EAST AFRICAN DAIRY DEVELOPMENT PROJECT

BASELINE SURVEYS

REPORT NO. 5

DAIRY PRODUCTION AND MARKETING



MARCH 2010

East Africa Dairy Development

In partnership with

HEIFER INTERNATIONAL | ILRI INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE | TechnoServe BUSINESS SOLUTIONS TO POVERTY | ABS | World Agroforestry Centre TRANSFORMING LIVES AND LANDSCAPES

TABLE OF CONTENTS

1 INTRODUCTION 4
2 FARM ASSETS 5
2.1 Herd Size 6
2.2 Herd structure and dynamics 7
2.3 Breed types 9
2.4 Other types of livestock 11
2.5 Farm size and land ownership 12
3 INPUTS AND COSTS 15
3.1 Labour costs 15
3.2 Expenditure on purchased feed, fodder and concentrates 18
3.3 Cost of watering cattle 19
3.4 Cost of cattle housing 20
3.5 Cost of animal health services 21
3.6 Costs of extension services 22
3.7 Cost of breeding services 23
4 OUTPUTs and REVENUEs 25
4.1 Milk price and milk marketing 25
4.2 Milk production and use 26
4.3 Revenue from milk sold 27
4.4 Revenue from cattle sales 29
4.5 Revenue from manure sales 30
5 PERFORMANCE ASSESSMENT 30
5.1 Milk yield per cow 30
5.2 Gross margin and cost of milk production per litre 31
6 SUMMARY AND CONCLUSIONS 33

TABLE OF FIGURES

Figure 1: Average cost of family and hired labour on cattle activities ($ per year per household) 16
Figure 2: Average milk prices by buyer ($ cent per litre) 25
Figure 3: Percentage quantity of milk sold to different buyers per day by country 26
Figure 4: Average revenue from cattle sold in the previous 12 months ($ per household) 30
Figure 5: Average milk produced per year per TLU cow 31

TABLES OF TABLES

Table 1: Number of cattle kept per household by hub in tropical livestock units (TLUs) 7
Table 2: Total number cattle kept and proportions of cattle purchased by cattle type (number) ... 8
Table 3: Total cattle by hub (number) 9
Table 4: Average number of cattle kept, bought and sold per household by genotype (number/household) 10
Table 5: Ownership of other livestock species per household (average livestock kept) 11
Table 6: Average land size (acres) farmed, owned and rented (in and out), by country and hub 12
Table 7: Average proportion of family and hired labour time allocated to dairy activities and other livestock activities 17
Table 8: Average cost of feed, fodder and concentrates per household ($ per year) 18
Table 9: Cost of watering cattle ($ per year per household) 19
Table 10: Average cost of depreciation ($ per year) 20
Table 11: Annual cost health services ($ per year) 22
Table 12: Costs of extension services ($ per year) 22
Table 13: Average annual cost of breeding services ($ per year) 23
Table 14: Amount of milk produced, sold, consumed and spoilt per year per household (in litres) 27
Table 15: Annual milk revenue per household ($) 28
Table 16: Summary performance indicators per annum 32

1 INTRODUCTION

The East Africa Dairy Development Project (EADD) is a regional industry development program, funded by the Bill & Melinda Gates Foundation and implemented by a consortium of partners. It is currently operating in Kenya, Uganda and Rwanda. The overall goal of the EADD project is to transform the lives of 179,000 families or approximately one million people by doubling household dairy income in ten years through integrated interventions in dairy production, market-access and knowledge application. In order to assess farmers and community's situation before the project starts and identify key constraints and opportunities that farmers and other agents, baseline survey was conducted in some of the selected areas of the project sites in the year 2008 and 2009. Data obtained from baseline survey would also be important while carrying out impact assessment by the end of the project term.

The project sites were selected using GIS layers based on two indictors: climatic characteristic (LGP or Length of Growing Period) and access to urban centre (as an indicator of market access). Based on the two indicators, the domain within which the project hubs/sites were identified. At least one site was selected from each domain. Out of the 42 project sites, a total of 11 sites were surveyed (3 in Kenya, 3 in Rwanda and 5 in Uganda). An additional 1 control sites was also surveyed in each country. The baseline consisted of three different surveys. The first one is a community level survey which was conducted through Participatory Rural Appraisal (PRA). This involved group discussions consisting about 20-25 persons from each area, mainly to capture how the community identifies the poor households and target project beneficiaries. The second survey is a household survey which involved use of GIS instrument to randomly sample and interview 75 households from each of the selected survey site. The third survey is a market agent survey conducted to assess the baseline conditions of business service providers in the project sites. 20 market agents surveyed in each site.

This report uses data collected during the baseline survey of the EADD and provides details of an economic performance analysis of the dairy farms surveyed. It focuses on production and marketing aspects to establish a benchmark against which future economic performances of the project beneficiaries will be assessed during the project monitoring, review and final impacts evaluations.

In order to undertake a sound economic performance analysis, it was important to broaden the scope of the report and cover wider sets of production conditions. These include discussion on the status of farm assets: herd size, structure, and herd dynamics as well as farm size and landholding. In addition to the asset basis of the dairy farms, the report covered institutional aspects such as milk market outlets and variations of milk prices by types of buyers. The analysis of the stocks of farm assets and marketing conditions is intended to facilitate the background to dairy economic performance analysis. The latter is undertaken by calculating a gross margin for the sampled farms in each of the project hubs. This involved separate analysis of a series of production costs and farm revenues from different but interrelated dairy farm activities. The gross margin is then obtained as a difference between the total revenues and total costs.

The economic performance analysis of the dairy farms is undertaken using mainly descriptive methods by displaying results of selected sets of indicators in tables and figures. However, it was noted that there were considerable differences among individual farms, hubs and countries across a range of indicators. In order to clearly show such disparities, we have frequently displayed summary statistics with a range of measurements for a particular variable. This involves presenting survey results for a particular indicator in terms of alternative statistical measures (minimum, median, mean, maximum, and standard deviation). Wherever such summary statistics are presented, it would be important to pay attention specifically to the differences between the “median” and the “mean” averages. This enables one to see the true picture more clearly since the median average indicates the position of 50% of the sampled respondents for whom the statistics are computed while the mean indicates the simple average for the variable.

The remaining part of this report is structured as follows. Section 2 presents the asset base of dairy households. Section 3 discusses the costs of inputs while section 4 focuses on farm outputs and streams of revenues. Section 5 brings together the cost and revenue elements and presents overview of selected performance indicators. Section 6 will summarise the report.

2 FARM ASSETS

This section discusses details of the assets of the farms and provides the basis for understanding production costs, and flows of farm outputs and revenues.

2.1 Herd Size

It is important to begin with the average herd size owned by households who reported to have cattle. We use Tropical Livestock Unit (TLU)[1] per household leaving details of cattle types and breeds for discussion further below. TLUs provide concise and summarized measures to understand stocking rates per farm and the extent to which households in project hubs rely on livestock farming as important source of livelihood (see Table 1 below).

From the total number of farm households interviewed, the percentage of those who reported to have at least one head of cattle is 51%, 56% and 87% in Uganda, Rwanda and Kenya respectively, as described in EADD Baseline Report 1.

In order to show variations in cattle ownerships, a number of measures of averages and dispersions are presented. For example, the cattle ownership for Uganda ranged from 0.3 to 1,120 TLUs, with a standard deviation of 80.5. The relatively large range in ownership and high standard deviation indicate that there are large variations in cattle ownership among the farming households. In such circumstances, the arithmetic "mean" average, 21.9 TLUs for Uganda, is clearly biased towards the larger figure in the range but the "median", 4.3 TLUs, provides a better representation of the average cattle ownership. The median figure for Uganda, for example, indicates that about 50% of those who have reported to have cattle in Uganda actually own less than 4.3 TLUs.[2]

The overall average figures for countries may hide large differences among districts. In Uganda, the median and mean averages, respectively, are 2.5 and 4.3 TLUs in Masaka to 30.6 and 57 TLUs for Kakooge. Similarly, there are notable divergences in cattle ownership among hubs in Rwanda and Kenya.

[1] TLU stands for Tropical Livestock Unit calculated by multiplying TLU factor and TLU breed factor. For example TLU factor for a cow is 1, while TLU breed factor for a Holstein-Friesian (pure) breed is 1.6. If a farmer has got 1 Holstein –Friesian pure cow, total TLU of that cow is 1*1.6=1.6

[2] For example, if we rank the 31 respondents in Masaka who reported to have cattle according to their herd size (from the smallest to the largest or vice versa), then the household who would be located in the middle, the 16th household in the list, would own 4.3 TLUs.

Table 1: Number of cattle kept per household by hub in tropical livestock units (TLUs)

	N	Min	Median	Mean	Max	St.Dev
Uganda	**230**	**0.3**	**4.3**	**21.9**	**1120.0**	**80.5**
Bbaale	40	0.7	9.3	33.8	249.6	57.1
Luwero	28	0.3	3.2	7.6	51.2	11.8
Masaka	31	0.7	2.5	4.3	25.4	5.6
Mukono	43	0.7	3.0	4.4	16.4	4.1
Kakooge	52	0.8	30.6	57.0	1120.0	156.2
Bumanya	36	0.7	3.3	5.1	27.8	5.6
Rwanda	**169**	**0.7**	**3.6**	**13.3**	**187.7**	**24.5**
Bwisanga	43	0.7	1.8	8.0	187.7	28.8
Kabarore	40	0.7	11.9	21.5	151.0	33.5
Mbare	53	0.8	14.1	18.2	62.1	15.8
Nyagihanga	33	0.7	1.3	2.4	19.6	4.1
Kenya	**458**	**0.3**	**5.2**	**8.9**	**678.0**	**32.5**
Kabiyet	70	1.4	8.3	11.8	76.2	11.3
Metkei	71	1.3	6.1	7.6	38.1	6.9
Siongiroi	69	0.7	7.2	18.1	678.0	80.9
Siaya	43	0.3	2.7	4.1	19.8	4.3
Soy	67	0.7	5.2	9.7	91.1	13.6
Kandara	65	1.0	2.4	2.8	8.6	1.7
Kaptumo	73	1.0	5.0	6.0	24.4	4.8

2.2 Herd structure and dynamics

Table 2 presents the herd structure by animal category for households who reported to have at least one head of cattle. The number of observations, cattle keeping households, for each country remains as in Table 1 but here district details are excluded to avoid cluttering the table. It is useful to start by focusing on the proportion of cows in the total number of cattle kept, as this proportion is a good indicator of household milk orientation (as opposed to keeping cattle for other reasons including meat, manure and traction). This was given as 37%, 39%, and 45% in Uganda, Kenya and Rwanda respectively. If we include heifers, then these ratios increase to 55%, 59%, and 73% in that order. It should be noted that the proportion of cows and heifers is the highest in Rwanda, perhaps because of the government policy of "one-cow per family" already having some effect on the herd structure.

