milk Profit only	10.4	23	15.1	25	1.4753
Total Profit	21.5	23	18.4	25	-0.6168

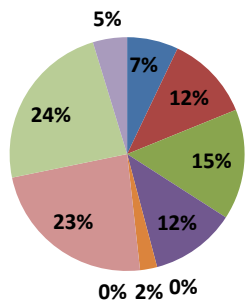
5 DISTRIBUTION OF COSTS BY HUB

5.1 Distribution of Costs per litre in semi-extensive production system hubs

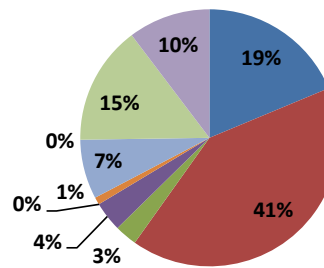
Mortalities and purchased feeds were the major drivers of cost of production Figure 2. Additionally, farmers from Metkei were incurring a substantial cost arising from calf milk while those from Tanykina were incurring a substantial cost on hired labour. The project should devise strategies to reduce mortalities and enhance better utilization of locally available feed resources to improve profitability in these hubs. Equally, optimal use of calf rations should be encouraged to assist farmers from Metkei reduce calf milk cost component.



Distribution of cost per litre in Kabiye



Distribution of cost per litre in Metkei

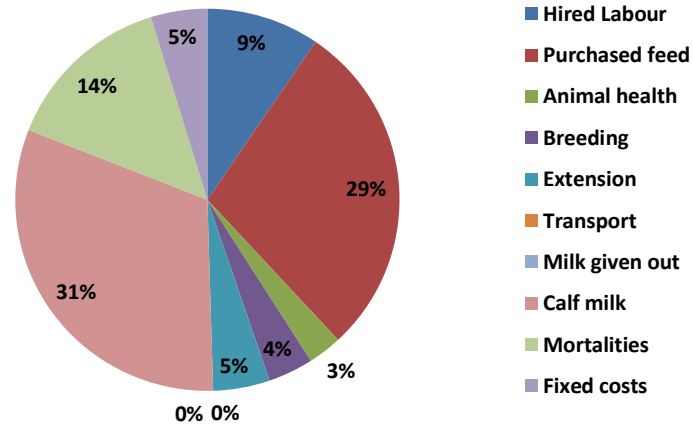


Distribution of cost per litre in Tanykina

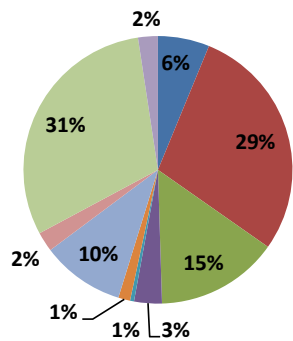
Figure2: Distribution of cost per litre in semi-extensive hubs

5.2 cost of milk production in extensive hubs

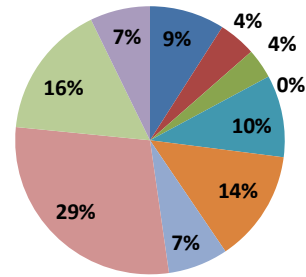
Mortalities, calf milk and purchased feed costs were the major cost drivers in the hubs that represented extensive production system. Contribution of purchased feeds was high in Sirikwa and Sot while contribution of calf milk was high in Tindiret and Sirikwa. Mortality cost was highest in Sot. EADD should thus design interventions aimed at reducing costs related to mortalities and purchased feeds in these hubs.



Distribution of cost per litre in Sirikwa



Distribution of cost per litre in Sot



Distribution of cost per litre in Tindiret

Figure 3: Distribution of cost per litre in Extensive hubs

Conclusion

The cost of production survey found out that, in Kenya there were no significant differences in total cost of production between small and medium-scale farmers, and between farmers practicing extensive and semi-extensive system of production. However farmers practicing extensive production system were incurring higher costs from cattle mortality and milk to labourers than farmers practicing semi-extensive production system. Farmers practicing semi-extensive production system, on the other hand, were incurring higher costs emanating from calf milk.

