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Milk Production in Uganda: Dairy Farming Economics and Development Policy Impacts

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PREFACE

This is the 9th of a series of Working Papers prepared for the IGAD Livestock Policy Initiative. The purpose of these papers is to explore issues related to livestock development in the context of poverty alleviation.

Livestock is vital to the economies of many developing countries. Animals are a source of food, more specifically protein for human diets, income, employment and possibly foreign exchange. For low income producers, livestock can serve as a store of wealth, draught power, fuel, prestige and organic fertiliser for crop production and a means of transport. Consumption of livestock and livestock products in developing countries, though starting from a low base, is growing rapidly.

The study applies the economic methodology developed by the International Farm Comparison Network (IFCN), which is based on the concept of 'typical farms', to gain insights in the economics of typical dairy farming systems in Uganda and assess the potential impacts of dairy development policies. Two districts near the city of Kampala, holding all major farming systems, were selected. The district of Mukono holds the small-intensive (1 exotic cow, zero grazing), the fenced-grazing (15 exotic cows) and the large-intensive (45 exotic cows; selling milk directly to urban processors/retailers) dairy production systems. And the district of Kayunga, more distant, holds the dairy farming systems classified as small-extensive (3 indigenous cows), intermediate-extensive (13 indigenous cows), the pastoralist (35 indigenous cows) and the agro-pastoralist (40 low graded cows). Each farm is described in detailed economic information presented both graphically and in the text.

Although this study is seen as a research method development exercise, we hope it will provide useful information to its readers. Any feedback on method improvements and results is much welcome by the authors, PPLPI and the Livestock Information, Sector Analysis and Policy Branch (AGAL) of the Food and Agriculture Organization (FAO).

Disclaimer

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Keywords

Milk production costs, Uganda, Impact analysis, Policy, Poverty reduction, Small-scale dairy, Typical farms, Dairy development.

1. EXECUTIVE SUMMARY

1.1 Introduction

Ugandan milk production is largely dominated by small-scale farmers who own over 90 percent of the national cattle population (FAO 2004). In rural areas, where 96 percent of poor Ugandans live (Okidi et al, 2004), up to about 60 percent of the households keep mostly indigenous cattle (NADDS; King 2002). By far, the majority of milk production systems in Uganda are characterized by (a) a 'low input-low output' approach, (b) livestock is not an important source of cash, but a source of food, store of wealth and status symbol, and (c) milk demand is increasing and driving more and more of these dairy farms to intensify and often to diversify as to increase household returns.

Due to market forces first, and to higher competition for production factors secondly, the main milk production systems in Uganda have been evolving seemingly in the same direction (towards intensification), but at different speeds. A coordinated dairy development program for the sector would require a clear understanding of (a) the present status of the main production systems and (b) an evaluation of potential impacts of the main dairy development interventions implemented and/or proposed on the predominant production system.

The dairy sector is considered to be the most organized livestock sub-sector in Uganda. Currently, the Dairy Development Authority (DDA) is charged with promoting production, competition and monitoring the markets for milk and dairy products. To achieve this, DDA collaborates closely with multiple private sector organizations operating in Uganda.

The main purposes of this study were to:

1. Identify and characterize the main typical dairy farming systems in Uganda,
2. Evaluate the economics of these typical dairy farms,
3. Gain insights in the household economics of such farms,
4. Evaluate the impacts of the main dairy development policies on the predominant farming systems,

In order to achieve the above, a methodology to quantify the farm-level impacts of different local dairy development programs, policies, interventions and ideas as seen by local dairy stakeholders (policy makers, farmers, milk processors, NGOs, etc.) was developed. The results are intended to both inform the political process and initiate discussions for finding the most efficient dairy development activities for the Ugandan dairy farming sector.

1.2 Methodology

The methodology applied for the economic analysis was developed by the International Farm Comparison Network (IFCN) and utilizes the concept of typical farms. For this initial study, the districts of Mukono (peri-urban, with intensive farming systems) and Kayunga (rural, with extensive farm types) were selected. Therefore, the selected farms include from zero-grazing, fenced-grazing, up to large pastoralist and agro-pastoralist farming systems. Management levels on the typical farms are average to slightly above average compared to other farms of the same type. The data was collected using a panel of local dairy experts followed by data from existing farms through farm visits and interviews using a standard questionnaire.

The calculations are based on the computer simulation model, TIPI-CAL (Technology Impact and Policy Impact Calculations) version 4.0. This version has been further developed in the years 2005-2006 to better represent the complexity of small-scale dairy farming and their non-cash benefits.

Although great efforts were made both to model the economic, social and biological complexities, the authors invite readers' comments and suggestions for improvements of the research methodology utilized (Please contact Otto Garcia at: otto.garcia@ifcndairy.org).

1.3 Farm Economic Results: Typical Milk Production Systems in Uganda

Using the EXTRAPOLATE model, a recent FAO study in Uganda identified fifteen direct stakeholder groups in the Ugandan dairy sector, from which seven represent the existing predominant dairy farming systems (FAO Paper still to be published). EXTRAPOLATE further classified the farming systems into three intensive and four extensive ones. Following the IFCN methodology, three and four cases were identified as 'typical' farming cases to be studied in the districts of Mukono and Kayunga. These dairy farm types provide an insightful picture of the income levels, possible effects of economies of scale and commercialisation on such systems.

Household Comparison (Livelihood Status Indicator)

The household per capita incomes range from a low 0.33 up to a high 20 US-\$. Four of the seven households make a per capita daily income below 0.60 US\$; that's about half of the so-called international poverty line of 1 US-\$/ person/ day. The large specialized Mukono farm and the large agro-pastoralist operation in Kayunga make a high per capita income of 20 US-\$, but these households rely on off-farm employment in the city of Kampala and a lucrative cash crop operation, respectively.

Return to Dairy Labour (Local Dairy Competitiveness Indicator)

On the one dimension, all the farms except the small peri-urban one make a return to each labour put into the dairy business that is higher than the wages the farm would pay for it. This means that these farmers make a profit on the labour used. On the other, these returns to dairy labour for the medium and larger farms in both regions are higher than the wages around them.

The farms that do not achieve the wage rate levels are a) the small farm in Mukono when it has to pay the costs of family labour and b) the two smaller Kayunga farm due to the extremely low productivity of their animals, low milk price, small herd size, and high mortality rates.

Costs of Milk Production (Local Dairy Competitiveness Indicator)

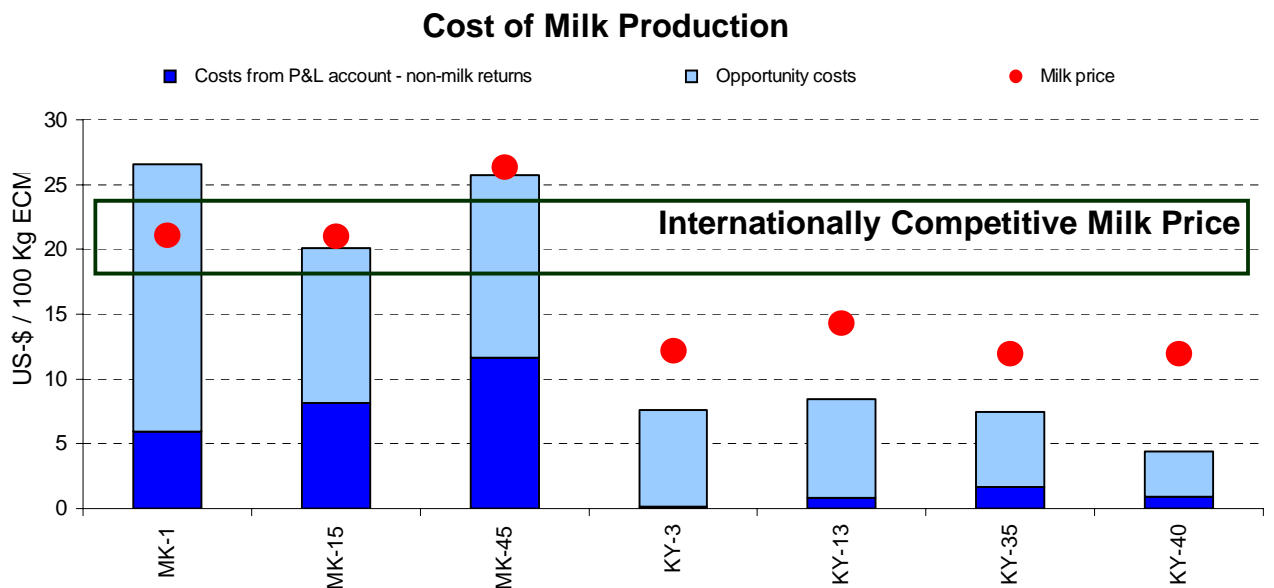
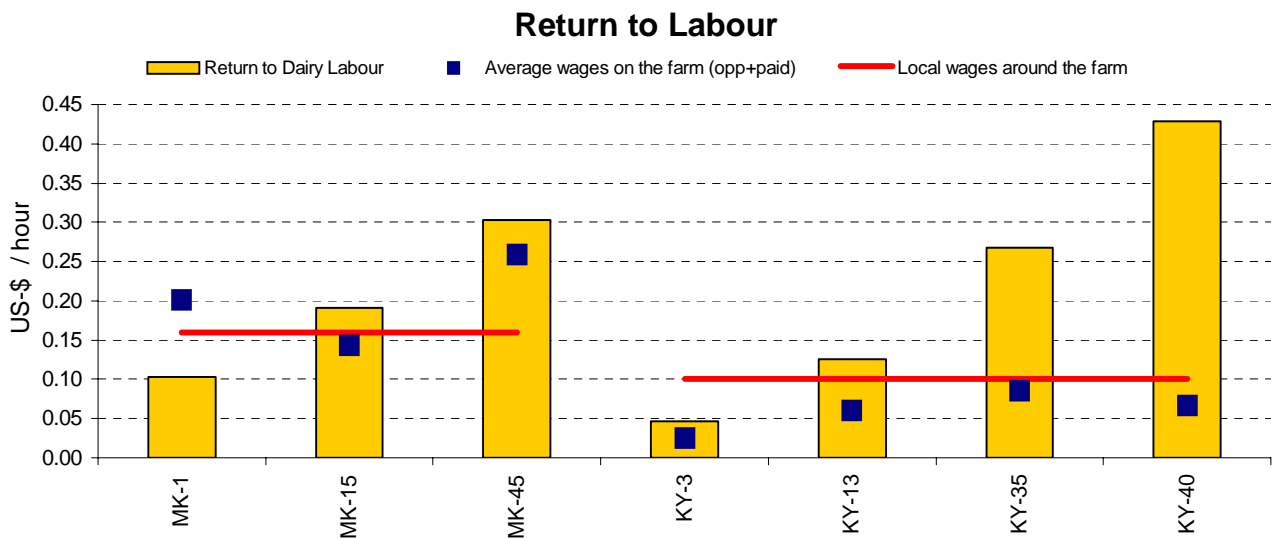
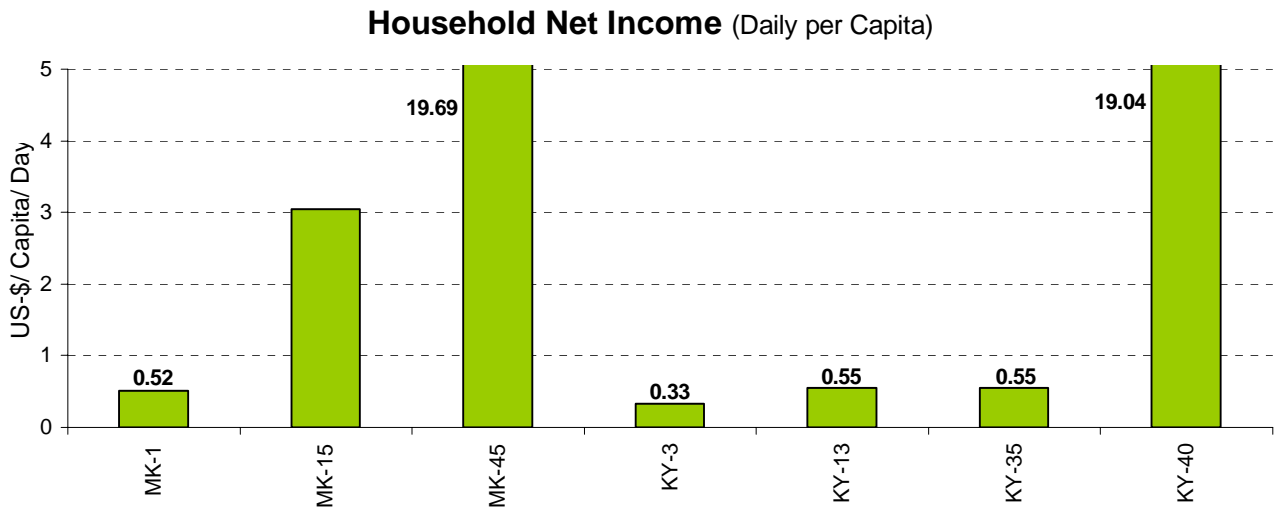
When considering only the cash costs (darker section of the bars), all the farms make attractive net incomes ranging from 10 to 15 US-\$/ 100 kg of Energy Corrected Milk (ECM). In this case the zero grazing farm in Mukono has the highest net income of 15 US-\$/ 100 kg ECM. However, when the farms have to pay for all the family own resources used, then all except the zero grazing farm in Mukono make a profit, which ranges from 0.6 up to 7.5 US-\$/ 100 kg ECM.