In order to show changes in the overall herd size and its structure, the number of cattle bought and sold during the previous twelve months of the survey date was expressed as a percentage of the total cattle kept by households as of the survey date. This reveals some interesting points. First, focusing on changes in the overall herd size in the three countries, the number of cattle sold consistently exceeds the number of cattle bought in the three countries. Unless births during the year preceding the survey date exceeded losses due to deaths, then the fact that sales

exceeded purchases may suggest that there was some degree of de-stocking. The rate of de-stocking (percentage bought less percentage sold) is the highest in Rwanda (-3%) and the smallest in Uganda (-0.8%).

Table 2: Total number cattle kept and proportions of cattle purchased by cattle type (number)

		Cattle Kept		Change (% cattle kept)	
Country		**No. kept**	**Total**	**Bought**	**Sold**
Uganda (N=230)	Bulls	856	16.6	0.5	1.8
	Castrated adult	177	3.4	2.3	9.0
	Immature males	361	7.0	9.4	6.1
	Cows	1889	36.6	0.8	2.6
	Heifers	974	18.9	2.3	1.8
	Pre-weaning male	425	8.2	0.2	0.5
	Pre-weaning fema	485	9.4	0.4	0.0
	Total	**5167**	**100.0**	**1.6**	**2.4**
Rwanda (N=169)	Bulls	77	3.2	14.3	35.1
	Castrated adult	23	1.0	4.3	8.7
	Immature males	82	3.4	4.9	25.6
	Cows	1076	45.2	1.7	5.2
	Heifers	655	27.5	5.2	5.5
	Pre-weaning male	199	8.4	1.0	0.0
	Pre-weaning female	270	11.3	0.0	0.0
	Total	**2382**	**100.0**	**2.9**	**6.0**
Kenya (N=458)	Bulls	356	9.4	3.4	14.3
	Castrated adult	203	5.3	4.4	15.8
	Immature males	208	5.5	12.0	14.9
	Cows	1490	39.1	3.1	5.4
	Heifers	764	20.1	6.7	5.2
	Pre-weaning male	350	9.2	0.6	0.9
	Pre-weaning fema	436	11.5	0.7	1.6
	Total	**3807**	**100.0**	**3.9**	**6.4**

In terms of changes by cattle types, the largest de-stocking happened to immature males and bulls in Rwanda (-21% each) and castrated adult male and bulls in Kenya (-11% each) . It is important to note that heifers are the only category that experienced consistent re-stocking rate in most countries, with the largest restocking rate happening in Kenya (2.5%) but a marginal destocking in Rwanda (-0.3%). These trends show a clear movement towards dairy intensification in the three countries, movement that EADD can capitalise on.

2.3 Breed types

Table 3 below summarises the number of cattle by breed type. The data is organised to show existing stock and changes in stock by breed types, as in the previous section, through purchases and sales during the previous 12 months. This is intended to provide further details and shed some light on the extent to which the herd dynamics discussed with regard to cattle type (Table 2 above) could possibly be explained by changes in the breed structure.

Starting with the structure of the existing stocks, the proportion of pure and cross breeds constitute, respectively, in Kenya 2.8 and 54 percents, in Rwanda 9 and 28 percent and in Uganda 12 and 15 percents respectively. It should be noted that the relatively high figures for pure breed in Uganda is due to about 600 exotic bulls in Kakooge which are kept for beef production. Even with this, as one would expect, the survey results confirm that Kenya has the highest and Uganda the lowest proportion of improved breeds. The proportion of pure breeds in Rwanda is even higher than the corresponding figure for Kenya, although much of this is explained by relatively large proportion of pure breed cattle in Bwisanga hub.

Table 3: Total cattle by hub (number)

		Cattle kept			Cattle bought			Cattle sold		
Country	N	Pure	Cross	Local	Pure	Cross	Local	Pure	Cross	Local
Uganda	**230**	**618**	**781**	**3768**	**2**	**9**	**71**	**4**	**18**	**100**
Bbaale	40	0	604	793	1	1	7	0	9	23
Luwero	28	0	14	230	0	0	6	0		9
Masaka	31	14	9	123	1	1	6	3		5
Mukono	43	3	55	144	0	6	6	1	7	7
Kakooge	52	600	99	2272	0	1	37	0	1	52
Bumanya	36	1	0	206	0	0	9	0	1	4
Rwanda	**169**	**214**	**676**	**1492**	**14**	**14**	**42**	**2**	**30**	**110**
Bwisanga	43	145	64	101	4	2	8	1	3	7
Kabarore	40	23	344	527	2	5	6	1	11	30
Mbare	53	45	256	777	7	5	12	0	16	66
Nyagihanga	33	1	12	87	1	2	16	0		7
Kenya	**458**	**108**	**2054**	**1645**	**7**	**99**	**42**	**9**	**186**	**50**
Kabiyet	70	12	727	3	0	24	0	3	36	0
Metkei	71	39	226	268	1	11	9	1	17	12
Siongiroi	69	18	261	968	1	15	16		15	11
Siaya	43	3	26	173	1	1	13		1	14
Soy	67	21	446	49	1	12	1	3	40	2
Kandara	65	3	144	2	3	21	0	1	37	0
Kaptumo	73	12	224	182	0	15	3	1	40	11
Total	**857**	**940**	**3511**	**6905**	**23**	**122**	**155**	**15**	**234**	**260**

If we turn our attention to cattle purchases and sales by breed type, the proportion of local breeds sold exceeds those that are purchased by a considerably large amount in Rwanda and Uganda. In Kenya, cross breeds constitute a large proportion of the herd and the number sold in this category is greater than the number purchased. This could be explained by the possibility of existing viable markets in improved breeds kept by Kenyan farmers who may sell bulls and cows for culling or even heifers to other farmers. Overall, more pure breeds are bought than sold in Rwanda, consistently in all districts, although if one considers pure and cross together, equal number of animals are sold and purchased. However, more cross and local breeds are sold than bought in most districts in Kenya and Uganda.

While Table 3 above provides total stock of cattle by breed in each hub, Table 4 below displays herd size by breed type per household in each hub. In Kenyan hubs, on average about one out of three households own a pure breed while in Uganda, excluding the case of Kakooge noted earlier, this comes to about one out of ten households. Although the average results for Rwanda shows that farmers in Rwandan hubs own at least one pure breed, this is far from being representative since much of this is explained by a unique situation in Bwisanga where the number of pure breeds is rather large. Excluding Bwisanga, one out of two households own a pure breed.

Table 4: Average number of cattle kept, bought and sold per household by genotype (number/household)

	N	Pure	Cross	Local
Uganda	**230**	**2.7**	**3.5**	**17.1**
Bbaale	40	0.0	15.4	20.6
Luwero	28	0.0	0.5	8.8
Masaka	31	0.6	0.3	4.3
Mukono	43	0.1	1.6	3.7
Kakooge	52	11.5	1.9	45.4
Bumanya	**36**	0.0	0.0	6.1
Rwanda	**169**	**1.4**	**4.3**	**9.7**
Bwisanga	43	3.5	1.6	2.7
Kabarore	40	0.7	9.0	14.1
Mbare	53	1.0	5.2	16.1
Nyagihanga	33	0.1	0.4	3.3
Kenya	**458**	**0.3**	**5.1**	**3.8**
Kabiyet	**70**	0.2	11.2	0.0
Metkei	71	0.6	3.6	4.1
Siongiroi	69	0.3	4.2	14.4
Siaya	43	0.1	0.7	4.7
Soy	67	0.4	7.4	0.8
Kandara	65	0.1	3.1	0.0
Kaptumo	73	0.2	3.8	2.7

The number of cross breeds per farm on average is five in Kenya, four in Rwanda and three in Uganda but there are substantial variations among the hubs within each country. Similarly, average number of local cattle per farm is 4 in Kenya, 10 in Rwanda and 17 in Uganda.

2.4 Other livestock species

Apart from cattle, smallholder farmers keep other species of livestock such as chicken, sheep, goats, donkeys, rabbits and pigs. Table 5 shows the number of farmers reported to have different species of livestock. As in the previous sections, the data is presented in terms of alternative measures of averages and deviations from the averages to show differences in ownership patterns.

Table 5: Ownership of other livestock species per household (average livestock kept)

		N	Min	Median	Mean	Max	St.Dev
Uganda	Local goats	208	1	3	6	100	11
	Exotic goats	13	1	2	9	60	16
	Sheep	37	1	2	3	20	4
	Local poultry	313	1	8	11	224	15
	Exotic poultry	6	1	11	79	250	114
	Rabbits	5	1	1	3	6	2
	Donkeys	7	1	2	2	5	1
	Pigs	146	1	2	3	18	2
Rwanda	Local goats	130	1	2	4	60	7
	Exotic goats	5	2	4	4	5	1
	Sheep	20	1	3	3	8	2
	Local poultry	114	1	4	7	38	7
	Exotic poultry	2	1	2	2	2	1
	Rabbits	11	1	4	6	20	6
	Donkeys	0	.	.	.	.	.
	Pigs	8	1	1	4	20	7
Kenya	Local goats	140	1	4	11	300	31
	Exotic goats	13	1	3	4	13	4
	Sheep	194	1	4	7	200	16
	Local poultry	395	1	10	13	500	26
	Exotic poultry	22	1	20	97	1750	370
	Rabbits	10	2	4	5	12	4
	Donkeys	43	1	1	2	6	1
	Pigs	11	1	2	2	2	1

Goats, sheep and poultry constitute the bulk of other livestock owned by respondents. The proportion of exotic breed of goats or poultry is very small in the total number of each category in the three countries. Relatively large number of farmers reported to own pigs in Uganda, with the number of pigs per households ranging from 1 to 18.

2.5 Farm size and land ownership

There are considerable variations in the average land holdings between countries, on the one hand, and between hubs within each country on the other hand (see Table 6 below). Land holdings were grouped into six land size classes, although most respondents in some of the districts fall strictly in a few of these classifications. Respondents were asked about sizes of their farms, land owned, land rented in and land rented out.