Small-scale farmers were found to be generating higher revenue from both milk and cattle sales than medium-scale farmers. As a result they were found to generate higher profits. This shows the significant contribution of cattle sales towards dairy enterprise profitability and this was demonstrated by high profits in Tanykina where cattle sales were contributing highest revenue per litre among the hubs.

The EADD baseline survey findings in 2010 showed that East Coast fever, diarrhoea and foot and mouth disease were the most important causes of cattle deaths in Kenya (EADD, 2010). Strategies should therefore be developed to improve the capacity of both farmers to reduce this cost through the hubs. This could be through enhancing their management practices like improved tick control and other disease preventive measures. Improved and better linkage to animal health service providers will also enhance their competitiveness.

Cost of feed was found to be a major component in both production systems. This indicates that the project should assist farmers to make better use of their own feed resources to produce increased quality and quantity feeds optimally, this will likely assist in enhancing profitability. Optimal use of calf rations should also be encouraged to enable farmers save on the cost of milk given to calves.

Annex1: Three months milk yield estimation

Milk Yield Calculation;

A regression was done for milk production levels the day preceding the survey and at calving against time, for the different breeds. Lactating cows were grouped into two categories per breed;

- Those whose current lactation length is greater or equal to three months
- Those whose current lactation length is less than three months

The area under the lactation curve was calculated for these categories to get three months milk yield estimates.

Annex 2: Revenue and cost components included in calculations, per option

	Revenues included in calculations	Costs included in calculations
Option 1	<ul style="list-style-type: none"> 5. Milk sales 6. Milk consumed by household 7. Milk given to calves and labourers 8. Sale of animal 	<ul style="list-style-type: none"> Variable Costs Fixed costs Milk given to calves and labourers Milk spoilage Mortality
Option 2	<ul style="list-style-type: none"> 4. Milk sales 5. Milk consumed by household 6. Milk given to calves and labourers 	<ul style="list-style-type: none"> Variable Costs Fixed costs Milk given to calves and labourers Milk spoilage Mortality

Annex 3: Three months total cost computation

Cost	Components
Variable costs	Hired Labour <ul style="list-style-type: none"> • Casual wage • Monthly wage
	Purchased Feeds <ul style="list-style-type: none"> • Purchased fodder/forage • Concentrates • Minerals • Water
	Animal health <ul style="list-style-type: none"> • Deworming • Vaccination • Tick control • Curative treatments • Milking salve • Teat disinfection • dehorning
	Breeding <ul style="list-style-type: none"> • AI and Bull services
Fixed costs	Depreciation <ul style="list-style-type: none"> • Machines • Equipment and tools

	<ul style="list-style-type: none"> • Buildings • Other structures
	Maintenance <ul style="list-style-type: none"> • Buildings • Other structures
Other costs	<ul style="list-style-type: none"> ➤ Milk spoilage ➤ Milk given to labourers ➤ Milk given to calves ➤ Cattle mortality

Annex 4: Average variable, fixed and other costs per litre in hubs

Cost per litre in KSh	Kabiyet		Metkei		Sirikwa		Sot		Tanykina		Tindiret	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
Hired Labour	0.9	5	0.6	9	1	10	1.3	10	2	10	0.9	10
Purchased feed	3.8	5	1	9	3	10	6	10	4.4	10	0.5	10
Animal health	1.6	5	1.3	8	0.3	10	3.1	10	0.3	9	0.4	9
Breeding	0	5	0.9	8	0.4	10	0.7	10	0.4	9	0	9
Extension	0	5	0	7	0.5	9	0.1	10	0	5	1.1	5
Transport	1.2	5	0.2	9	0	10	0.3	10	0.1	10	1.5	10
Milk given out	1	5	0	9	0	10	2.1	10	0.8	10	0.8	10
Calf milk	0	5	2	9	3.3	10	0.5	10	0	10	3.2	10
Mortalities	6.1	5	2	9	1.5	10	6.4	10	1.6	10	1.8	10
Fixed costs	0.3	5	0.4	9	0.5	10	0.5	10	1.1	10	0.8	10

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