The farm in Mukono receive an internationally competitive milk price (at the world milk price level of from 18 to 24 US-\$/ 100 kg ECM), while their Kayunga counterparts receive about half of that.

Key Conclusions

- 1 The large majority of cattle holders in Kayunga make an extremely low per capita income, on one side, while on the other, they are extremely competitive milk producers receiving an (inter)nationally low milk price. Such farmers, who form the vast majority in the country, are positioned to capitalize on dairy development interventions that both (a) connect them to the growing urban dairy markets of Kampala, Jinja, etc. and (b) promote access to affordable farm inputs and services that support business development.
- 2 The performance of the zero-grazing farm type (MK-1) is both strong and weak, depending on how it is looked at. All in all, this particular farming system in Mukono makes economic sense as long as farmers do not have a (more) lucrative alternative for their labour, which is the current situation. Once better-paid alternatives appear, we should see milk production shifting to more distant areas like Kayunga.

1.4 Economics of Milk Production in Uganda



1.5 Dairy Development Policies in Uganda: Impacts on the Typical Farm Type

Dairy stakeholders consulted agreed that the farm type KY-3 represents the most commonly found milk production system in Uganda. However, this farm types are not only low in the priority focus of ongoing dairy development efforts, but even when reached, this type of farmer does not engage in effectively enough to develop his/her operation. Presently, there are various sets of dairy development policies and some have the potential to both engage and develop this particular farm type. The following results show the impacts of the main (ongoing and proposed) dairy development policies on this most numerous farm type as perceived and expected by different dairy stakeholders in Uganda.

Household Comparison (Livelihood Status Indicator)

When indigenous cows and extensive management are used, these policies could increase and decrease the household per capita daily income by 7 and 5 percent, when milk prices increase and decrease respectively. This relatively slight impact is due to the farm's poor link to input and output markets (poor commercial engagement). However, when both genetics and management are improved (higher commercial engagement), these policies could increase and decrease the household per capita daily income by 20 and 15 percent from the Graded farm respectively.

Notice that a higher commercial engagement increases the household income by over 60 percent (from KY-3 to Graded). However, no scenario brings the household to the well-known reference poverty line of 1 US\$ per capita per day. This is mostly explained by the low scale of the dairy business and lack of value-adding activities by the farmer.

Return to Dairy Labour (Local Dairy Competitiveness Indicator)

With indigenous cows, these policies could increase and decrease the return to dairy labour by 40 and 20 percent respectively. None of these policies bring the return to labour from working on the dairy farm to what the farmer would make working in an off-farm job. This means that whenever the family has an off-farm job alternative, producing milk for sale under these conditions is not attractive.

With graded cows, this farm becomes a very attractive alternative for family labour since the return to labour is now 40 percent above the wages around it. Furthermore, six of these policies could lead to increases of up to 55 percent while the other four could decrease it to 30 percent of the current level.

Costs of Milk Production (International Dairy Competitiveness Indicator)

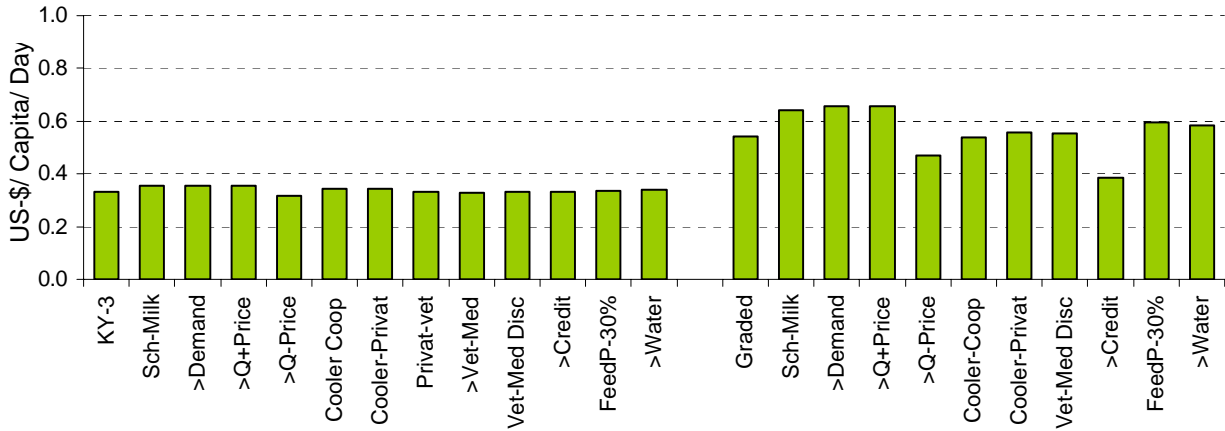
These policies have little impact on the costs of milk production for KY-3 as it is. Only when the farmer puts more hours in fetching water, opportunity costs increase by up to 20 percent, but notice that this is basically family labour which is not cash and most likely, there is no other economic use for it. When animals are graded, costs increase by 40 percent, but the real fear for this farms is that the cash costs increase from practically null to 6 US-\$/ 100 kg ECM milk (about 55 percent of its total costs). This increase in cash expenses represents a major burden for a working-capital-constrained farm.

Key Conclusions

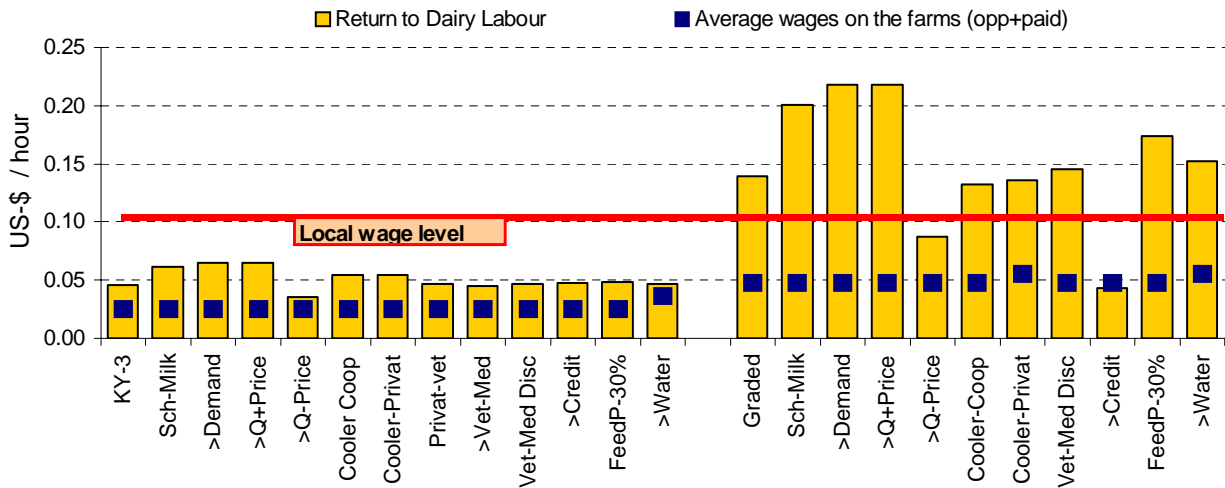
- 1 These policies seem to have a slight impact on the household income and dairy competitiveness unless the farm intensifies and/or grows in size. Either direction will require more competitive dairy markets for both outputs and inputs.
- 2 If intensification is chosen, breed and management improvements would make the farm very competitive locally. However, while intensifying this farm type could increase the household income by 3 times, the cash needs to produce 100 kg milk increases by 30 times.
- 3 Either intensification or up-scaling of this farm type will mean more investment and higher risks for already capital-poor farmers. A successful dairy development in Kayunga will, therefore, require clear-cut policies that minimize risks for the farmers (so they engage commercially) and create efficient dairy chains (to link farmers to consumers most effectively).

1.6 Impacts of Dairy Development Policies - Farm 3-KY

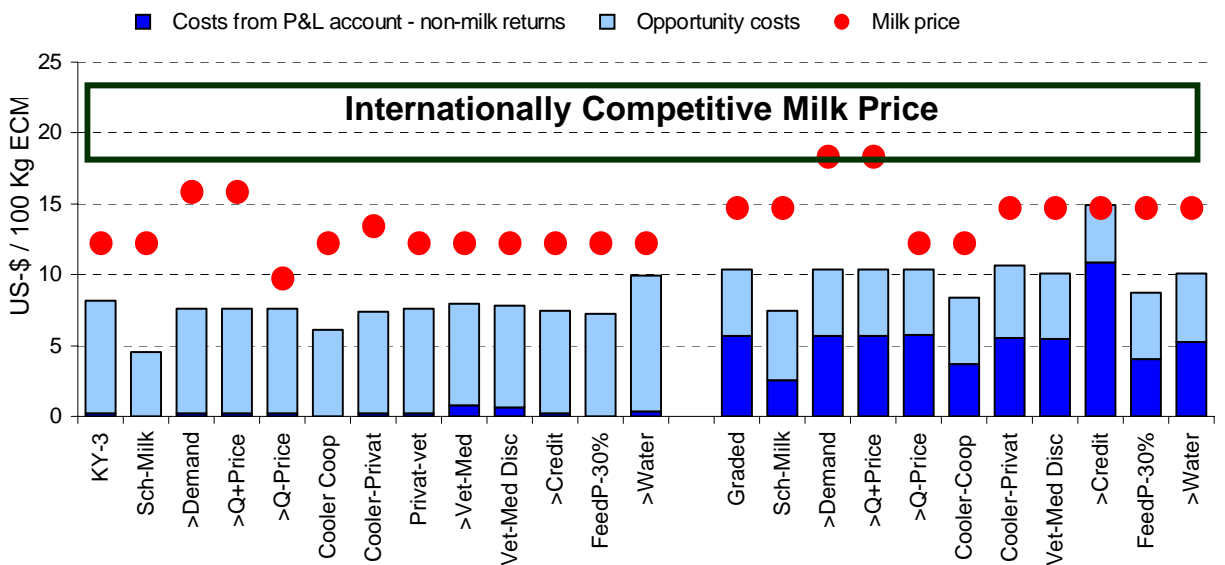
Household Net Income



Return to Labour



Cost of Milk Production



2. INTRODUCTION

2.1 Introduction

Dairy production is largely dominated by small-scale farmers who own over 90 percent of the national cattle population (FAO 2004). In rural areas, where 96 percent of poor Ugandan live (Okidi et al, 2004), up to about 60 percent of households keep mostly indigenous cattle, as seen in the 'cattle corridor' zone (NADDS; King 2002). Then it can be said that dairy production provides subsistence and income for many Ugandans.

It is also known that (a) milk production in Uganda is characterized by a 'low input-low output' approach, (b) for most households, livestock is not an important source of cash, but a source of food, store of wealth and status symbol, and (c) Ugandan dairy stakeholders have been looking for and capitalizing on opportunities to diversify on dairy production so as to increase their returns to land and labour.

The most common milk production systems in Uganda have been evolving seemingly in the same direction (towards intensification), but at different speed, which depends on market forces and availability of production factors, especially land. A coordinated dairy development program for the sector would require a clear understanding of (a) the present status of the main production systems and (b) an evaluation of potential impacts of the main dairy development interventions implemented and/or proposed on the predominant production system.

The dairy sector is considered to be the most organized livestock sub-sector in Uganda. Currently, the Dairy Development Authority (DDA) is charged with promoting production, competition and monitoring the markets for milk and dairy products. To achieve this, DDA collaborates closely with multiple private sector organizations operating in Uganda.

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2.2 Objectives

As the Ugandan dairy sector is increasingly moving towards a more open market environment, there is a paramount need to better understand the current economics of the main milk production systems found in Uganda and how dairy development programs impact both the household livelihood (income situation) and the (inter)national dairy competitiveness level of the most typical dairy farm type. In this context, this study aims to address the following specific questions:

1. What is the current economic situation of typical dairy farming households in Uganda? How high are their incomes? How much do these households benefit from dairying and how competitive is milk production of the main farming systems both regionally and internationally speaking?
2. What are the expected farm-level impacts of the main dairy development programs and proposed interventions to develop a pro-poor dairy farming sector in Uganda?

2.3 Methodology

The methodology applied for the economic analysis was developed by the International Farm Comparison Network (IFCN) and utilizes the concept of typical farms (for more on the IFCN methods, please go to Annex A1-A3). For this initial study, the districts of Mukono (peri-urban, with intensive farming systems) and Kayunga (rural, with extensive farm types) were selected. Therefore, the selected farms include from zero-grazing, fenced-grazing, up to large pastoralist and agro-pastoralist farming systems. Management levels on the typical farms are average to slightly above average compared to other farms of the same type. Data was collected using a panel of local dairy experts followed by and data from existing farms through a standard questionnaire.

The calculations are based on the computer simulation model, TIPI-CAL (Technology Impact and Policy Impact Calculations, version 4.0). This version has been further developed in the years 2005-2006 to better represent the complexity of small-scale dairy farming and their non-cash benefits.