Table 6: Average land size (acres) farmed, owned and rented (in and out), by country and hub

a) Uganda

			Total land		Land owned		Land rent in		Land rent out	
Village	**Land size categories**	N	Median	Mean	Median	Mean	Median	Mean	Median	Mean
Bbaale	0.1-100	59	6.0	9.6	5.0	7.7	0.0	1.9	0.0	0.0
	100.1-200	4	125.8	138.6	63.3	81.6	50.0	57.0	0.0	0.0
	200.1-300	1	300.0	300.0	300.0	300.0	0.0	0.0	0.0	0.0
	300.1-400	1	350.0	350.0	350.0	350.0	0.0	0.0	0.0	0.0
	400.1-500	3	500.0	486.5	459.4	319.8	0.0	0.0	0.0	0.0
	>500	7	1500.0	1689.6	1500.0	1611.0	0.0	78.6	0.0	477.1
	Total	**75**	**6.0**	**200.8**	**6.0**	**182.2**	**0.0**	**11.8**	**0.0**	**44.5**
Luwero T.C	0.1-100	75	5.0	6.7	5.0	5.4	0.0	0.0	0.0	0.0
Masaka	0.1-100	75	3.0	3.0	2.0	2.8	0.0	0.2	0.0	0.0
Mukono	0.1-100	74	3.0	5.8	3.0	5.3	0.0	0.2	0.0	0.1
Kakoge	0.1-100	48	5.0	17.8	5.0	15.4	0.0	2.4	0.0	0.0
	100.1-200	1	166.0	166.0	166.0	166.0	0.0	0.0	0.0	0.0
	200.1-300	4	300.0	300.0	140.0	145.0	10.0	80.0	0.0	0.0
	300.1-400	3	320.0	346.7	0.0	106.7	0.0	133.3	0.0	0.0
	400.1-500	1	500.0	500.0	0.0	0.0	0.0	0.0	0.0	0.0
	>500	17	1280.0	1832.1	0.0	604.7	0.0	139.4	0.0	0.0
	Total	**74**	**20.0**	**471.7**	**3.0**	**163.3**	**0.0**	**43.3**	**0.0**	**0.0**
Bumanya	0.1-100	75	4.0	7.1	3.0	6.2	0.0	0.9	0.0	0.2

b) Rwanda

Village	Land size categories	N	Total land		Land owned		Land rent in		Land rent out	
			Median	Mean	Median	Mean	Median	Mean	Median	Mean
Bwisanga	0.1-10	68	2.5	3.1	2.2	2.7	0.0	0.4	0.0	0.0
	10.1-20	3	12.4	12.8	12.4	11.1	0.0	1.6	0.0	0.0
	20.1-50	2	39.5	39.5	39.5	39.5	0.0	0.0	0.0	0.0
	>120	2	370.5	370.5	370.5	370.5	0.0	0.0	0.0	0.0
	Total	**75**	**2.5**	**14.3**	**2.5**	**13.9**	**0.0**	**0.4**	**0.0**	**0.0**
Kabarore	0.1-10	55	2.5	3.0	2.5	2.7	0.0	0.3	0.0	0.0
	10.1-20	5	12.4	13.8	12.4	13.8	0.0	0.0	0.0	0.0
	20.1-50	9	26.6	27.0	24.7	25.5	0.0	1.4	0.0	0.0
	50.1-80	1	61.8	61.8	61.8	61.8	0.0	0.0	0.0	0.0
	80.1-120	2	101.3	101.3	101.3	101.3	0.0	0.0	0.0	0.0
	>120	2	190.2	190.2	24.7	24.7	165.5	165.5	0.0	0.0
	Total	**74**	**3.4**	**15.2**	**2.5**	**10.3**	**0.0**	**4.9**	**0.0**	**0.0**
Mbare	0.1-10	39	3.7	3.9	2.5	3.4	0.0	0.5	0.0	0.0
	10.1-20	15	14.8	14.8	14.8	13.6	0.0	1.2	0.0	0.0
	20.1-50	11	29.6	33.6	24.7	28.5	0.0	5.2	0.0	0.4
	50.1-80	10	61.8	60.3	61.8	51.6	0.0	8.6	0.0	0.0
	80.1-120	2	107.4	107.4	107.4	107.4	0.0	0.0	0.0	0.0
	Total	**77**	**9.9**	**20.3**	**7.4**	**17.9**	**0.0**	**2.4**	**0.0**	**0.1**
Nyagihanga	0.1-10	69	2.5	3.0	2.5	2.7	0.0	0.2	0.0	0.0
	10.1-20	3	14.8	14.8	14.8	14.0	0.0	0.8	0.0	0.0
	20.1-50	3	25.3	29.8	25.3	29.8	0.0	0.0	0.0	0.0
	Total	**75**	**2.5**	**4.5**	**2.5**	**4.3**	**0.0**	**0.2**	**0.0**	**0.0**

c) Kenya

Village	Land size categories	N	Total land		Land owned		Land rent in		Land rent out	
			Median	Mean	Median	Mean	Median	Mean	Median	Mean
Kabiyet	0.1-10	45	5.0	5.5	5.0	5.3	0.0	0.2	0.0	0.2
	10.1-20	14	13.5	14.7	13.5	14.6	0.0	0.1	0.0	0.6
	20.1-50	10	26.0	28.2	24.5	25.0	0.0	3.2	0.0	0.7
	50.1-80	4	60.0	64.5	59.5	53.8	1.5	10.8	0.0	0.0
	>120	1	200.0	200.0	200.0	200.0	0.0	0.0	0.0	0.0
	Total	**74**	**9.0**	**16.1**	**8.5**	**14.9**	**0.0**	**1.2**	**0.0**	**0.3**
Metkei	0.1-10	62	3.3	4.3	3.0	4.2	0.0	0.1	0.0	0.0
	10.1-20	9	15.0	16.4	15.0	15.9	0.0	0.6	0.0	0.1
	20.1-50	3	30.0	30.3	30.0	30.3	0.0	0.0	0.0	0.0
	>120	1	148.0	148.0	148.0	148.0	0.0	0.0	0.0	0.0
	Total	**75**	**4.5**	**8.7**	**4.0**	**8.5**	**0.0**	**0.1**	**0.0**	**0.0**
Siongiroi	0.1-10	59	3.0	3.8	3.0	3.6	0.0	0.2	0.0	0.0
	10.1-20	14	15.0	15.0	15.0	14.5	0.0	0.5	0.0	1.0
	20.1-50	1	31.0	31.0	31.0	31.0	0.0	0.0	2.0	2.0
	>120	1	500.0	500.0	500.0	500.0	0.0	0.0	0.0	0.0
	Total	**75**	**4.0**	**12.9**	**3.5**	**12.6**	**0.0**	**0.3**	**0.0**	**0.2**
Siaya	0.1-10	73	3.5	3.9	3.0	3.5	0.0	0.4	0.0	0.1
	10.1-20	2	10.8	10.8	10.0	10.0	0.8	0.8	3.5	3.5
	Total	**75**	**3.5**	**4.1**	**3.0**	**3.6**	**0.0**	**0.4**	**0.0**	**0.1**
Soy	0.1-10	53	3.0	3.7	2.0	2.8	0.0	0.7	0.0	0.2
	10.1-20	8	17.0	16.1	17.0	16.1	0.0	0.0	0.0	0.8
	20.1-50	7	37.0	35.3	30.0	27.4	0.0	1.4	0.0	1.7
	50.1-80	1	58.0	58.0	58.0	58.0	0.0	0.0	0.0	0.0
	80.1-120	2	100.0	100.0	100.0	100.0	0.0	0.0	15.0	15.0
	>120	3	150.0	166.7	130.0	116.7	0.0	50.0	20.0	30.0
	Total	**74**	**4.3**	**17.9**	**3.7**	**14.6**	**0.0**	**2.6**	**0.0**	**2.0**
Kandara	0.1-10	75	1.5	2.2	1.5	2.0	0.0	0.1	0.0	0.0
Kaptumo	0.1-10	63	3.0	4.0	2.5	3.6	0.0	0.3	0.0	0.0
	10.1-20	9	12.0	13.3	11.7	12.9	0.0	0.4	0.0	0.0
	20.1-50	2	34.5	34.5	34.5	34.5	0.0	0.0	0.0	0.0
	80.1-120	1	104.1	104.1	104.1	104.1	0.0	0.0	2.0	2.0
	Total	**75**	**4.0**	**7.2**	**3.5**	**6.9**	**0.0**	**0.3**	**0.0**	**0.0**

The reported farm sizes display extremely skewed pattern of land holdings in all countries. The extreme cases of divergences are observed in Uganda where average holding of close to 90 percent of the respondents was less than 10 acres. The remaining 10 percent of respondents reported to have farm sizes ranging from 140 to 3000 acres

It is worth noting that a good proportion of landholdings reported by those who hold small farms are rented from others. Except for differences in the extent of divergence in land holdings and

ownerships, most districts in all countries show similar patterns with the majority owning small farms but supplementing this by renting farm lands.