Although great efforts were made both to model the economic, social and biological complexities, the authors invite readers' comments and suggestions for improvements of the research methodology utilized (Please contact Otto Garcia at: otto.garcia@ifcndairy.org).

2.4 Structure of the Paper

This paper has been arranged in the following sequence:

1. Executive Summary: It gives a quick overview of the main findings of the study.
2. Introduction: It provides details about the project, the methodology used, and the contents of this report.
3. Economics of Typical Milk Production Systems in Uganda: Firstly, it shows condensed pictures of the national and state milk production sectors and their characteristics, and secondly economic results are presented at the household, whole farm, and dairy enterprise levels for the selected typical farms.
4. Impact Evaluation of Dairy Development Activities in Uganda: Presents the results from the farm-level impact analysis of the main dairy development intervention existing and emerging from key dairy stakeholders.

3. ECONOMICS OF TYPICAL MILK PRODUCTION SYSTEMS IN UGANDA

3.1 Description of 'Typical' Milk Production Systems in Uganda

The table on the next page attempts to supplement these brief introductions.

Typical dairy farms in Mukono district (20 KM from Kampala)

1-Cow farm (MK-1): (Small-holder Intensive)

Introduction: This farming system represents the typical zero grazing 1 to 3 graded dairy cows and a total herd of around 2 to 6 animals at any one time. The household owns some land and grows mostly grass (i.e. Pennisetum purpureum) for the dairy and some cash crops. Milk yield per cow reaches 2,500 kg milk per lactation, which is obtained with relatively high use of concentrates. Manure is easily collected and utilized as fertilizer. The household income from off-farm sources is significant.

15-Cow farm (MK-15): (Medium-holder Intensive)

Introduction: This farm keeps 15 graded cows grazing on fenced paddocks. Both lactation yield and use of concentrates per animal are lower than the zero grazing. Although this system has extra costs in fencing and its maintenance, it shows significant labour and purchased feed cost reductions.

45-Cow farm (MK-45): (Large-scale Intensive)

Introduction: This farm type represents a business man or a civil servant working and living in the city. The farm has high investment in farming assets such as highly productive animals and a pickup to deliver the milk to the city, thereby capturing a high milk price than other farm types. This farm type is seen as both a lucrative economic activity and attractive investment option for the savings from off-farm sources.

Typical dairy farms in Kayunga district (130 KM from Kampala)

3-Cow farm (KY-3): (Small-holder Extensive)

Introduction: The household head is an agricultural labourer, who owns about 2 ha of land and has access to other 20 ha. Milk is sold to the local vendor, who comes once a day to the farm. Due to a low milk volume sold daily, the farmer sees no reason in delivering the milk to the collection centre (about 3 km away). No concentrates are used, but salt as a mineral supplement.

13-Cow farm (KY-13): (Medium-holder Extensive)

Introduction: The farmer is a civil servant and puts 1-2 hours per day in the dairy. A hired herdsman grazes the animals along with other herds on rented land. He sells milk to the collection centre directly.

35-Cow farm (KY-35): (Pastoralist; semi-nomadic)

Introduction: This farm type is a semi-nomadic system. Due to the shortage of public grazing land, nomadic systems are increasingly renting private land and staying in the same area for months and even years. They also feed only salt and have a hired herdsman. Although the farm hires a herdsman, the children put many labour hours in the dairy, which makes the farm total labour costs considerably lower.

40-Cow farm (KY-40): (Agro-pastoralist)

Introduction: The farmer's main economic activity is cash crop production, which he sells under a contract basis with distributors in the capital city. The dairy is a side activity that allows better utilization of the available low-priced land and labour and produces manure to fertilize the crops. The animals here are about 25 percent graded, which means that they are slightly more productive than those of the other three farm types, while the management and technology levels used are basically the same. In addition, this system has crop residues to feed the animals during the dry season.

Typical Farms	Units	MK-1	MK-15	MK-45	KY-3	KY-13	KY-35	KY-40
HOUSEHOLD								
Number of persons	No.	6	5	5	6	6	6	8
Family cash living expenses	US-\$/yr	1075	1638	19624	504	958	1956	2229
Family consumption from dairy farm	US-\$/yr	137	67	247	24	220	244	294
Family labour Availability	Man hrs/ yr	4750	4240	4240	4750	4750	4750	5990
FARM ENTERPRISES								
Types of enterprises	Description	Dairy + Crops + Pigs + Poultry	Dairy + Crops + Goat + Pigs + Poultry	Dairy + Crops + Poultry	Dairy + Crops + Goats + Poultry	Dairy + Crops + Goats + Poultry	Dairy + Crops + Goats + Poultry	Dairy + Crops + Sheep + Poultry
Land								
Farm land (owned)	Ha	0.8	8.2	28.3	2.0	1.0	0.0	40.5
Farm land (hired)	Ha	0.0	0.0	0.0	20.2	40.5	86.2	0.0
Land value	US-\$/yr	3320	3310	3320	200	159	0	132
Labour								
Family labour utilization	Man hrs/ yr	3650	2555	156	1771	3309	2679	3650
Hired labour utilisation	Man hrs/ yr	0	2600	5520	2600	3795	1872	16830
Regional wage	US-\$/ hr	0.17	0.17	0.17	0.10	0.10	0.10	0.10
Farm hired labour wage	US-\$/ hr	0.00	0.12	0.17	0.012	0.042	0.052	0.027
Capital								
Total farm assets	US-\$	3716	41169	165175	1042	3187	6185	16460
Farm buildings	US-\$	196	322	17345	39	39	39	1991
Machinery	US-\$	32	2512	9491	45	348	46	643
Land value	US-\$	2688	27130	93783	402	161	0	5359
Livestock value	US-\$	800	11117	44556	556	2638	6100	8467
DAIRY ENTERPRISES								
Herd management								
Adult cows only	No.	1	15	45	3	13	35	40
Total Herd size	No.	2	27	93	5	24	56	73
Animal breed	Description	Graded	Graded	Graded	Local	Local	Local	25% Graded
Lactation yield (Non-ECM)	Kg/ cow/ lactation	2700	2400	2500	564	480	435	1141
Daily lactation yield (Non-ECM)	Kg/cow/day	9.0	8.0	8.2	2.7	2.3	2.4	4.2
Intercalving period	Months	13	14	14	16	16	16	15
Days in milk	Days	300	300	305	210	210	180	270
Feeding								
Grazing land (own + rented)	Ha	0.41	7.11	22.13	20.24	40.49	86.23	26.32
Concentrate	Ton/ cow/ yr	1.22	0.83	0.50	0.00	0.00	0.00	0.00
Minerals	Ton/ cow/ yr	0.01	0.014	0.011	0.030	0.021	0.083	0.021
Herd production								
Insemination method	Description	AI	AI	AI	Natural	Natural	Natural	Natural
Breeding costs	US-\$/cow/year	27	23	20	0	0	0	0
Health parameters								
Vet+Med expenses	US-\$/cow/year	54	46	40	8	5	5	13
Cow mortality	%	0.05	0.05	0.04	0.05	0.10	0.10	0.10
Heifer mortality	%	0.10	0.07	0.04	0.10	0.08	0.08	0.10
Calf mortality	%	0.20	0.30	0.10	0.20	0.20	0.50	0.20
Notes: ECM = Energy Corrected Milk; Exchange rate used: 1 US-\$ = 1866 Ugandan Shillings								

3.2 Farm Comparison: Household Approach

Household net income and structures

The household net incomes combine the net cash income from on-farm and off-farm activities. When seen in a daily per capita income, the farm households MK-1, KY-3, KY-13, and KY-35 are extremely poor with incomes well below the well-known reference line for poverty of 1 US-\$ per person per day.

These household incomes come typically from off-farm sources first and the dairy enterprises secondly. The exceptions are MK-15 and KY-35, which are far more specialised in milk production, have little or no own land and poor access to off-farm employment while KY-40 is heavily focused on crop production.

This clearly indicates that most Ugandan dairy farm households are mostly part-time farmers with proceeds from farming contributing less than 50 percent to their household incomes, with few exceptions.

Household assets

The distribution of assets of the farm households analyzed is highly inequitable with values ranging from 3,000 US-\$ for KY-3 up to 293,000 US-\$ for MK-45. Interestingly, the share of family assets used for income-generation activities is lowest for the smallest farms (40 to 60 percent), then highest for intermediate farms (80 to 97 percent), and goes again slightly down in the largest farms (65 to 85 percent).

Household labour utilization

The use of family labour for income generating activities ranges from 1,500 to over 4,000 man-hours per year. The tendency is that labour utilization increases for households near the urban centres and those in rural areas that have a government/ community job (like KY-13) and/or those with more assets to create employment opportunities (like KY-40 cash crops). The opposite is true for KY-35, which has animals, but no owned land and poor access to employments.

Household consumption (Cash and Non-Cash)

The total family living expenses, including cash expenditure and consumption of own farm produce, vary significantly from 1,500 US-\$ to over 22,000 US-\$ per year (for KY-3 and MK-45).

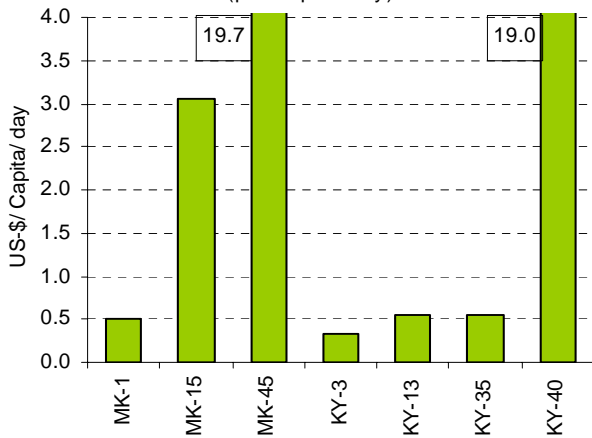
Interestingly, these households derive from 5 up to 70 percent of their living expenses from their own farms, which includes products from the dairy, crops and other farm enterprises (goat, chicken, etc.). In the case of smaller farms, households get from 50 to 70 percent of their living expenses from their own farms, which points to the relevance of the farms for food security. Furthermore, households in Kayunga are more reliant on food production from their own farms for their immediate consumption than those in Mukono. The exceptions are KY-35 (has no land for crops) and KY-40 (commercial crops). Even though both families consume much milk in various ways: KY-35 must rely on cash purchases for other food items to supplement its diet while KY-40 has, besides food purchases, also high non-food expenses linked to its higher social status.

Explanations of variables; year and sources of data:

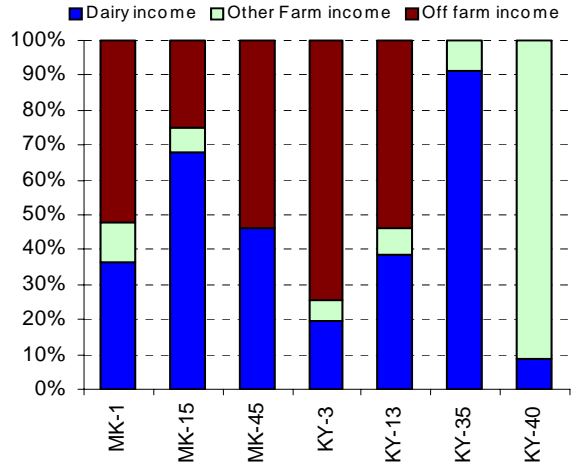
- Household per capita income: All cash receipts received by all family members from the farm and off-farm jobs.
- Household assets: All farm assets (land, cattle, machinery, buildings, etc.) and family assets (house, motorcycle, television, etc.)
- Labour used for income generation: Labour used only for farm and off-farm work, as Man-hours equivalent.
- IFCN data collection based on expert estimations and statistics, year 2006.