3 INPUTS AND COSTS

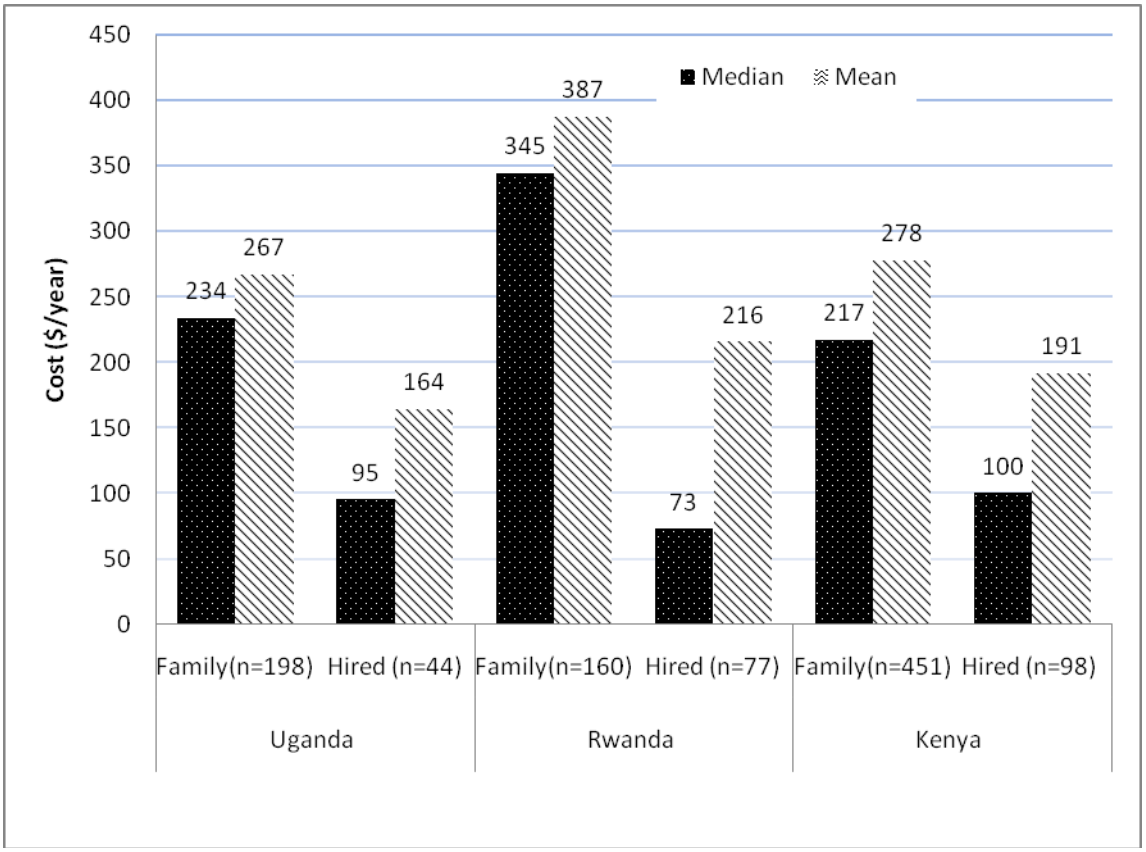
A gross margin analysis is used to determine net farm revenue as a measure of economic performance of dairy farming, providing details of variable cost breakdowns and sources of farm revenues. Estimated costs include costs of feed, animal health services, labour, housing (annual depreciation) and water. Since gross margin analysis involves variables costs only, it excludes fixed costs such as land under pasture either owned or rented. Hence, investment costs such as cost of purchased animals were not included.

3.1 Labour costs

Labour costs include cost of hired labour and family labour. Family labour is estimated to cost at 80% of the casual rural wage in the area (Staal *et al.*, 2003). This is based on the assumption that the opportunity cost of the family labour is below the wage rate simply because off-farm employment is not always readily available to farm family members. It would therefore not realistic to value family labour at the full wage rate since this would assume that off-farm casual employment opportunities are available on every day during every season. This study revealed that most of the labour input is derived from the household or family labour, with less than half of the households keeping cattle reporting to hire labour. Due to high variations in the data, it was necessary to plot median and mean annual labour costs per farm. The labour costs are classified into family and hired labour (see Figure 1 below). The figures in brackets indicate the number of respondents who provided details of their labour cost by family and/or hired labour categories.

In order to obtain realistic economic costs of production, it was necessary to impute the family labour; considering as if the household farm has paid each and every family member for their labour time

Figure 1: Average cost of family and hired labour on cattle activities ($ per year per household)



Beginning with family labour, there are notable differences between the countries - mean family labour cost in Rwanda is the highest and in Kenya being the lowest. In Rwanda, the mean imputed family labour cost is just over $387 per year with 50 percent of households reporting $345 or less. In Uganda, median family labour cost is estimated to be $234 or less per annum for half of the respondents while the mean is $267. Although Rwanda reported the highest cost of both hired and family labour, the wage rate is lower than that of Uganda, while Kenya reported the lowest rate. Average daily wage rates for dairy labour for Uganda, Rwanda and Kenya are $0.86, $0.69 and $0.64 per day respectively.

Well over half of the farmers do not hire labour for cattle keeping as it can be seen from the households who reported to hire labour: 19.1% in Uganda, 45.6% and 21.2% from Rwanda and Kenya respectively. The mean averages costs of hired labour are $216 for Rwanda, $191 for Kenya, and $164 for Uganda. These indicate that most farmers rely on family labour and extremely few farmers do actually hire labour.

Table 7: Average proportion of family and hired labour time allocated to dairy activities and other livestock activities

	Uganda		Rwanda		Kenya	
Family labour:	N	%	N	%	N	%
Grazing and watering	173	39	125	42	340	65
Cattle feeding	64	14	114	39	196	37
Fodder related	20	04	46	16	132	25
Milking	335	74	210	69	447	85
Marketing milk	21	05	19	06	129	25
All activities related to cattle	134	30	64	21	215	41
Hired labour:						
Grazing and watering	18	50	21	57	44	63
Cattle feeding	2	6	11	30	18	26
Fodder related	0	0	5	14	14	20
Milking	14	38	12	31	32	43
Marketing milk	0	0	5	14	5	7
All activities related to cattle	22	59	13	33	20	27

Respondents were also asked to report extents of labour use by a range of cattle keeping related activities. Results are reported in

Table 7. As one would expect, cattle keeping and watering takes substantially larger proportion of both family and hired labour time. It should be noted that the percentages indicate share of average labour time spent on different activities, not the share of each cattle keeping activity in the total labour time on all activities. For instance, 65% against grazing and watering for Kenya means that for several household members the overall average time spent on this activity is 65%.

Cattle feeding and milking come second and third in terms of average labour time spent. However, there are notable variations between countries, with "all other activities related to cattle" taking relatively larger share of hired labour time while the corresponding figures for this activity is relatively low in Kenya where milking and cattle grazing take a considerably larger share of both family and hired labour. This is likely to reflect the fact that improved breeds are predominant in Kenya's herd and they require relatively larger amount of care and milking time due to higher productivity than local breeds which are predominant in Rwanda and Uganda.

3.2 Expenditure on purchased feed, fodder and concentrates

It should be noted that the feed and fodder costs reported in this section refer to purchased amounts. Imputed costs of feed and fodder grown on farm are not included in the figures (Table 8 below).

It should be noted that the feed and fodder costs reported in this section refer to purchased amounts. Imputed costs of feed and fodder grown on farm are not included in the figures (Table 8 below).

Table 8: Average cost of feed, fodder and concentrates per household ($ per year)

	Cost of purchased feed			Cost of concentrates		
Village	N	Median	Mean	N	Median	Mean
Uganda	**10**	**16.9**	**27.3**	**9**	**101.7**	**143.7**
Bbaale	0			2	226.0	226.0
Luwero	0			1	101.7	101.7
Masaka	5			2	273.3	273.3
Mukono	5	28.2	19.3	4	55.1	48.3
Kakooge	0	5.6	35.3	0		
Bumanya	0			0		
Rwanda	**27**	**25.5**	**39.7**	**20**	**196.4**	**463.9**
Bwisanga	5	37.3	31.1	4	335.5	263.2
Kabarore	5	16.4	31.5	3	130.9	177.0
Mbare	13	38.2	56.2	13	122.7	591.9
Nyagihanga	4	4.5	7.0	0		
Kenya	**73**	**26.1**	**70.6**	**147**	**131.1**	**202.4**

Kabiyet	2	199.8	199.8	20	114.1	209.9
Metkei	4	46.0	49.3	13	101.3	152.6
Siongiroi	7	46.0	39.4	8	63.6	72.7
Siaya	4	9.5	15.9	3	105.9	187.2
Soy	12	11.1	185.9	22	101.3	189.4
Kandara	38	26.1	47.7	54	168.8	245.7
Kaptumo	6	23.5	28.7	27	156.4	184.7

The number of respondents who reported to have purchased feed and fodder was considerably low in all country but particularly so in Uganda where only 4.3% (10 out of 230) respondents reported expenditure on this category of input. From these, less than half spent about $17 per annum on feed and fodder. The mean average of $27 per year indicates that actually only a few of those farmers spend relatively larger sum on feed and fodder. The mean and median averages for expenditure per year on concentrates in Uganda are $102 and $144 respectively, but it should be noted that these are average expenditure for only 9 respondents.

Compared to Uganda, the proportion of farmers who purchase feed, fodder and concentrates in Rwanda and Kenya is relatively larger and the size of expenditure is much higher. In Kenya, about half of the respondents spend less than $26 on feed and fodder, and $131 on concentrates.

The country averages hide important differences between districts. For instance, in Uganda, there is no one reporting to have purchased feed, fodder of concentrates in Bbaale, Luwero, Kakoge and Bumanya. In Kenya, average expenditure on concentrates in Kabiyet is about twice the corresponding figure for Siongiroi.

3.3 Cost of providing water to cattle

Respondents were asked to provide estimates of expenditure on water for livestock. A summary of this information is provided in Table 9 below. It should be noted that only a very small proportion (mostly less than 10 farmers in each district) reported expenditure on water. Even then, we notice considerable variations between the size of expenditure on water between countries and between districts in each country. The largest expenditure per household is registered in Kandara, where annual expenditure on water for cattle ranges between $8 and $951. This could be attributed to the fact that Kabiyet has mostly improved breeds (pure and cross) which require better livestock management regime than other districts where local breeds predominant.

Table 9: Cost of watering cattle ($ per year per household)

variable	N	Min	Median	Mean	Max	Std.Dev

Uganda	**36**	**0.3**	**6.8**	**21.8**	**223.7**	**49.7**
Bbaale	**4**	**1.9**	**5.3**	**53.1**	**199.8**	**97.8**
Luwero	**18**	**0.3**	**8.0**	**8.9**	**26.5**	**6.9**
Masaka	**1**	**79.9**	**79.9**	**79.9**	**79.9**	**.**
Mukono	**3**	**8.0**	**67.1**	**99.6**	**223.7**	**111.5**
Kakooge	**6**	**0.6**	**2.3**	**4.7**	**18.4**	**6.8**
Bumanya	**4**	**0.6**	**1.0**	**1.6**	**4.0**	**1.6**
Rwanda	**38**	**0.2**	**19.0**	**52.8**	**568.8**	**101.9**
Bwisanga	**10**	**6.6**	**19.0**	**18.2**	**28.4**	**7.4**
Kabarore	**5**	**6.7**	**15.6**	**72.7**	**265.5**	**110.5**
Mbare	**20**	**7.1**	**13.0**	**68.0**	**568.8**	**128.4**
Nyagihanga	**3**	**0.2**	**33.2**	**33.3**	**66.4**	**33.1**
Kenya	**42**	**1.2**	**84.9**	**99.0**	**951.4**	**165.7**
Kabiyet	**2**	**26.3**	**322.2**	**322.2**	**618.1**	**418.5**
Metkei	**0**					
Siongiroi	**2**	**7.6**	**19.2**	**19.2**	**30.7**	**16.3**
Siaya	**9**	**1.2**	**9.2**	**40.9**	**110.5**	**46.5**
Soy	**1**	**68.0**	**68.0**	**68.0**	**68.0**	**.**
Kandara	**27**	**7.9**	**84.9**	**109.4**	**951.4**	**173.8**
Kaptumo	**1**	**84.9**	**84.9**	**84.9**	**84.9**	**.**

3.4 Cost of cattle housing

Cost of housing regarded in this report refers to costs incurred in maintenance of cattle housing units (like shed or stall). The number of those reporting housing cost was very small: 44% in Rwanda, 10% in Uganda and 22% in Kenya (Table 10). This could be due to different reasons; First, due to the fact that keeping cattle in a housing premise is not a common livestock management system (perhaps this may apply mainly to Uganda). Second, the economics of housing is not familiar among farmers and. Third, farmers might have found it difficult to cost as they usually use locally available materials and own labour. The latter reason is likely to explain the relatively low response in Kenya; otherwise given the breed type one would expect a reasonably high housing cost. Regardless of the paucity of information on the housing cost, it is felt it would still be of some use to analyse and present the available information.

Table 10: Average cost of depreciation ($ per year)

Village	N	Min	Median	Mean	Max	St.Dev
Uganda	22	1.4	10.6	17.6	56.5	16.2
Bbaale	0					
Luwero	3	11.3	22.6	19.2	23.7	6.9
Masaka	10	2.8	15.5	18.3	42.4	14.8

Mukono	5	2.8	7.1	13.8	48.0	19.3
Kakooge	3	1.4	9.9	7.1	9.9	4.9
Bumanya	1	56.5	56.5	56.5	56.5	.
Rwanda	76	0.1	4.5	12.9	72.7	17.7
Bwisanga	28	0.5	7.3	16.8	72.7	20.7
Kabarore	11	2.3	6.8	13.3	45.5	16.5
Mbare	6	7.3	34.1	34.5	68.2	22.5
Nyagihanga	31	0.1	1.8	5.1	27.3	7.1
Kenya	99	0.2	6.5	13.3	65.2	14.1
Kabiyet	0					
Metkei	0					
Siongiroi	0					
Siaya	13	6.3	12.6	16.5	63.1	15.1
Soy	18	0.2	13.0	17.1	48.9	15.3
Kandara	64	0.5	6.5	11.7	65.2	13.5
Kaptumo	4	1.6	4.1	10.6	32.6	14.7

The cost estimates were obtained by calculating depreciation per annum as follows: Depreciation equals the current market value less salvage value divided by the useful life of the cattle house. The figures in Table 10 are computed by assuming a 10 year useful life for permanent structures such as those used by households practicing pure zero grazing and 4 years for other livestock management systems and zero salvage value.

The median average annual housing cost calculated using this straight-line depreciation method is $11 for Uganda, $5 for Rwanda and $6 for Kenya. It should be noted that data for 3 project districts in Kenya was missing.

3.5 Cost of animal health services

Respondents were asked to provide information on expenditure on a range of animal health services including vaccination, de-worming, tick control and curative treatments (**Error! Reference source not found.**). A reasonable number of respondents reported these categories of expenditure. In most countries and districts, by far the largest proportion of animal health service expenditure goes to tick control. The average yearly expenditure ranges between $42 in Kenya and $49 in Rwanda. In terms of districts, the Bbaale average is the highest ($78) and that of Siaya is the lowest ($10). Expenditure on curative treatments and de-worming come second and third respectively in their share from total expenditure on animal health by farmers in most districts. It is useful to note that vaccination constitute the smallest proportion of total expenditure in most cases.

Table 11: Annual cost health services ($ per year)

	Deworming		Vaccination		Tick control		Curative services		Other costs	
	N	Mean	N	Mean	N	mean	N	mean	N	Mean
Uganda	**196**	**22.9**	**81**	**11.3**	**209**	**42.3**	**168**	**27.1**	**3**	**18.5**
Bbaale	29	35.8	5	6.8	34	78.0	23	27.1	2	26.6
Luwero	25	9.7	10	3.6	28	19.1	27	13.7	0	
Masaka	27	9.8	13	8.5	27	11.2	10	9.2	0	
Mukono	37	24.9	13	9.5	40	27.9	33	28.7	1	2.3
Kakooge	44	35.9	24	20.3	46	73.1	45	41.3	0	
Bumanya	34	13.2	16	7.8	34	26.0	30	22.3	0	
Rwanda	**140**	**29.0**	**111**	**23.6**	**142**	**49.4**	**82**	**29.2**	**1**	**1.5**
Bwisanga	36	8.3	32	13.8	32	33.8	21	21.2	0	
Kabarore	34	38.2	26	34.5	39	67.3	21	42.4	0	
Mbare	50	45.4	39	31.3	47	61.8	28	33.3	1	1.5
Nyagihanga	20	9.8	14	4.4	24	17.0	12	10.5	0	
Kenya	**413**	**19.0**	**331**	**4.9**	**390**	**41.8**	**248**	**22.5**	**9**	**6.8**
Kabiyet	67	27.8	61	6.9	67	66.6	63	42.0	1	30.3
Metkei	70	22.1	55	1.9	69	35.0	34	23.2	3	5.3
Siongiroi	68	20.3	61	9.6	67	42.2	49	11.5	2	2.6
Siaya	25	10.3	12	1.4	29	10.1	29	8.1	0	
Soy	57	23.1	56	4.5	61	48.5	20	13.8	1	3.1
Kandara	56	7.9	42	3.2	24	14.8	20	21.7	0	
Kaptumo	70	14.8	44	2.6	73	40.9	33	19.2	2	3.3

3.6 Costs of extension services

Table 12 provides details of expenditure on extension services by type of service providers. In order to arrive at some full economic cost as much as possible, the figures corresponding to government extension services, which mostly are freely provided, are imputed by making use of equivalent private sector services.

Although government was reported as the most accessible source of extension service (see EADD Baseline Survey Report No.4), private practitioners take the largest share of cost incurred in this input category in Kenya, Uganda a and Rwanda (96%, 63%, and 45% respectively of the total extension services expenditure respondents reported to have incurred during the previous 12 months).

Table 12: Costs of extension services ($ per year)

	Government		NGO		Cooperative		Private	
Country	N	Mean	N	Mean	N	Mean	N	Mean
Uganda	**88**	**9.9**	**15**	**12.8**	**1**	**0**	**61**	**38.0**
Bbaale	15	17.4	0	.	0	.	2	288.1
Luwero	10	1.1	4	12.0	0	.	8	16.2
Masaka	10	0.0	2	0.0	0	.	9	7.3

Mukono	21	28.2	3	48.2	0	.	27	28.7
Kakooge	12	0.0	5	0.0	1	0	2	68.5
Bumanya	20	0.2	1	0.0	0	.	13	48.5
Rwanda	**29**	**2.4**	**5**	**8.0**	**3**	**3.6**	**4**	**8.4**
Bwisanga	7	1.4	1	0.0	0	.	1	18.2
Kabarore	5	1.8	0	.	1	0	1	7.3
Mbare	13	4.0	3	13.3	2	5.5	1	1.8
Nyagihanga	4	0.0	1	0.0	0	.	1	6.4
Kenya	**111**	**1.5**	**21**	**0.2**	**13**	**0.2**	**46**	**44.8**
Kabiyet	12	0.1	1	3.8	0	.	15	88.0
Metkei	33	0.0	2	0.0	2	0	1	7.6
Siongiroi	21	0.0	12	0.0	4	0	3	0.5
Siaya	12	0.7	1	0.0	0	.	16	19.1
Soy	15	9.5	2	0.0	2	0	9	45.0
Kandara	10	0.3	2	0.0	4	0.7	2	10.8
Kaptumo	8	1.6	1	0.0	1	0.0	0	.

3.7 Cost of breeding services

Breeding services covered artificial insemination (AI) and bull services (Table 13). In all the three project countries, it was noted that, although a larger number of farmers would prefer to use AI, a much smaller sample of them actually used it. This is discussed in detail in the EADD Baseline Report 2.

The proportion of cattle keeping households reported to have used AI services in the last 12 months was the highest in Kenya, Rwanda, and Uganda (26.4%, 12.4% and 5.2% respectively). Average household expenditure on AI services in the last 12 months was $12, $6 and $27 for Kenya, Rwanda and Uganda in that order. In Uganda, relatively larger proportion of respondents (47% of cattle keeping households) indicated they have used bull services with average fee of $16 during the previous 12 months. Similarly, 51 cattle keepers spent on average annual expenditure of $8 each in Rwanda. The number of farmers who reported some expense on bull services was very low in Kenya, only 20 respondents out of the 87 who reported breeding expenses

Table 13: Average annual cost of breeding services ($ per year)

	AI		Bull		Total	
Country	N	mean	N	mean	N	mean
Uganda	**12**	**27.5**	**107**	**16.0**	**119**	**22.4**
Bbaale			24	23.6	27	44.0
Luwero	3	29.2	16	8.9	17	13.5
Masaka	3	56.5	21	6.3	24	12.6
Mukono	3	12.2	30	9.3	32	9.9
Kakooge	2	4.2	14	42.3	16	37.6

Bumanya	1	28.2	2	1.7	3	10.5
Rwanda	**12**	**10.3**	**51**	**8.3**	**61**	**11.9**
Bwisanga	4	12.7	17	4.2	20	6.1
Kabarore	1	18.2	7	6.5	8	8.0
Mbare	7	7.8	13	17.5	19	24.4
Nyagihanga			14	5.6	14	5.6
Kenya	**68**	**20.4**	**20**	**4.9**	**87**	**18.9**
Kabiyet	8	26.9	0		9	40.7
Metkei	6	16.6	3	5.9	8	14.7
Siongiroi	0		1	1.3	1	1.3
Siaya	1	12.6	2	6.3	3	8.4
Soy	6	36.8	3	2.8	9	25.5
Kandara	39	17.1	10	5.3	48	15.0
Kaptumo	8	21.7	1	5.2	9	19.8

4 OUTPUTS AND REVENUES

4.1 Milk price and milk marketing

We begin by discussing milk price per litre by type of buyers in each country (**Error! Reference source not found.**). Milk price per litre ranges between 28 to 33 cents in Rwanda; 26 to 30 in Kenya; and 17 to 26 in Uganda. These indicate that, on average, milk price per litre in Rwanda is much higher in Rwanda compared to Kenya and Uganda. In terms of relative offers by buyer types, farmers are better off selling to individual customers in Kenya and Uganda but in Rwanda other types of buyers such as public and private institutions pay higher price.