Household Net Income

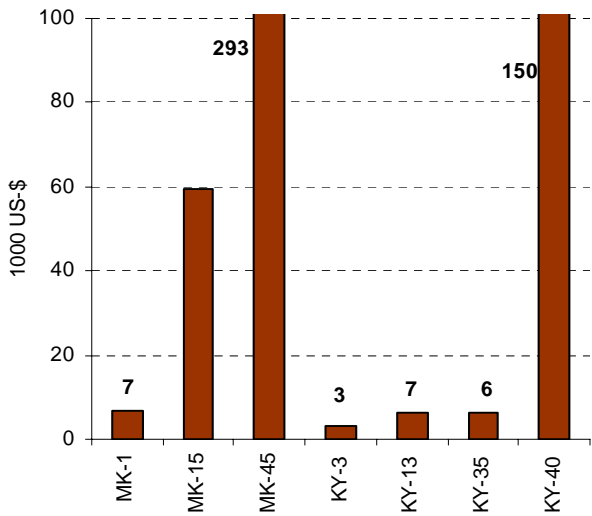
(per Capita/ Day)



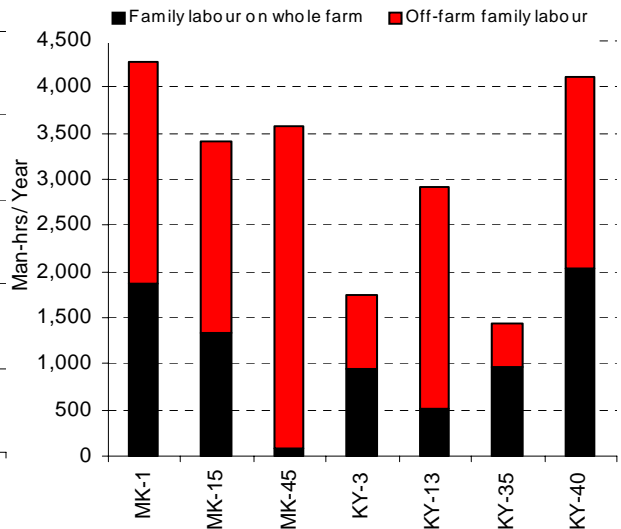
Household Income Structure



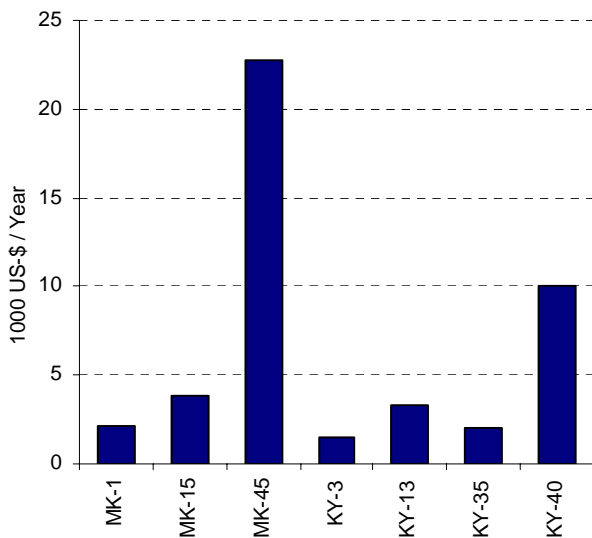
Total Household Assets



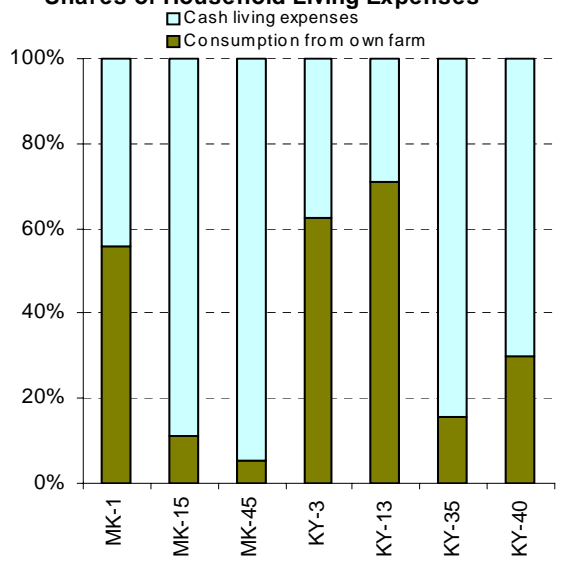
Labour- Used for Income Generation



Total Household Living Expenses



Shares of Household Living Expenses



3.3 Farm Comparison: Whole Farm Approach

Farm returns

Farm returns range from 350 to 62,000 US-\$ per year. All farms are able to cover the total farm expenses and generate a net positive farm income ranging from 200 to over 55,000 US-\$ per year for (KY-3 and KY-40). Both the highest and lowest farm incomes are found in the Kayunga farms. On one side, the three smaller farm types in Kayunga show relatively small differences in returns, expenses and net incomes. On the other the larger Kayunga farm extremely high returns, which are mainly due to firstly its large and very profitable cash crop enterprises and secondly to factors in the dairy enterprise such as bigger herd size, better genetics and better feeding management during the dry seasons.

The shares of dairy returns are higher than 75 percent of the total farm returns, except in the case of KY-40, whose crop enterprise dominates.

Farm output marketed and cash flow

In relation to the production volume, dairy products (milk, livestock and manure) show the highest proportion sold out (from 85 up to 99 percent in Mukono and about 90 percent in Kayunga). These high figures indicate that dairy farming is a major source of cash to meet the daily cash needs their households. Crops except for the agropastoralist farm, however, is sold at lower proportions (below 10 percent), which means that households tend to use them for own consumption and/or for their own farm enterprises. In the case of other farm enterprises (goats, chicken, etc.), household sell out at a rate of 60 to 80 percent as to add on the dairy daily cash income to meet higher cash needs happening at times.

The annual net farm cash flow ranges from US-\$ 211 to 55,000 for KY-3 and KY-40 respectively. This low net cash flows (particularly, those under 600 US-\$/ year for MK-1, KY-3, and KY-13) indicates that the small-scale and medium dairy farms are in a subsistence basis, with weak farm liquidity status and high business risks.

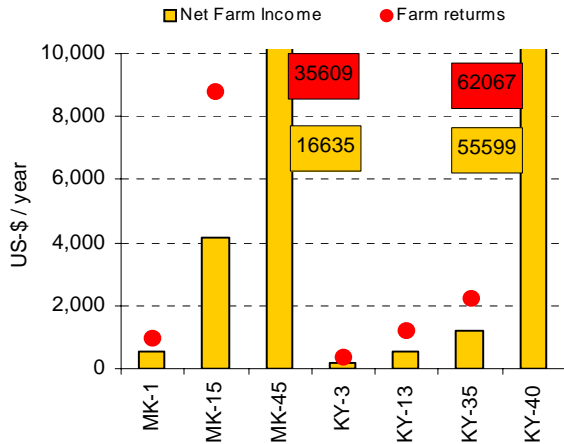
Farm assets and structures

Farm assets vary significantly between slightly over 1,000 US-\$ for KY-3 up to a high 165,000 US-\$ for MK-45. While in Mukono land represents 60 to 70 percent of the farm assets, in Kayunga livestock is the main asset comprising from 50 up to 97 percent of the farm asset value.

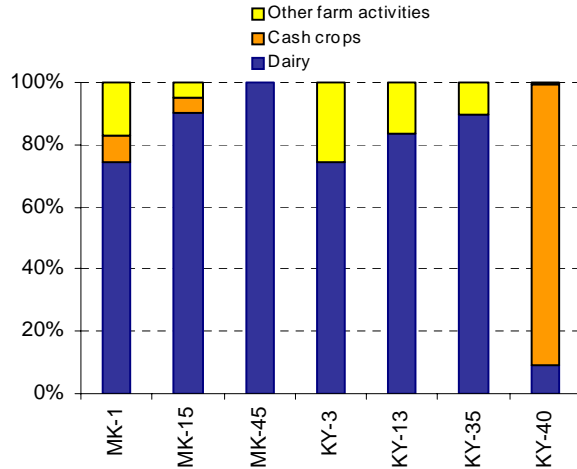
Explanations of variables; year and sources of data:

- Farm returns: All cash receipts minus the balance of inventory (for example livestock).
- Returns to dairy: Milk, cull cows, heifers, calves, sale and use of manure, draught power, etc.
- Proportion of farm output sold: Sale of crops, animal products, etc. divided by value of total farm production.
- Other farm output sold: Sale of poultry meat/ eggs, and goats. Residual is for home consumption & farm use.
- Farm cash flow: Total cash farm returns / year - Total cash farm expenses / year.
- Farm assets: All assets related to the farm (land, livestock, machinery, buildings, etc.)
- IFCN data collection based on expert estimations and statistics, year 2006.

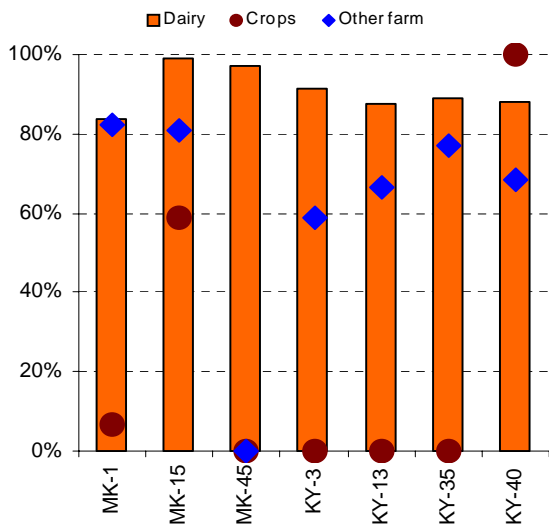
Farm Returns and Income



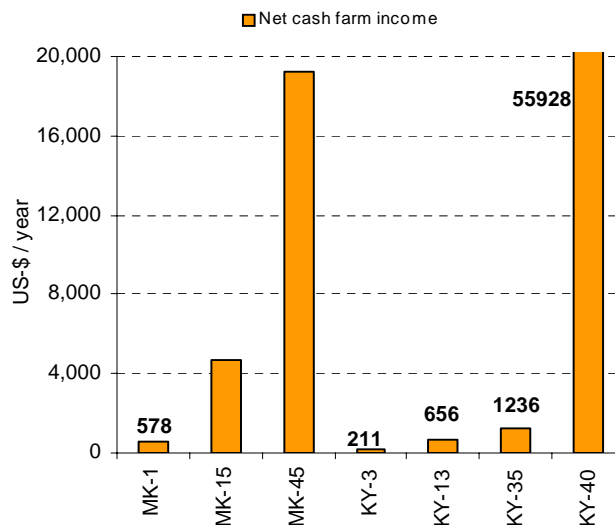
Farm Return Structure



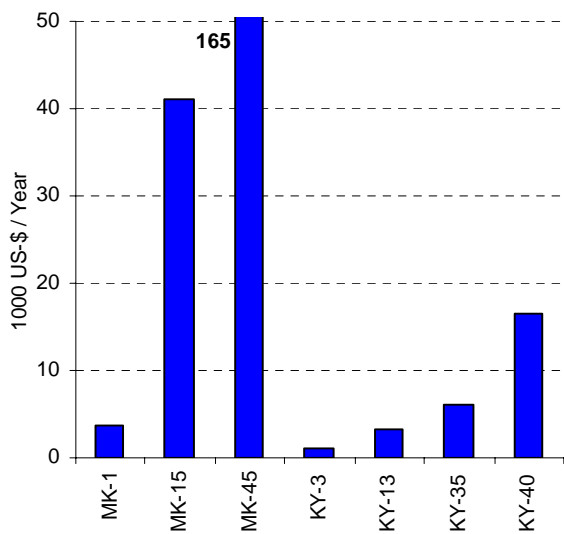
Proportion of Farm Output Sold



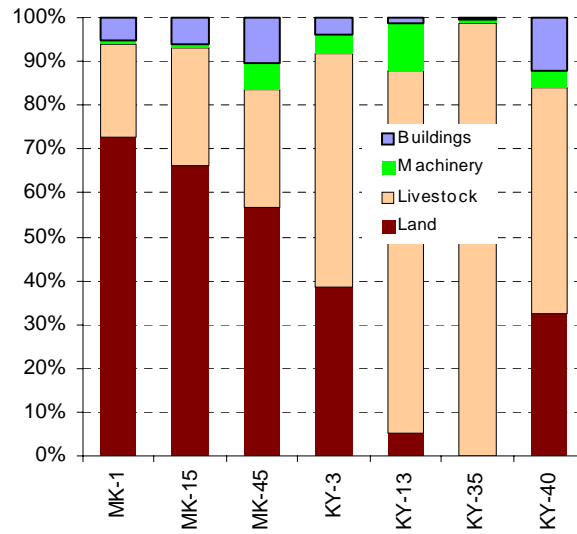
Farm Cash Flow



Total Farm Assets



Structure of Farm Assets



3.4 Farm Comparison: Dairy Enterprise Approach

Returns to the dairy enterprises (cash and non-cash)

The total cash returns per 100 kg ECM range from 18 to 37 US-\$ for KY-35 and MK-45 respectively. These returns combine the sales of milk, livestock and manure. In addition, households consume milk and beef, which are non-cash returns from the dairy enterprises. Non-cash returns range from a low 0.15 up to almost 5 US-\$/ 100 kg ECM produced. The milk used for calves and manure left on the field as fertilizer has not been deducted since they become the inputs for the production of milk, livestock, etc., which are readily captured here.

Costs and profits of the dairy enterprises

When the household's own resources used on the dairy enterprises are included, total milk production costs range from 8 to 36 US-\$ per 100 kg ECM for KY-40 and MK-45 respectively. In Mukono, the fenced system (MK-15) shows significant reductions in labour and feed cost as compared to the zero grazing (MK-1); while MK-45 has high costs of means of production. Low labour and land costs make Kayunga farmers very low cost producers.

When only cash transactions are calculated, all farm types make a positive net farm income, which varies between 10 and 15 US-\$/ 100 kg ECM. However, when the household's own resources are included in the cost calculations, six dairy enterprises generate a positive entrepreneurs profit that ranges from about 0.6 to 7.5 US-\$ per 100 kg ECM. Only the MK-1 (zero grazing) makes a negative entrepreneur profit (loss) of 6 US-\$/ 100 kg ECM. However, it is worth noting first of all that, dairy farming (like MK-1) will make definite sense, as long as there is no better alternative to it and if the farm makes a positive cash net income.

Cost of milk production

The cost of milk production varies from 4.5 to 26 US-\$ per 100 kg of ECM. The highest production cost of 26 US-\$ (MK-1) is mainly attributable to high opportunity costs of labour, with family labour being valued at the existing market wage rate. However, the high unemployment rate questions the validity of using existing local wages for valuation of family labour. The high cash cost (darker blue bar) in MK-45 is mainly due to maintaining the farm as a hobby, vacation place and not necessarily an efficient business. This is reflected in the high capital and operating cash costs. Finally, KY-35 has high cash costs due to annual fees paid to private landowners to have access to reliable water sources in the drought seasons.

Kayunga farmers are very cost competitive producers thanks to: minimal cash expenses and low opportunity costs for labour and land. This explains why they can make a profit regardless of receiving a milk price that is about half of the world milk price.

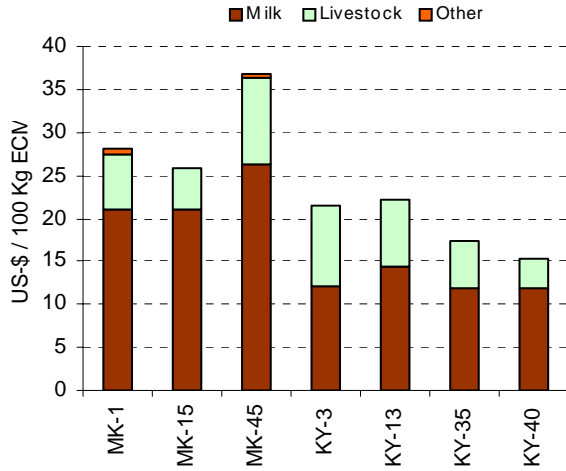
Returns to labour

All the farms, except MK-1, make a return to dairy labour higher than their local wage rates. This higher return on dairy labour shows that farmers make a higher income from working on their farms than from most of the jobs around their location. This also shows that dairy is a very competitive form of employment when compared to local alternatives. Kayunga's low labour and land rents favour high returns to dairy labour.

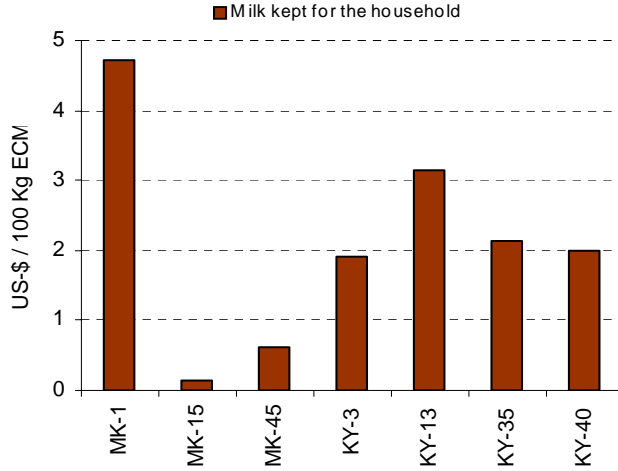
Explanations of variables; year and sources of data:

- See Annexes 2 and 3

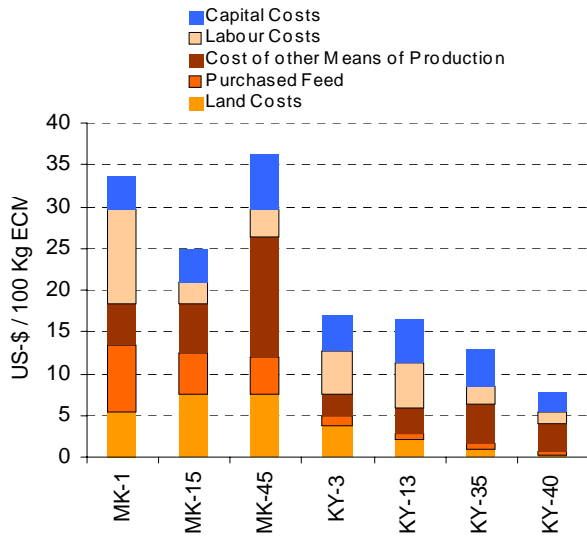
Total Cash Dairy Returns



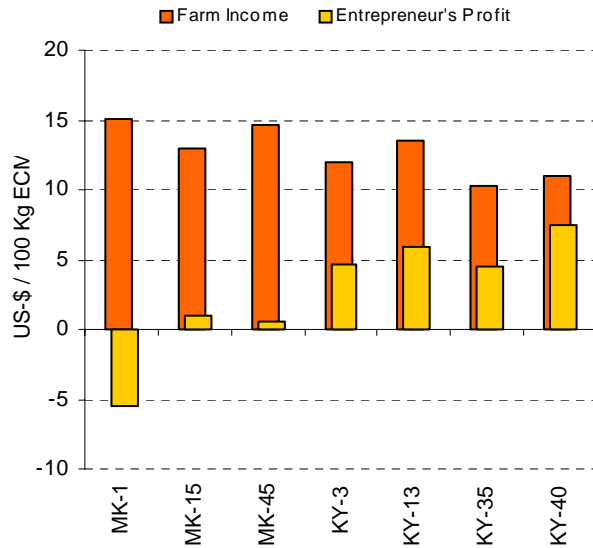
Total Non-Cash Dairy Returns



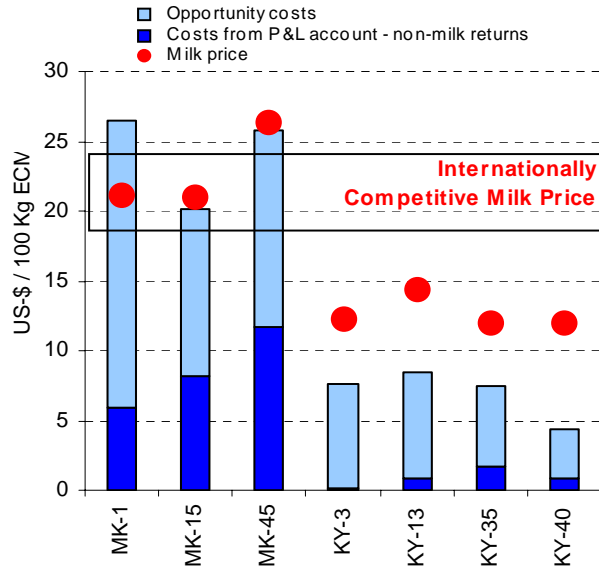
Cost Items Structure



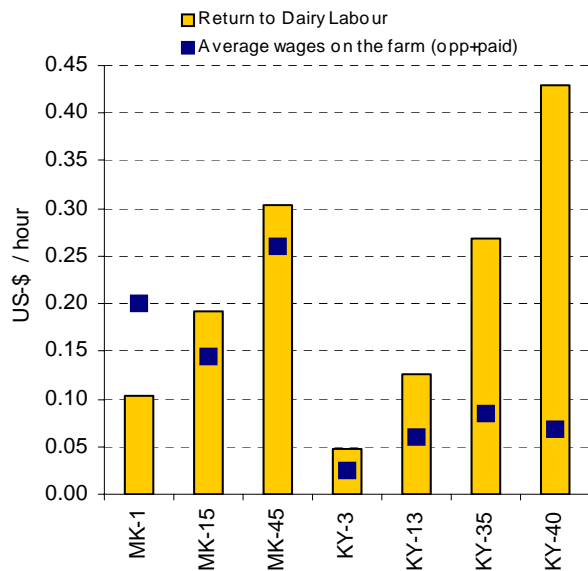
Returns and Profits



Cost of Milk Production



Return to Labour



Labour productivity

Labour input varies from about 100 up to 1,400 man-hours per lactating dairy animal per year. The profitability of the two large Mukono farms is clearly driven by higher labour productivity and resulting lower wage cost per 100 kg ECM (contrary to MK-1). The labour input per cow decreases as herd size increases. In the case of KY-40, labour wages are so low that the farmer can afford the extra labour.

Capital productivity

Capital input per dairy animal is significantly higher for MK-45 basically due to the farm being used as a recreational place for the owner's family, who live in the city of Kampala. Typically wealthy businessmen living and working in the capital city find dairy farming to be both an attractive investments opportunity and ideal to make their social activities away from their hectic urban lives.

Both regions have similar capital productivities of between 1,500 to 2,000 kg of ECM/ each 1000 US-\$ invested. This is mainly explained by the Mukono farms having higher output levels with high capital invested, while Kayunga farms have low production volumes with low investment.

Land productivity

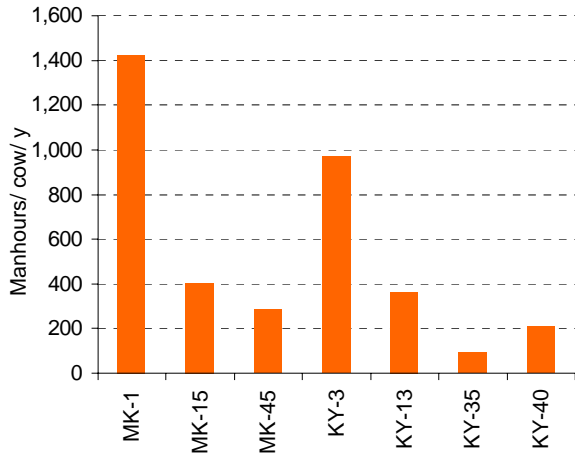
Land input per dairy animal varies from 0.4 up to almost 7 hectares, which includes owned and rented land used for both grazing and to produce by-products fed to dairy animals. In Mukono, unlike in Kayunga, the land needed per animal (about 0.5 ha per head) does not seem to decline as herd size increases.

There is a clear difference in the intensity of land use for fodder cultivation in Mukono while Kayunga farmers rely on natural pastures. Cultivated crops allows for a constant supply of green fodder (such as sorghum, napier grass and maize grain & silage) throughout the year, which results in higher land productivity and hence a higher stocking rate.

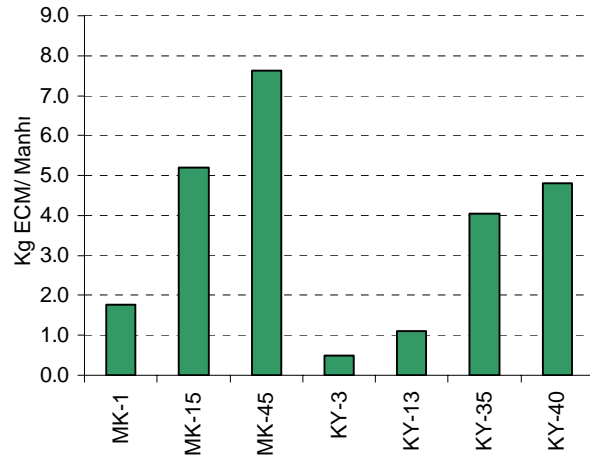
Explanations of variables; year and sources of data:

- IFCN method: See Annex A2 and A3
- Labour productivity: Total milk production in kg ECM per year/ Total Man-hours of labour in dairy per year.
- Capital productivity: Total milk produced in kg ECM in the year/ Total present market value of capital assets used in dairy enterprise in 1,000 US-\$
- Land productivity: Total milk produced in kg ECM in the year / Total land used in dairy enterprise in hectares
- IFCN data collection based on expert estimations and statistics, year 2006.