Figure 2: Average milk prices by buyer ($ cent per litre)

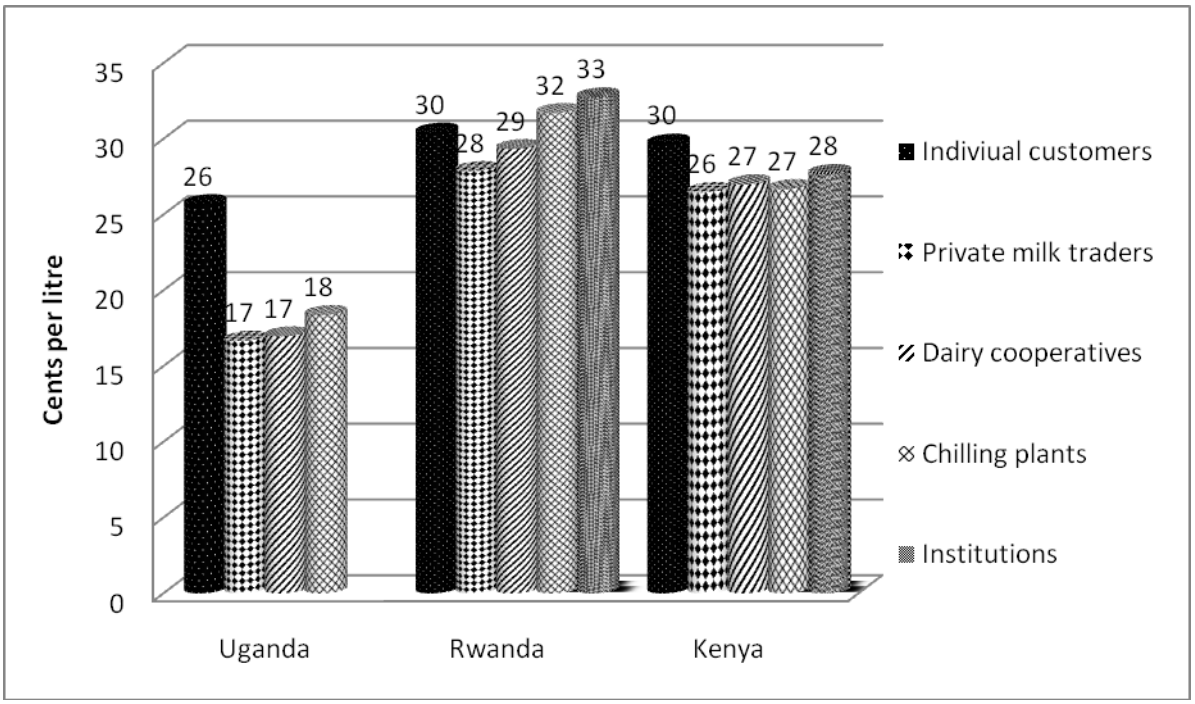
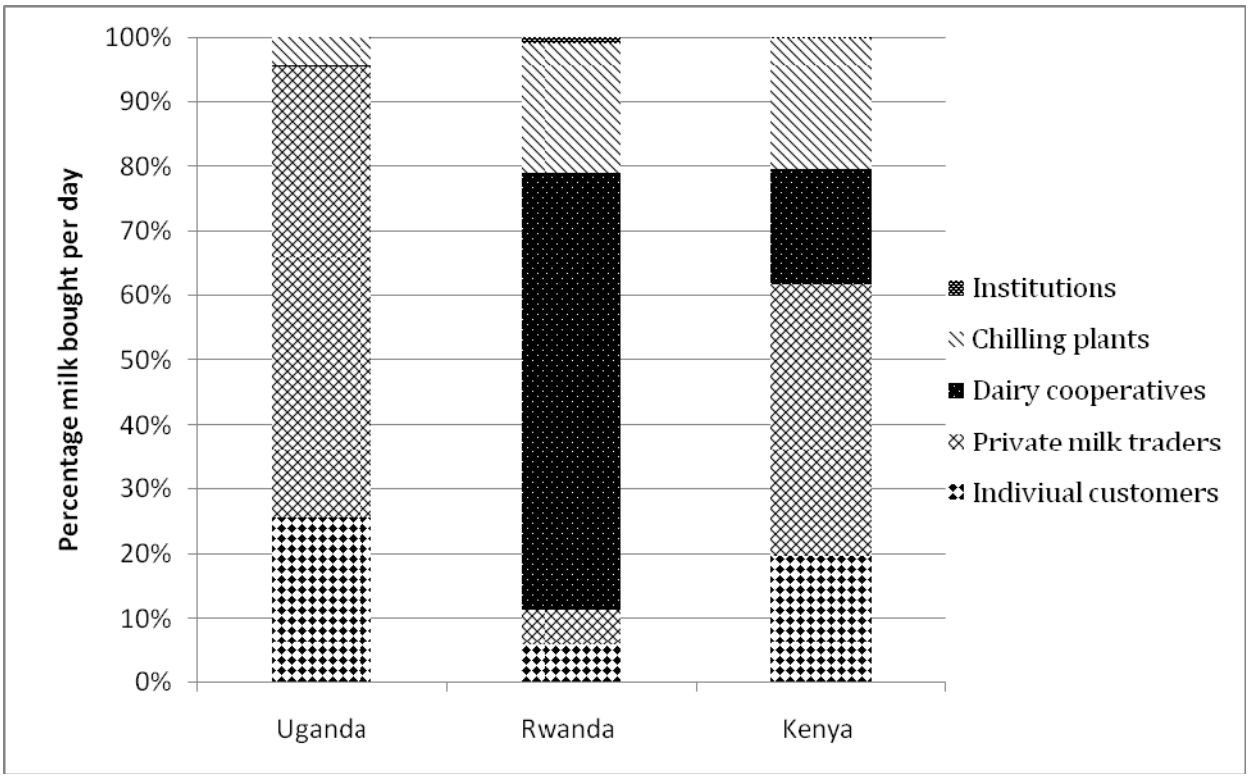


Figure 3 below shows the proportion of daily milk sale by buyer types. It is interesting to observe the contrasting patterns of milk sales in Uganda and Rwanda. In Uganda, the bulk of milk, 70% and 26% of total daily milk supplied to the market, is bought by private traders and individual households respectively. Only 0.4% is sold to dairy cooperatives while the remaining proportion is sold to processor owned chilling plants. In Rwanda, on the other hand, 88% of milk is sold to chilling plants and dairy cooperative (20% and 68% respectively) while the remaining proportion of 12 is shared out among individual households, private traders and institutions (6%, 5% and !% respectively). However, it should be noted that the overall Rwanda average may hide the level of developments in chilling plants at different hubs. Daily milk sale in Kenya shows a relatively mixed buyer types but the proportion bought by private traders is

still relatively higher (42%) compared to the amount bought by other buyer types. Direct sale to processor owned chilling plants constitute 20% of the total while dairy cooperatives and individual households buy about 18% each.

Figure 3: Percentage quantity of milk sold to different buyers per day by country



4.2 Milk production and use

Table 14 below shows use of total milk produced per household during the previous 12 months of the survey date. For most districts, there are notable disparities as indicated by substantial differences between the median and mean averages.

In Uganda, 188 respondents produce milk, but since only a few of the respondents sell much larger volumes of milk, the median is 0 and the mean is 1318 litres per year. It is worth noting that there are substantial differences between Uganda hubs in terms of the volume of milk each household sells; for instance, in Kakooge, most households sell about 1700 litres while in Bbaale the mean is well over 2800 litres per year.

The disparities between hubs in Rwanda are even more pronounced; for instance, in Kabarore, most farmers sell about 600 litres while some farmers sell well over 2000 litres per year. There are relatively lower disparities among Kenyan hubs with average milk sale per household ranging between 800 and 2500 litres per year.

Table 14: Amount of milk produced, sold, consumed and spoilt per year per household (in litres)

		Produced		Sold		Consumed		Spoilt	
VillageCode	N	Median	Mean	Median	Mean	Median	Mean	Median	Mean
Uganda	**188**	**1096.5**	**2449.7**	**0.0**	**1318.4**	**730.0**	**1101.8**	**0.0**	**29.5**
Bbaale	34	1801.4	4540.7	676.5	2831.6	948.4	1638.2	0.0	71.0
Luwero	22	730.0	1347.0	0.0	748.0	638.8	599.0	0.0	0.0
Masaka	25	730.0	1420.6	0.0	669.6	547.5	751.0	0.0	0.0
Mukono	37	912.5	1299.5	0.0	527.2	450.0	772.3	0.0	0.0
Kakooge	48	2520.0	3345.2	765.0	1669.4	1095.0	1639.3	0.0	36.6
Bumanya	22	1095.0	1471.2	521.0	852.5	480.8	555.8	0.0	62.8
Rwanda	**127**	**1460.0**	**3610.3**	**60.0**	**1771.4**	**1440.0**	**1829.2**	**0.0**	**9.7**
Bwisanga	31	912.5	2129.7	0.0	982.1	730.0	1147.6	0.0	0.0
Kabarore	30	2073.8	5045.9	570.0	2457.3	1460.0	2588.6	0.0	0.0
Mbare	48	2573.1	4697.6	1398.0	2508.2	1699.3	2163.6	0.0	25.8
Nyagihanga	18	638.8	867.9	0.0	22.5	638.8	845.4	0.0	0.0
Kenya	**410**	**1644.6**	**3441.4**	**820.0**	**1618.0**	**730.0**	**1821.4**	**0.0**	**2.0**
Kabiyet	70	2817.5	4207.3	1596.0	2627.9	1103.8	1579.4	0.0	0.0
Metkei	68	1487.8	2134.5	698.0	1186.1	825.9	948.4	0.0	0.0
Siongiroi	65	1095.0	2150.1	324.0	1041.1	775.5	1109.0	0.0	0.0
Siaya	28	685.0	836.4	0.0	458.9	217.8	377.6	0.0	0.0
Soy	61	2137.1	7446.5	1106.0	2254.8	547.5	5191.7	0.0	0.0
Kandara	50	2070.0	2381.4	1340.0	1773.0	507.0	608.4	0.0	0.0
Kaptumo	68	1651.3	3453.4	315.0	1353.9	963.6	2087.6	0.0	11.9

Reported cases of milk spoilage were extremely low in all the countries: 5 cases in Uganda, 3 cases in Rwanda, and none in Kenya. The low response rate does not necessarily imply that there was no milk spoilage. Since farmers can make best use of milk in all circumstances, for instance by making cheese or sour milk etc, milk returned from a chilling plant for not meeting the quality control standards may not necessarily be perceived as a spoilt milk.