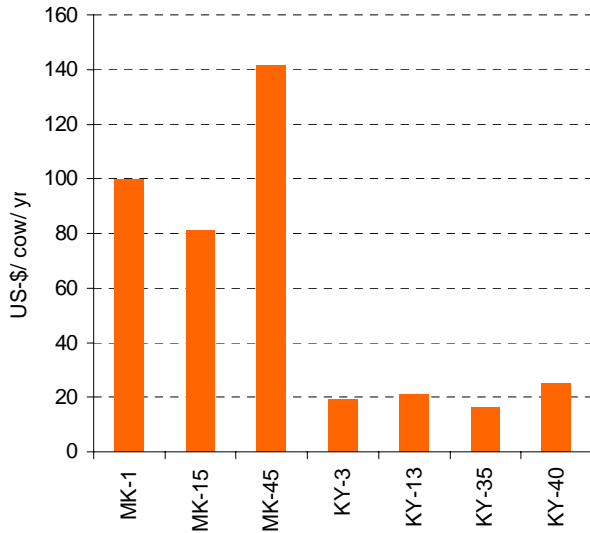
Labour Input



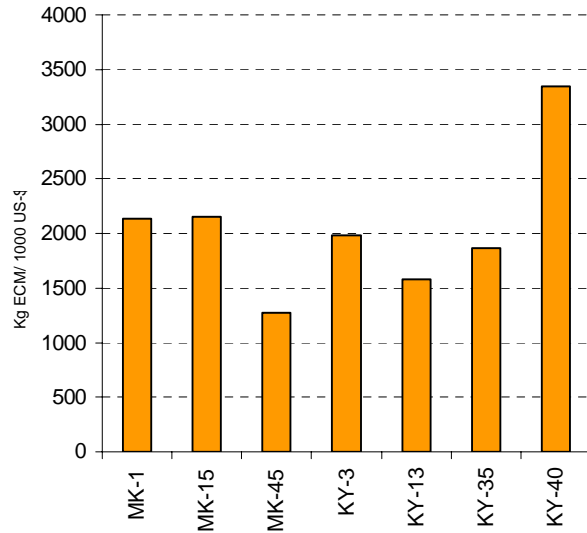
Labour Productivity



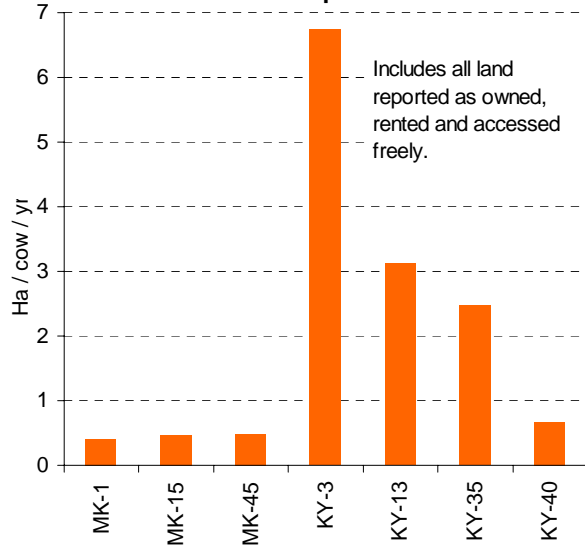
Capital Input



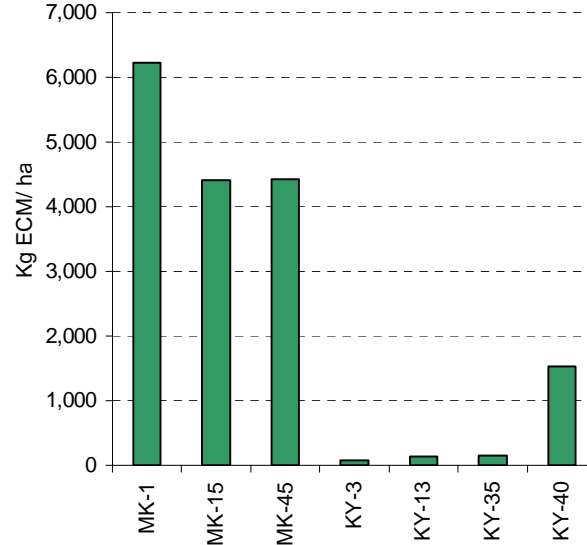
Capital Productivity



Land Input



Land Productivity



4. EVALUATION OF DAIRY DEVELOPMENT POLICIES IN UGANDA

4.1 Introduction

Livestock as an integral part of most farming systems in Uganda has evolved over time into a variety of dairy production systems. They range from highly intensive to highly extensive ones as to suit the different agro-ecological zones and socio-economic settings. The main factors driving changes of Ugandan dairy farming systems are a growing market for milk, increasing population pressure, and the promotion of dairy development by key stakeholders. Most, if not all, of these forces point to the same direction: the intensification of dairy production systems in Uganda.

Intensification of dairy production usually anticipates that it is economically and ecologically sustainable. However, in the Ugandan case it is not clear what the impacts of such policies are on the economics of the predominant dairy production system. Research was therefore undertaken to quantify the potential and expected impacts of the main dairy development policies on the most common dairy production system in Uganda. This section of the report presents the key results and findings.

4.2 Methodology Used

The methodology used in this study is that of the International Farm Comparison Network (IFCN). It is intended to build on and complement a recent FAO policy study done in the Ugandan dairy sector, which is to be published by the Pro-Poor Livestock Policy Initiative (PPLPI) shortly.

The methodological steps done in this policy analyses can be summarized as follows:

A- **Farm selection:** From the seven dairy farming systems analysed in the previous section, KY-3 was selected as the most representative of the largest number of farms in the country. The panels in both districts agreed that, at the country level cattle keeping is a small-holder and pastoralist undertaking. The most typical dairy farmer owns some land and has access to rented land for grazing either seasonally or throughout the year. Therefore, this farm type is no longer purely nomadic. This farm type also satisfied the pro-poor focus of PPLPI. KY-3 is located in the northern tip of the Kayunga district, an area belonging to the 'cattle corridor' zone, where 60 percent of the households keep local cattle and live on similar (extreme) poverty level as shown by the KY-3 household per capita income of 0.33 US-\$ per day.

B- **Policy selection:** Ugandan dairy stakeholders were quick to list the major dairy development interventions taking place and proposals they consider most appropriate to develop such farming system. Three broader policy categories emerged which include: genetic improvement, dairy market development and improving access to dairy farm inputs.

C- **Building policy scenarios and validating results:** Researchers met with separate dairy-related organizations and quantified farm-level changes in the production, economic and biological parameters of KY-3, which could result from the implementation of the current policies they are promoting. As a validation procedure, researchers discussed results and made adjustments based on new field insights from farmers, veterinarians and dairy development agents operating in Kayunga. However, the authors would truly welcome any feedback, , etc. that may result in improving this methodology for policy impact evaluation. (Any comment, please email Otto Garcia to otto.garcia@ifcndairy.org).

4.3 Policy Category: Promoting Genetic Improvements

Milk production in Kayunga relies on extensive systems holding indigenous cows with very low milk yields (about 500 kg milk per lactation). Local dairy stakeholders see genetic improvement through crossing local animals with exotic breeds as an appropriate approach to increase yields.

Local stakeholders agreed that most KY-3 farmers would upgrade their genetics in a gradual manner and as fast as certain prerequisites are met as concerning output markets, inputs supplies and livestock services, among others. This is why they insisted in having at least one intermediate genetic improvement scenario, which we called Graded~25%.

4.3.1 Description of the Policy Scenarios

KY-3 (Baseline): The household head is an agricultural labourer, who owns about 2 ha of land and has access to other 20 ha. Milk is sold to the local vendor, who comes once a day to the farm. Due to a low milk volume sold daily, the farmer sees no reason for delivering the milk to the collection centre (about 3 km away). No concentrates are used, but some mineral salt.

Graded~25%: The farmer, together with similar farmers, introduce and share a crossbred bull (50:50; local breed: Holstein Friesian) to bring the level of exotic blood from zero up to about 25 percent. The management of the animals and the herd remain unchanged. This means that the farmer keeps grazing his herd through a herdsman, milking once a day by hand and supplementing only with mineral salt. Only expenses for veterinary services and medicine increase slightly. On the other side, just by this genetic crossing, several key production parameters improve such as lactation length, inter-calving period, and a higher peak of daily milk production per cow. All of these improvements result in higher output sales. Important is that farmers see this step as a risk management necessity towards having more productive animals, during which they can learn more intensive farming practices and can also test the market conditions of their outputs and inputs.

Graded: The farmer now utilizes as much technology and exotic-blood cows as in the farms in Mukono. This means high Holstein cows are stall-fed with elephant grass grown on the farm and relatively high concentrates and mineral supplementations. Veterinary, medicine and breeding costs are also significantly higher. Assuming the farmer is also as skilled at dairy farming as his counterpart in Mukono, this higher inputs result in significantly higher milk yields, shorter dry periods, lower mortalities and therefore higher sales (milk and cattle). Equally important is that with a marketable milk volume, which is over 4 times higher, the farmer finds it attractive to bypass the local vendor and start delivering milk to the collection centre for a 20 percent higher milk price. Direct milk delivery also increases the need and utilization of available family labour, which is not currently used for economic purposes.

Typical Farms	Units	KY-3	Graded~25%	Graded
HOUSEHOLD				
Number of persons	No.	6	6	6
Family cash living expenses	US-\$/yr	504	504	504
Family consumption from dairy farm	US-\$/yr	24	73	117
Family labour Availability	Man hrs/ yr	4750	4750	4750
FARM ENTERPRISES				
Land				
Farm land (owned)	Ha	2.0	2.0	2.0
Farm land (hired)	Ha	20.2	20.2	1.2 *
Land value	US-\$/yr	200	200	200
Rent value	US-\$/yr	2.6	2.6	2.6
Labour				
Family labour utilization	Man hrs/ yr	1771	1641	1641
Hired labour utilisation	Man hrs/ yr	2600	2760	2760
Regional wage	US-\$/yr	0.10	0.10	0.10
Farm hired labour wage	US-\$/yr	0.01	0.03	0.03
Capital				
Total assets	US-\$	1042	1210	3235
Farm buildings	US-\$	39	39	479
Machinery	US-\$	45	90	108
Land value	US-\$	402	402	402
Livestock value	US-\$	556	679	2246
DAIRY ENTERPRISES				
Herd management				
Adult cows only	No.	3	3	3
Total Herd size	No.	5	5	6
Animal breed	Description	Local	25% Graded	> 75% Graded
Milk yield (Non-ECM)	Kg/ cow/ yr	564	1080	2400
Daily lactation yield (Non-ECM)	Kg/ cow/ day	2.7	4.0	8.0
Intercalving period	Months	16	15	14
Days in milk	Days	210	270	300
Feeding				
Grazing land (own + rented)	Ha	20.24	22.06	3.04
Feeding system				
Concentrate	Ton/ cow/ yr	0.00	0.00	0.84
Minerals	Ton/ cow/ yr	0.03	0.03	0.03
Herd production				
Insemination method	Description	Natural	Natural (shared bull)	AI
Breeding costs	US-\$/ service	0	2	27
Health parameters				
Medicine expenses	US-\$/ animal/ year	8	10	61
Cow mortality	%	0.05	0.10	0.10
Heifer mortality	%	0.10	0.10	0.10
Calf mortality	%	0.20	0.20	0.15
Notes:				
ECM = Energy Corrected Milk; Exchange rate used: 1 US-\$ = 1866 Ugandan Shillings; * Graded animals are confined (little rented land).				

Technical parameters associated with the policy scenarios

1.3.1 Policy Impacts: Dairy Enterprises

Household income

The KY-3 household currently obtains a total household income of 0.33 US-\$ per capita per day. From this, off-farm employment and the farm activities contribute 75 and 25 percent respectively.

By slightly increasing the level of exotic-blood in the herd, the Graded-25% scenario increases the household per capita income by 15 percent and requires little to practically no changes in how KY-3 is operating.

However upgrading the herd to over 75 percent exotic-blood means making considerable changes, which in turn will increase both costs of production and farm outputs. These new production conditions for the Graded scenario result in a household per capita income 60 percent above that of KY-3.

Dairy competitiveness in the local market

KY-3 currently achieves a return to labour of 0.046 US-\$ per capita per hour put in the dairy.

Although Graded-25% and Graded require 12 percent higher labour input, their milk yield increases bring up the return to labour imputed in the dairy farm by 120 and 300 percent above the KY-3 level. Furthermore, the higher the return to labour is as compared to the wages on the farms, the more attractive is to use available labour on the dairy enterprises. Here, it is evident that crossbreeding has a significant impact on increasing the profitability of the dairy farm.

Dairy competitiveness internationally

Presently, KY-3 has cost of milk production at about 8 US-\$/ 100 kg ECM milk.

Graded-25% has the same production with 24 percent less costs. In spite of its 12 and 25 percent higher requirement of labour and capital, Graded-25% higher milk outputs bring costs well down.

Highly graded animals, in the Graded scenario, require so much higher capital investment, feed purchases, and cash expenses that the costs of producing 100 kg ECM is 27 percent higher than that of KY-3.

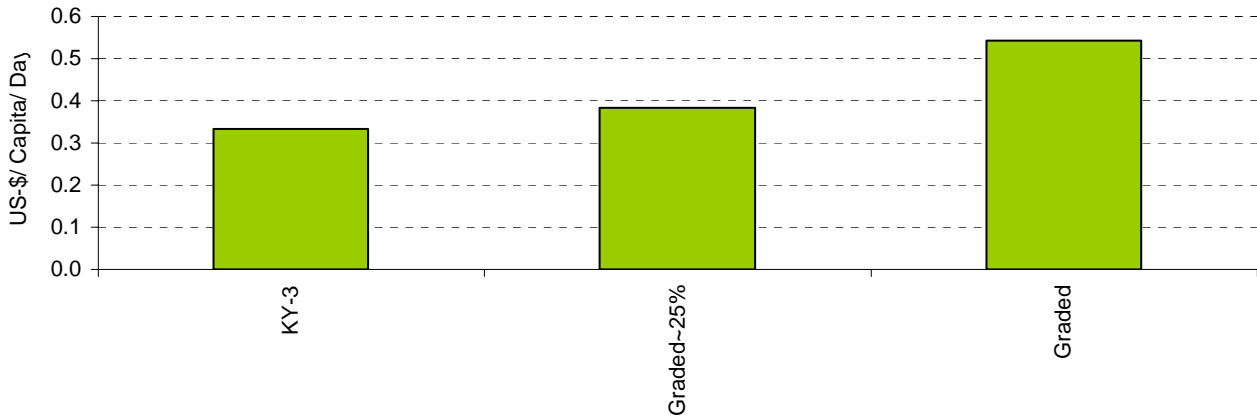
Finally, the Graded scenario performs much better due to not only higher milk yields, but also a 20 percent higher milk price. With the higher milk output, the farmer stops selling to the milkman and starts delivering directly to the nearest collection centre, which brings his milk price up.