4.3 Revenue from milk sold

Table 15 below provides summary statistics related to household revenue from selling milk by country and districts. The statistics were computed for those who own cows, excluding households with cattle but no cows since milk sale is not relevant to this group.

Table 15: Annual milk revenue per household ($)

	N	Min	Median	Mean	Max	St.Dev
Uganda	**188**	**0**	**0.0**	**214.5**	**3918.2**	**474.6**
Bbaale	34	0	73.7	417.1	3918.2	824.5
Luwero	22	0	0.0	143.6	648.9	228.4
Masaka	25	0	0.0	151.4	1702.3	396.8
Mukono	37	0	0.0	120.2	1353.4	256.9
Kakooge	48	0	83.1	221.6	2262.9	435.6
Bumanya	22	0	105.9	186.9	957.9	272.7
Rwanda	**127**	**0**	**16.4**	**453.1**	**3644.0**	**870.5**
Bwisanga	31	0	0.0	288.7	3611.2	817.2
Kabarore	30	0	120.2	613.3	3644.0	1038.8
Mbare	48	0	299.8	627.0	3435.7	893.1
Nyagihanga	18	0	0.0	5.5	82.0	19.5
Kenya	**410**	**0**	**173.1**	**391.8**	**5725.3**	**640.7**
Kabiyet	70	0	358.3	590.2	5725.3	883.4
Metkei	68	0	183.6	264.9	1668.2	326.0
Siongiroi	65	0	70.0	202.0	2534.9	378.7
Siaya	28	0	0.0	177.7	1665.1	392.1
Soy	61	0	266.0	595.9	3626.0	803.1
Kandara	50	0	353.2	479.8	2608.9	531.4
Kaptumo	68	0	91.6	336.1	4340.3	674.3

For the 188 households who have reported to have cows in Uganda, mean annual revenue from milk sales was $215. The median is zero and this indicates about half of these households do not sell milk at all. On the other hand, there are some households whose income from selling milk is as high as $3918. There are considerable disparities among hubs, with a median household in Bumanya, Kakoge and Bbaale earning a modest income from selling milk.

There are even larger disparities among Rwandan households in their annual revenue from milk sales; the median revenue from milk sales in Rwanda is as high as $300 in Mbare and $120 in Kbarore. The maximum earning from milk sale is reported in Kabarore as $3644.

Unlike Uganda and Rwanda where the dairy sector is not market oriented, most cattle keeping households in Kenya make a living by selling milk. There is a relatively high response rate, i.e., close to 75% of households in Kenya have reported some revenue from milk sales. Consequently, in the Kenyan hubs, the disparity among households in terms of revenue from milk sales is relatively low compared to the other two countries. Overall median and mean average revenue from milk sales per household in Kenya were $173 and $392 respectively. The

median average revenue in Kenya for most hubs is reasonably high and much larger than the corresponding figures for hubs in the other two countries.

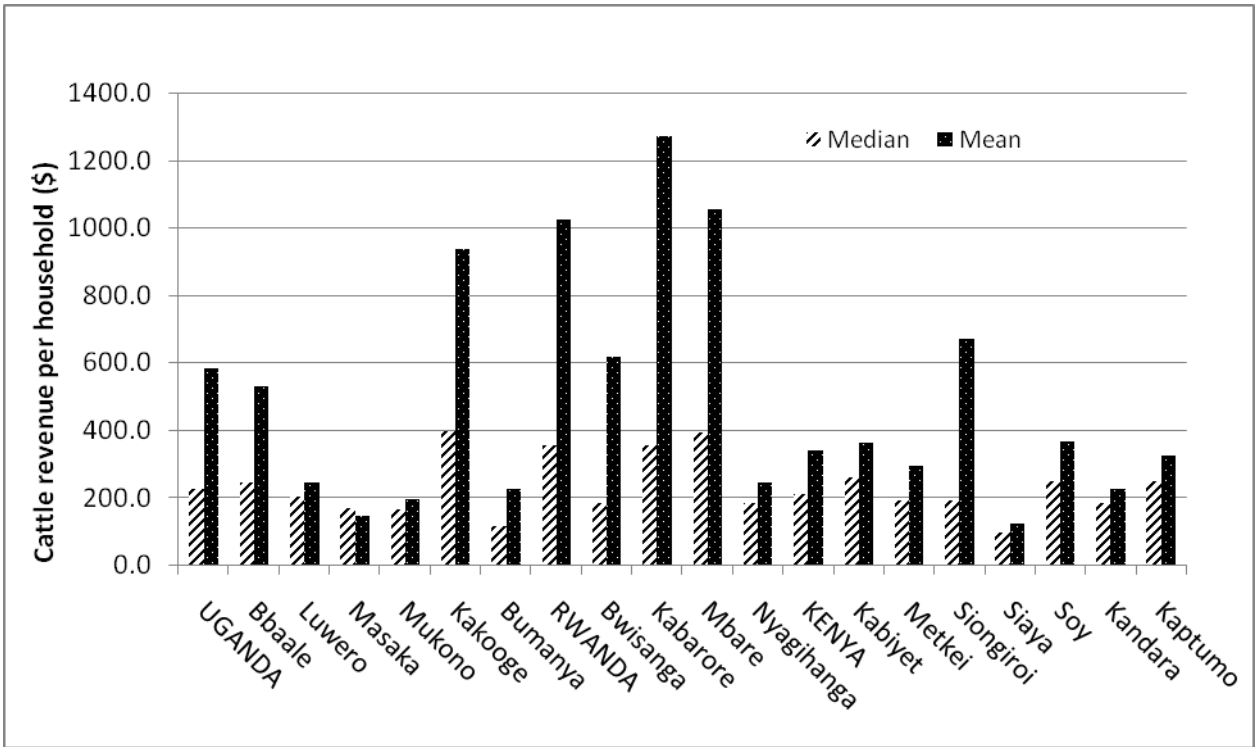
4.4 Revenue from cattle sales

About 39%, 20% and 17% of total respondents in Kenya, Uganda and Rwanda respectively have reported estimates of total revenue from selling cattle during the previous 12 months of the survey date. Figure 4 displays the average revenue per household by districts together with the country averages. The mean average revenue for Kabarore respondents was the highest of all districts, $1271 per household during the previous year; this figure is computed for 39 of the 75 respondents in the hub. The second and third highest mean average income from cattle sales are Mbare ($1056) and Kakooge ($935). Siaya reported the least sales of $122

It should be noted that the large diversity among the countries and districts means that there are substantial difference between the median and mean average figures for most districts. The highest annual median average revenue ($396) from cattle sales is reported in Kakooge, while the lowest is reported in Siaya ($94).

Respondents were also asked reasons for selling cattle. Immediate need for cash was cited as the major reason in all of the three countries. The insurance function of livestock results from the potential of being able to sell the animals in case of emergencies. Such emergencies include school fees, health bills among others. Culling and replacement of cattle was also an important reason for sale of cattle reported highly in Kenya. Also, it is useful to note that the non-marketed benefit of livestock, where farmers reported to have given out an animal for as a gift, or for a ceremony or as bride price. A few farmers in Rwanda noted to have disposed their animals due to lack of land and feed to provide for the animals.

Figure 4: Average revenue from cattle sold in the previous 12 months ($ per household)



4.5 Revenue from manure sales

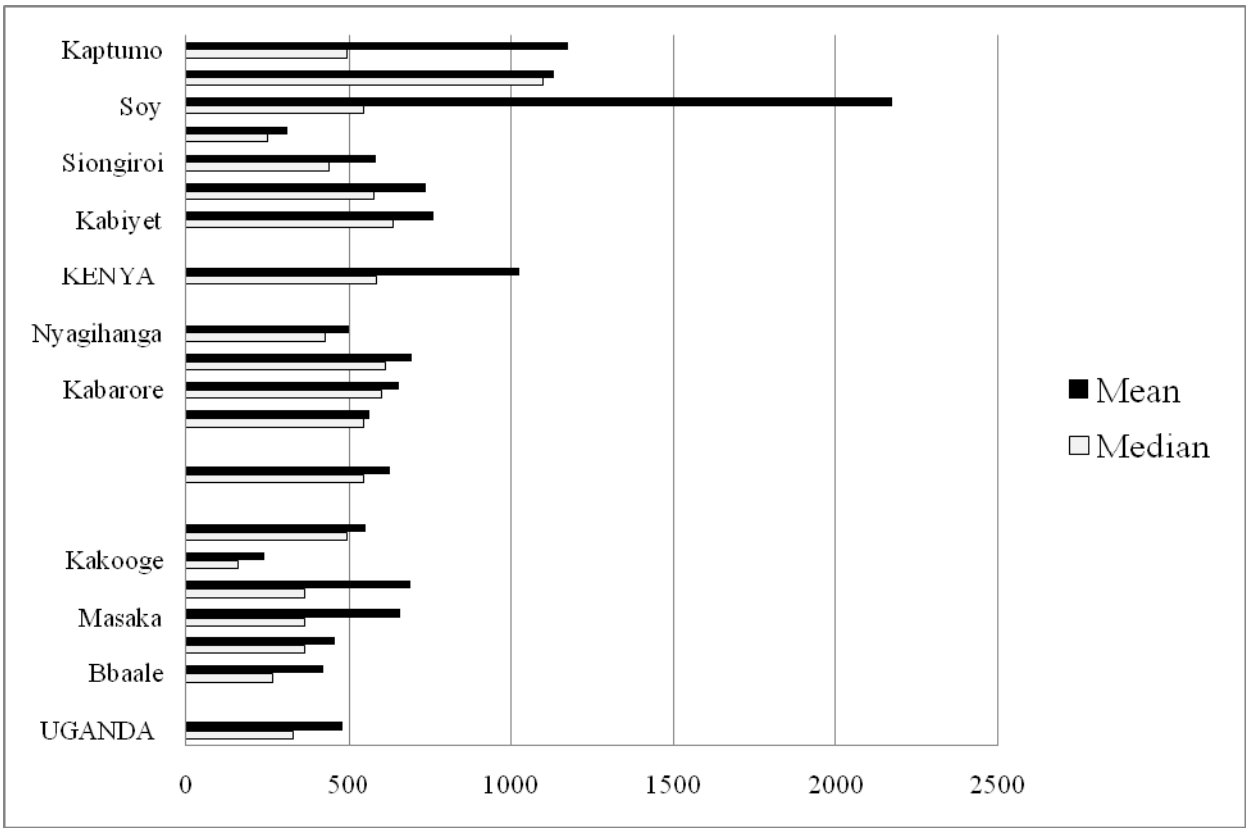
The survey results indicated that sale of cattle manure is not common across the three countries. Out of the total cattle keepers, only ten households (7 in Kenya and 3 in Uganda) reported to have sold manure. The 3 households from Uganda were 2 from Masaka Municipality hub (with average revenue of $14) and one from Bumanya while the 7 cases in Kenya were reported from Siaya (3), Soy (2) and one each from Kandara and Kaptumo (with average annual revenue of $20).