Explanations of variables; year and sources of data:

- Household per capita income: Income from farming and off farm activities/ number people (adult equivalents) in the household
- Return to labour: Entrepreneur's profit plus labour costs divided by total labour input.
- Average wages on the farms: total labour costs (wages paid plus opportunity costs) divided by the total number of hours worked as Man-hour equivalent. Number of hours worked were estimated by farmers and local dairy experts.
- Cost of milk production: Costs of the dairy enterprise - non milk returns like livestock, manure, etc.
- IFCN method: See Annex A2 and A3

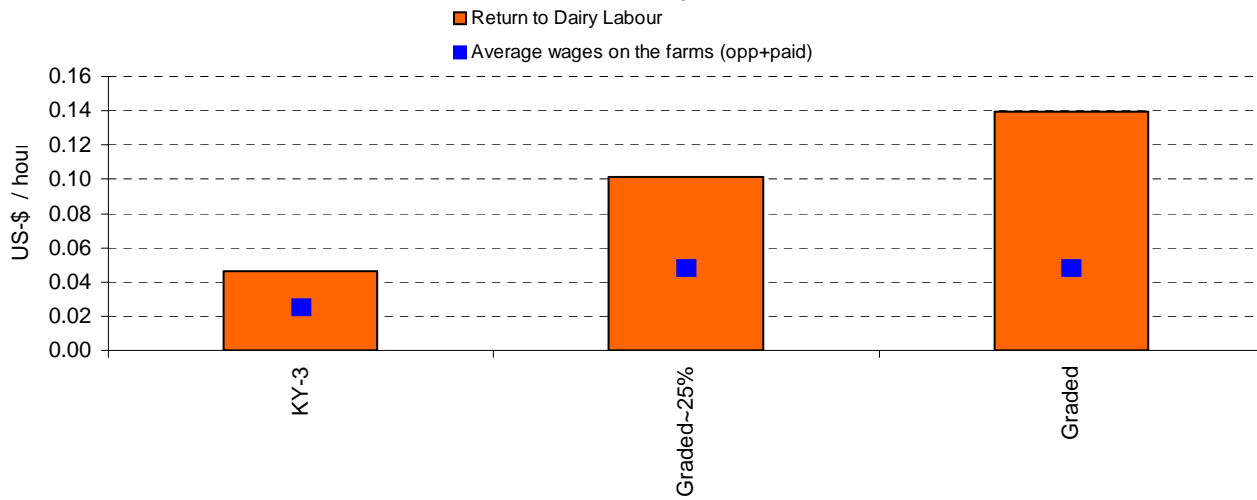
Household income situation

Household Net Income



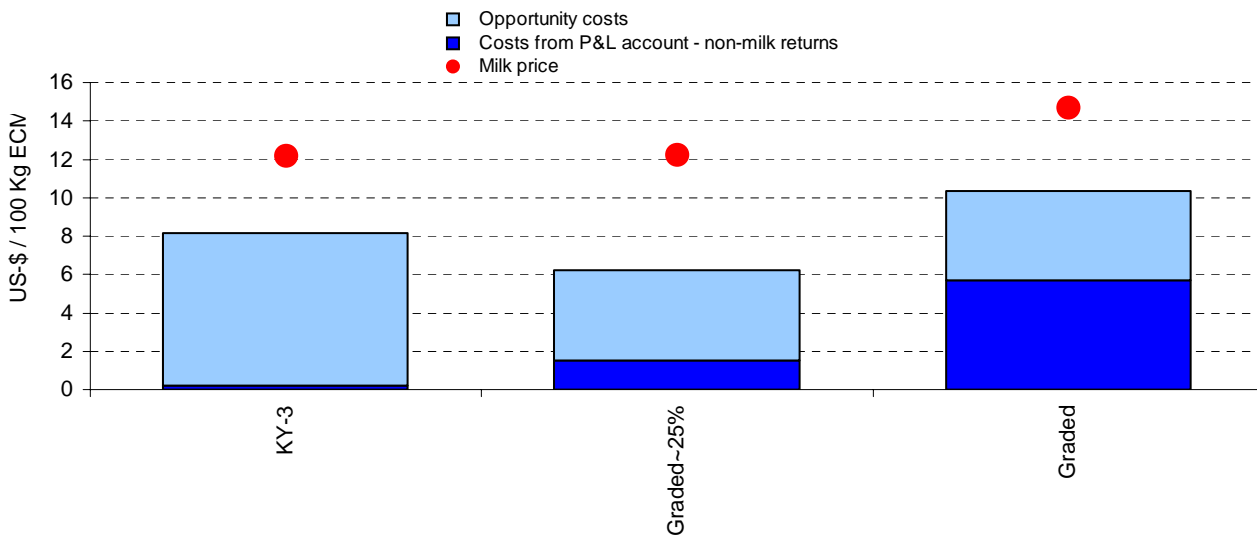
Dairy competitiveness in the local labour market

Returns to Dairy Labour



Dairy competitiveness internationally

Cost of Milk Production



4.4 Policy Category: Promoting Dairy Market Improvements

4.4.1 Description of the Policy Scenarios

KY-3 (Baseline): The household head is an agricultural labourer, who owns about 2 ha of land and has access to other 20 ha. Milk is sold to the local vendor, who comes once a day to the farm. Due to a low milk volume sold daily, the farmer sees no reason in delivering the milk to the collection centre (about 3 km away). No concentrates are used, but salt as a mineral supplement.

Sch-Milk (School Milk Program): A group of farmers in Kayunga associates to provide the local school with yoghurt. Students consume it thrice a week and parents pay about 5 US-\$ (or 10,000 Shillings) per term per kid. Farmer group or coop makes over 500 kg/day of yoghurt. (1 kg milk=1 yoghurt). Dairy processors in Uganda estimated that the costs of producing 1 kg yoghurt to be at about 0.47 US-\$ (880 Shillings) including the raw material and would sell for 0.54 US-\$ (1000 Shillings). This makes a profit of 0.07 US-\$ (120 Shillings) per kg of yoghurt provided to the school. This scenario assumes that the farmer uses all his daily milk for the school milk yoghurt while for the graded Sch-Milk scenario only half of the farm milk production is taken by the school program; the rest is delivered to the collection centre.

>Demand (Higher Milk Demand): This scenario assumes that for any reason (or combination of factors) milk consumption in the region and country increases, which in turn results in a farm-gate price as high as in the dry season. In other words, the 30 percent higher milk price that this farmer gets (about 325 shillings/kg) remains constant throughout the year. This increase reaches the farmer, who still sells to the local vendor.

>Q+Price (Better Milk Quality Control = Higher Farm Milk Prices): Assuming that anti-milk-adulteration regulations are enforced and national milk volume shrinks by about 16.67 percent, which brings the farmer milk price up by 0.04 US-\$ (or 75 Shillings) per kg. This is a 30 percent milk price increase passed from the vendor.

>Q-Price (Better Milk Quality Control = Lower Farm Milk Prices): Assuming that anti-milk-adulteration regulations are enforced and in order to both comply with regulations and make profit informal traders reduce the farm milk price by 0.03 US-\$ (or 50 shillings) per kg. This is a milk price decrease of 20 percent passed to the farmer, who still will not deliver to the collection centre.

Cooler-Coop (Farmer gets cooperative dividends): Farmer delivers to his cooperative for 250 shillings/ kg. The cooperative sells for 500 shillings in Kampala/Jinja. Farmer gets cooperative dividends at year end for about 25 US\$. Milk price remain same, but spoilage of 4 percent of his milk delivered to the centre is eliminated.

Cooler-Privat (Private milk buyer/ Intermediary): Farmer delivers to the private collection centre for 275 Shillings/ kg. Milk spoilage of 4 percent of his milk delivered to the centre is eliminated. Additional benefits, market is stable, payment is secure and every 2 weeks; training for members on production practices, milk quality, credit, etc.

Graded: The farmer now utilizes as much technology and exotic blood cows as farms in Mukono. This means high Holstein-blood cows are stall-fed with elephant grass grown on the farm and relatively high concentrates and mineral supplementations. Veterinary, medicine and breeding costs are also significantly higher. Assuming the farmer is also as skilled at dairy farming as his counterpart in Mukono, this higher inputs result in significantly higher milk yields, shorter dry periods, lower mortalities and therefore higher sales. Equally important is that with a marketable milk volume, which is over 4 times higher, the farmer finds attractive to bypass the local vendor and start delivering milk to the collection centre for a 20 percent higher milk price. Direct milk delivery also increases the need and utilization of available family labour, which is not currently used for economic purposes.

Technical parameters associated with the policy scenarios

Typical Farms	Units	KY-3	Sch- Milk	> Demand	>Q+ Price	>Q-Price	Cooler-Coop	Cooler-Privat		Graded	Sch-Milk	>Demand	>Q+ Price	>Q-Price	Cooler-Coop	Cooler-Privat
HOUSEHOLD																
Family cash living expenses	US-\$/yr	504	504	504	504	504	504	504		504	504	504	504	504	504	504
Family cons. from dairy farm	US-\$/yr	24	24	32	32	20	24	27		117	117	147	147	98	98	117
Family labour Availability	Hrs/yr	4750	4750	4750	4750	4750	4750	4750		4750	4750	4750	4750	4750	4750	4750
FARM ENTERPRISES																
Land																
Farm land (hired)	Ha	20.2	20.2	20.2	20.2	20.2	20.2	20.2		1.2	1.2	1.2	1.2	1.2	1.2	1.2
Land value	US-\$/yr	200	200	200	200	200	200	200		200	200	200	200	200	200	200
Rent value	US-\$/yr	2.6	2.6	2.6	2.6	2.6	2.6	2.6		2.6	2.6	2.6	2.6	2.6	2.6	2.6
Labour																
Family labour utilization	Man hrs	1771	1771	1771	1771	1771	1771	1771		1641	1641	1641	1641	1641	1641	1641
Hired labour utilisation	Man hrs	2600	2600	2600	2600	2600	2600	2600		2760	2760	2760	2760	2760	2760	2760
Regional wage	\$/ hr	0.134	0.134	0.134	0.134	0.134	0.134	0.134		0.134	0.134	0.134	0.134	0.134	0.134	0.134
Farm hired labour wage	\$/ hr	0.012	0.012	0.012	0.012	0.012	0.012	0.012		0.035	0.035	0.035	0.035	0.035	0.035	0.035
Capital																
Total assets	US-\$	1042	1042	1042	1042	1042	1042	1042		3235	3235	3235	3235	3235	3235	3235
Farm buildings	US-\$	39	39	39	39	39	39	39		479	479	479	479	479	479	479
Machinery	US-\$	45	45	45	45	45	45	45		108	108	108	108	108	108	108
Land value	US-\$	402	402	402	402	402	402	402		402	402	402	402	402	402	402
Livestock value	US-\$	556	556	556	556	556	556	556		2246	2246	2246	2246	2246	2246	2246
DAIRY ENTERPRISES																
Adult cows only	No.	3	3	3	3	3	3	3		3	3	3	3	3	3	3
Total Herd size	No.	5	5	5	5	5	5	5		6	6	6	6	6	6	6
Animal breed	Description	Local	Local	Local	Local	Local	Local	Local		Graded	Graded	Graded	Graded	Graded	Graded	Graded
Milk yield (Non-ECM)	Kg/ cow/ yr	564	564	564	564	564	564	564		2400	2400	2400	2400	2400	2400	2400
Daily lactation	Kg/cow/day	2.7	2.7	2.7	2.7	2.7	2.7	2.7		8	8	8	8	8	8	8
Intercalving period	Months	16	16	16	16	16	16	16		14	14	14	14	14	14	14
Days in milk	Days	210	210	210	210	210	210	210		300	300	300	300	300	300	300
Feeding																
Total grazing land	Ha	20.24	20.24	20.24	20.24	20.24	20.24	20.24		3.04	3.04	3.04	3.04	3.04	3.04	3.04
Feeding system	Description															
Concentrate	Ton/ cow/ yr	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.84	0.84	0.84	0.84	0.84	0.84	0.84
Minerals	Ton/ cow/ yr	0.03	0.03	0.03	0.03	0.03	0.03	0.03		0.03	0.03	0.03	0.03	0.03	0.03	0.03
Herd prod.																
Insemination method	Description	Natural	Natural	Natural	Natural	Natural	Natural	Natural		AI	AI	AI	AI	AI	AI	AI
Breeding costs	US-\$/service	0	0	0	0	0	0	0		27	27	27	27	27	27	27
Health																
Vet+Med expenses	US-\$/cow/year	8.06	8.06	8.06	8.06	8.06	8.06	8.06		61.09	61.09	61.09	61.09	61.09	61.09	61.09
Cow mortality	%	0.05	0.05	0.05	0.05	0.05	0.05	0.05		0.10	0.10	0.10	0.10	0.10	0.10	0.10
Heifer mortality	%	0.10	0.10	0.10	0.10	0.10	0.10	0.10		0.10	0.10	0.10	0.10	0.10	0.10	0.10
Calf mortality	%	0.20	0.20	0.20	0.20	0.20	0.20	0.20		0.15	0.15	0.15	0.15	0.15	0.15	0.15

Notes: ECM = Energy Corrected Milk; Exchange rate used: 1 US-\$ = 1866 Ugandan Shillings

4.4.2 Policy Impacts: Dairy Enterprises

Household income

The KY-3 household currently obtains a total income of 0.33 US\$/capita per day. From this, off-farm employment and the farm activities contribute 75 and 25 percent respectively.