5 PERFORMANCE ASSESSMENT

5.1 Milk yield per cow

Respondents were asked to provide information on total milk production as well as number of cows owned by the household by breed type. However, it was not practical to obtain information on milk yield for each and every cow on the farm. Consequently, it was necessary to calculate milk yield per cow by dividing total milk reported by the number of cows in TLU unit (see footnote 1 for the method of obtaining TLUs). The annual milk yield per cow is displayed in figure 5 below showing the median and mean averages for respondents who own cows.

Figure 5: Average milk produced per year per TLU cow



Focusing on the differences between median and mean averages within the countries, we note that the largest disparity exists in Kenya where the median is 588 and the mean is 1024 litres per cow per year. On the other hand, the lowest differences between mean and median average is in Rwanda with respectively 548 and 630 litres per cow per year. If we compare median milk yield per cow per year across hubs, the lowest is Kakooge (162) and the highest is registered in Kandara (1097).

The milk yield disparities are much more pronounced in Uganda than in Kenyan and Rwandan hubs, where the differences between median and mean averages is much lower compared to the estimates obtained for Ugandan hubs.

5.2 Gross margin and cost of milk production per litre

Table 16 below provides a summary of economic performance indicators for the dairy farms. The selected key indicators are obtained by aggregating individual cost and revenue elements separately discussed in the preceding sections. Column A shows milk production per household per annum by cattle keepers who own at least one cow. Column B is obtained by adding revenues from all sources of dairy related activities, including milk sales (obtained by

multiplying column A by the average milk prices in the hubs and countries[3]), cattle sales, and feed sales. Similarly, total costs (columns C and F) of milk production for each hub are obtained by adding separate mean averages cost items.

Table 16: Summary performance indicators per annum

	Milk produced per hh (Lts)	Total Revenue ($)	With family labour			Without family labour		
			Total cost ($)	Gross margin ($)	Prod. Cost per litre ($)	Total Cost ($)	Gross margin ($)	Prod. Cost per litre ($)
	A	B	C	D=B-C	E=C/A	F	G=B-F	H=F/A
Uganda	2,579	739	717	23	0.28	420	320	0.16
Bbaale	4,541	1,001	1,032	-31	0.23	703	298	0.15
Luwero	1,347	363	322	41	0.24	83	280	0.06
Masaka	1,421	398	218	180	0.15	99	299	0.07
Mukono	1,299	354	657	-303	0.51	449	-95	0.35
Kakooge	3,345	1,201	981	221	0.29	517	684	0.15
Rwanda	5,714	2,380	1,219	1,161	0.21	769	1,611	0.13
Bwisanga	2,130	865	1,525	-660	0.72	1,026	-161	0.48
Kabarore	7,582	3,420	1,239	2,180	0.16	746	2,673	0.10
Mbare	6,778	2,674	1,017	1,658	0.15	623	2,051	0.09
Kenya	3,110	930	513	417	0.17	249	681	0.08
Kabiyet	4,207	1,115	682	433	0.16	347	768	0.08
Metkei	2,134	616	400	216	0.19	150	466	0.07
Siongiroi	2,150	663	334	329	0.16	196	467	0.09
Soy	5,018	1,654	1,172	482	0.23	522	1,132	0.10
Kaptumo	3,146	1,036	368	668	0.12	193	843	0.06

The key performance indicators reported here are gross margins and cost of milk production per litre (columns D and H). It should be noted that the foregoing discussion on economic performance of dairy farms in the project districts involved imputing costs such as family labour, which are not usually taken into account in making decisions among subsistent farming households. In order to capture this notion, we have computed total costs, gross margins, and cost per litre of milk produced separately with or without family labour.

The highest gross margin per household was in Mbare and Kabarore (in Rwanda). On the other hand, as long as imputed family labour is included in the analysis, then three hubs (Mukono, Bwisanga, and Bbaale) would experience negative gross margins (respectively, $-303, $-660 and $-31). When imputed family labour is excluded from cost of production then all hubs will

[3] Total revenue includes the value of milk consumed in the household computed at the same market price.

experience positive gross margins, except for Bwisanga which would still have negative gross margin of $-161 Most hubs in Kenya experience positive gross margins with or without imputing cost of family labour.

In terms of overall cost of production per litre of milk, the overall average for Kenya (including cost of family labour), Uganda and Rwanda are respectively $0.17, $0.21 and $0.28; When family labour costs are not included the corresponding figures are $0.08, $0.13 and $0.16 respectively. This results compares with those reported for Kenya ($0.16-$0.27) in 2002 (Staal *et al*., 2003) and Uganda ($0.06-$0.22) (Baltenweck *et al*., 2007) There are substantial variations among hubs in Uganda where cost of producing a litre of milk ranges from $0.15 in Masaka and $0.51 in Mukono. The variation in Rwanda is even higher, $0.15 in Mbare and $0.72 in Bwisanda. Cost of producing a litre of milk in Kenya ranged between $0.12 in Kabiyet and $0.23 in Soy, the lowest range compared to the corresponding figures for Uganda and Rwanda.

6 SUMMARY AND CONCLUSIONS

This section discusses a summary of key findings from the economic performance analysis undertaken in this report. The preceding section provided the position of each hub in terms of key performance indicators – gross margin and cost of producing a litre of milk. For the purpose of summarising the findings in this report, it would prove useful to compare and contrast relative performances of hubs within and across countries against each other and then seek explanations for differences in levels of performance in terms of the details of production conditions discussed in detail in earlier sections.

- Starting with the revenue side, after examining all the relevant details, by far the most important and straightforward explanation for the differences between hubs in their economic performance lies in the volume milk produced. In Uganda, Bbaale is the best performing hub and the volume milk sold per household is about five times the corresponding figure for Mukono which comes least in its level of performance compared to the other hubs in the country. The same holds true for Rwanda where households in Kabarore sell more than three times as households in Bwisanga. However, the figures for Kenya suggests that volumne of milk sales is not necessarily explain the good performance measured in terms of cost of producing a litre of milk. The differences between performances of hubs in Kenya is relatively small.Bearing this in mind, Kabiyet and Kaptumo have relatively lower cost of producing a litre of milk while Soy and Mitkei have relatively higher cost per litre of milk.

- In Rwanda, best performing hubs, Kabarore and Mbare, have large annual revenue from cattle sales per household which considerably exceeded the corresponding figures for least performing, Bwisanga. However, for Kenyan and Ugandan hubs, revenue from cattle sales does not appear to explain better performance measured in terms of gross margins or cost incurred in producing a litre of milk.
- Since revenue from milk (sales and consumption) or cattle sale tend to be higher for best performing hubs compared to least performing hubs, then it becomes necessary to see if these indicators can in turn be explained by patterns of dairy farm asset which determine production conditions. We consider hired labour cost, herd size, herd type and farm sizes as some of the key farm assets already examined in earlier sections but now see the association between the patterns of asset ownerships and economic performance.
- There are clear patterns of similarities between herd size and economic performances of hubs in the most countries. For instance, a typical dairy farmer in Bbaale has 34 cattle in tropical livestock units (TLUs) but the corresponding figure for Mukono is 4.3 TLUs. This pattern is consistent across the countries although there are differences in the extents of differences.
- It appears that economic performances of dairy farming households in the least performing hubs could also be adversely affected by sizes of farm lands. Average farm size per household in Kabiyet is well over 10 acres while that of Mitkei is below 6 acres. Similarly average farm size per household in Bwisanga is about a third that of Kabarore. Dairy farming households in Mukono own less than 6 acres on average but dairy farms in Bbaale own above 10 acres.
- In the three countries, all best performing hubs have the lowest cost of hired labour, e.g. Kaptumao in Kenya, Luwero in Uganda, and Mbare in Rwanda. Thus, hire labour is the only factor that consistently explains best economic performance in all countries.
- Except for the cost of hire labour, the relationships between levels of economic performances of dairy farms across the hubs and countries and the costs of producing milk are not as clearly associated with economic performances. The reason for this could be the fact that costs of production, applied optimally, can enhance productivity and hence improve economic performances. For instance, expenditures on animal health in better performing hubs in all the three countries are about twice as the corresponding amount of expenditure among least performing hubs in the corresponding country. Although this could partly be explained by larger herd sizes (as well as existence of

improved breeds) the animal health expenditure might have also contributed to better cattle health and hence improved productivity.

- As far as the prospect of cost of producing milk adversely influencing dairy economic performance is concerned, it seems that proximity to large urban centres can contribute to cost disadvantage. Such location disadvantage may affect economic performance by unfavourably affecting farm size as well as some elements of costs of production. For instance, Mukono is relatively close to Kampala and this may explain not only the relatively small farm size (due to land scarcity) but also the disproportionately larger costs of labour. Similarly, Bwisanga dairy farming households spend considerably larger amount on feed compared to any other hub in Rwanda.

In summary, it is important to note that the economic performances of dairy farms in different hubs across the three countries face different sets of opportunities and constraints. It would prove useful to pay attention to specific settings of the hubs to intervene appropriately by capitalising on existing opportunities and tackling specific constraints.

This report has largely been based on descriptive analysis of conditions of production and economic performances of dairy farms. To do so, we have relied on key sets of performance indicators. For this, most variables have been analysed at the level of hubs. However, the sets of averages across a range of variables at hub level may mask differences due to individual farm level attributes within each hub. Different categories of households may face varying degrees of constraints. It becomes important to pay attention to such differences at household level when implementing interventions devised by taking into account conditions observed at hub or country levels. Farm level economic performance analysis by using econometric methods will be the subject of subsequent research.

Reference:

Staal S.J, Waithaka , M., Njoroge, L., Mwangi ,D.M., Njubi, D., Wokabi, A., 2003: Cost of Milk production in Kenya. SDP Research and Development Report 1.

Baltenweck I., Mubiru,S., Nanyeenya W., Njoroge, L., Halberg N., Romney D. And Staal S (2007). Dairy Production in Uganda: Production Efficiency and Soil Management Strategies under Different Farming Systems. ILRI Research Report 1. International Livestock Research Institute, Nairobi, Kenya.