The policies promoting both milk quality throughout the chain and consumption of dairy products are assumed to result in higher farm-gate milk prices. Therefore, the scenarios of >Demand and >Q+Price would have identical farm-level impacts.

For KY-3, with indigenous cows, a 30 percent higher milk price can increase the household income by up to 7 percent.

However, if KY-3 held graded cows, a 30 percent higher milk price caused by these policies would mean a household income increase by 95 percent (doubling).

Also interesting is that while only 20 percent of the KY-3 household income comes from the dairy, better genetics means that over 50 percent of the income will originate from the dairy business.

Dairy competitiveness in the local market

KY-3 currently achieves a return to labour of 0.046 US-\$ per capita per hour put in the dairy.

For KY-3, with indigenous cows, the policies increasing the milk price (>Demand and >Q+Price) bring the dairy return to labour by up to 40 percent.

However, if KY-3 had graded cows, a 30 percent higher milk price caused by these policies would mean a return to labour increase by 55 percent.

Furthermore, the higher the return to labour is as compared to the wages on the farms, the more attractive is to use available labour on the dairy enterprises. Here, it is evident that crossbreeding has a significant impact on increasing the profitability of the dairy farm.

Dairy competitiveness internationally

Presently, KY-3 has cost of milk production at about 8 US-\$/ 100 kg ECM milk.

For KY-3, with indigenous cows, the policies Sch-Milk and Cooler-Coop reduce costs of milk production by 40 and 25 percent respectively.

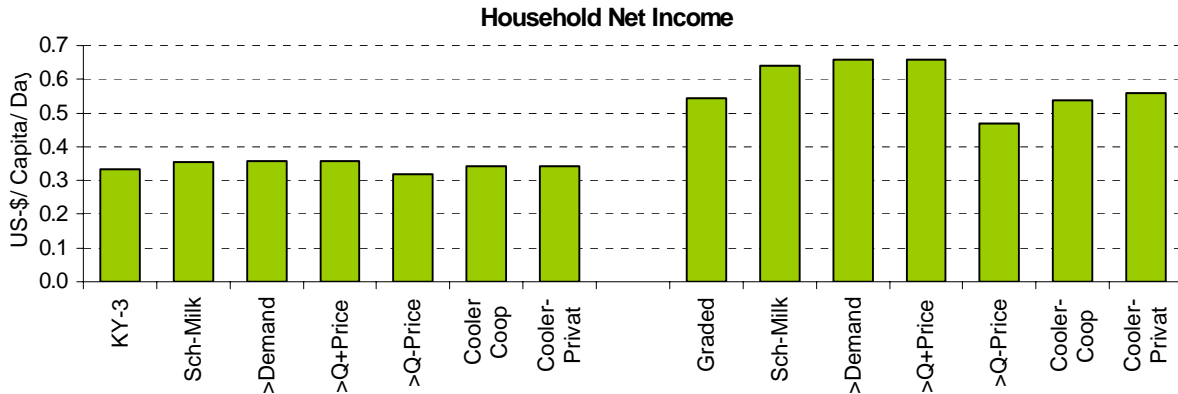
However, if KY-3 had graded cows, Sch-Milk and Cooler-Coop reduce costs of milk production by 30 and 20 percent respectively.

The main impacts of these scenarios are that: Sch-Milk allows the farmer to add value to its milk while and Cooler-Coop assumes that the cooperative delivers milk to the urban market and pays dividends to farmer members at year end. Both scenarios keep the same milk price, but they process or deliver directly, both of which increases the competitiveness of this farm type significantly.

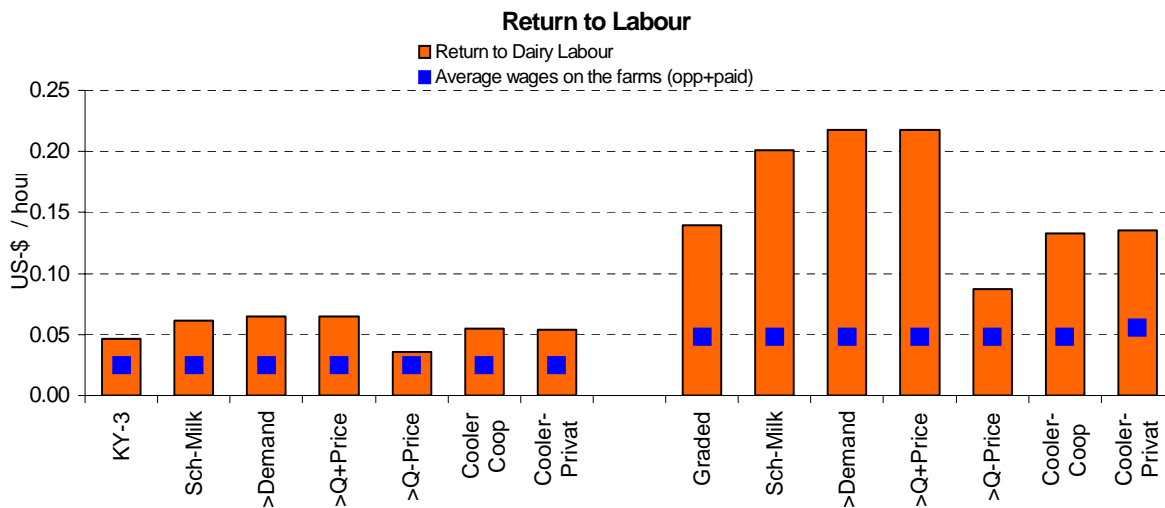
Explanations of variables; year and sources of data:

- Household per capita income: Income from farming and off farm activities/ number of people (adult equivalents).
- Return to labour: Entrepreneur's profit plus labour costs divided by total labour input.
- Average wages on the farms: total labour costs (wages paid plus opportunity costs) divided by the total number of hours worked as Man-hour equivalent. Number of hours worked were estimated by farmers and local dairy experts.
- Cost of milk production: Costs of the dairy enterprise - non milk returns like livestock, manure, etc.
- IFCN method: See Annexes 2 and 3

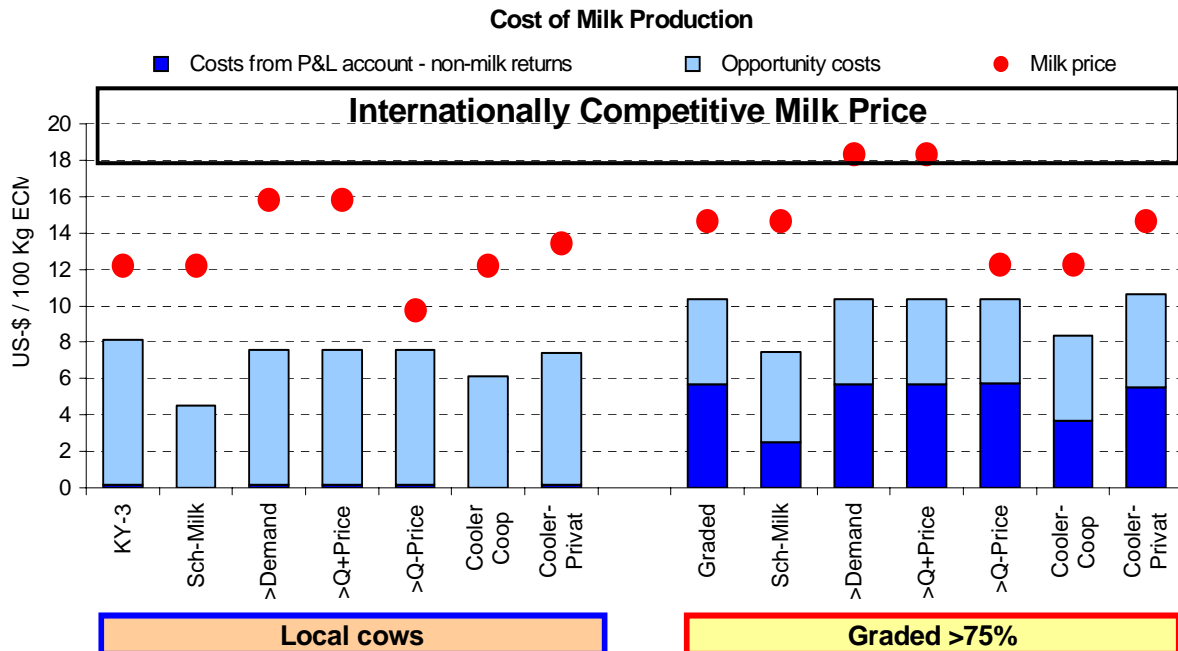
Household income situation



Dairy competitiveness in the local labour market



Dairy competitiveness internationally



4.5 Policy Category: Promoting Access to Dairy Farm Inputs

4.5.1 Description of the Policy Scenarios

KY-3 (Baseline): The household head is an agricultural labourer, who owns about 2 ha of land and has access to other 20 ha. Milk is sold to the local vendor, who comes once a day to the farm. Due to a low milk volume sold daily, the farmer sees no reason in delivering the milk to the collection centre (about 3 km away). No concentrates are used, but salt as a mineral supplement.

Private-Vet (Private Veterinarian Available): Several entities are supporting private veterinary services to reach out to more farmers. Under current farm performance and prices for veterinary services and medicines, farmers like KY-3 would not make more use of health services than they currently do. Farmers' general perception is that local animals have low production and purchasing such services does not pay off. Only in emergency cases, the farmer would call the veterinarian. Therefore, the economics of the farm remains unchanged.

>Vet-Med (Use of 10% more Medicine): This type of farmer rarely has access to veterinarian services and when so, he calls the veterinarian only in case of serious emergency. Otherwise, he spends very little in purchasing the basic anti-parasitic medicine routinely applied. This scenario assumes that due to the effect of veterinary services, free of charge, this farm spending in medicine increases by 10 percent.

Vet-Med Disc (Veterinary and Medicine Costs Discounted): Any organization purchasing a specified volume of medicine per year could get a 6 percent discount from the major animal medicine distributors. This scenario assumes that KY-3 belongs to a farmers group to benefit from this discount. For that, he must have a minimum medicine expenditure of 35000 Ugandan Shillings and have about 2 visits by the veterinarian at 10000 each consultation. It is expected that milk yield would go slightly up, but the bigger impacts would be in decreased mortalities.

>Credit (More Credit): Local groups are formed to save and lend out small loans to their membership. When lending to livestock keepers, these groups look carefully into the farm mortality rates among other factors. Therefore, for KY-3 to qualify for such loan, it may have to decrease its mortality rate. It does this by feeding small quantities of a local by-product to lactating cows as well as by increasing its medicine expenses by 25 percent.

FeedP-30% (Feed Prices Lowered by 30 percent): Major feed suppliers in Kampala agreed that feed prices for KY-3 could cut down by up to 30 percent if an efficient feed chain were in place as they have suggested. This price reduction has been applied to all concentrates and minerals purchased in, but farmers do not increase their inputs. Therefore, there are not impacts on milk yields, mortalities, etc.

>Water (One Extra Water Provision per Day): Water for livestock use is a major constraint to farms like KY-3 and for several months per year. If this farmer would have water available throughout the year, he would invest in three plastic containers (25-30 litres each), use 1 extra hour per day to carry and provide one extra watering to lactating cows per day. This may result in a daily milk yield increase of 0.5 kg more per lactating animal.

For the Graded scenarios, the descriptions above apply within the Graded production system.

Technical parameters associated with the policy scenarios

Typical Farms	Units	KY-3	Privat-vet	>Vet-Med	Vet-Med Disc	>Credit	FeedP-30%	>Water		Graded	Vet-Med Disc	>Credit	FeedP-30%	>Water
HOUSEHOLD														
Family cash living exp.	US-\$/yr	504	504	504	504	504	504	504		504	504	504	504	504
Family consumption from dairy farm	US-\$/yr	24	24	24	24	24	24	24		117	117	117	117	117
Family labour Availability	Man hrs/ yr	4750	4750	4750	4750	4750	4750	4750		4750	4750	4750	4750	4750
FARM ENTERPRISES														
Land														
Farm land (hired)	Ha	20.2	20.2	20.2	20.2	20.2	20.2	20.2		1.2	1.2	1.2	1.2	1.2
Land value	US-\$/yr	200	200	200	200	200	200	200		200	200	200	200	200
Rent value	US-\$/yr	2.6	2.6	2.6	2.6	2.6	2.6	2.6		2.6	2.6	2.6	2.6	2.6
Labour														
Family labour utilization	Man hrs/ yr	1771	1771	1771	1771	1771	1771	2031		1641	1641	1641	1641	2005
Hired labour utilisation	Man hrs/ yr	2600	2600	2600	2600	2600	2600	2600		2760	2760	2760	2760	2760
Regional wage	US-\$/ hr	0.10	0.10	0.10	0.10	0.10	0.10	0.10		0.10	0.10	0.10	0.10	0.10
Farm hired labour wage	US-\$/ hr	0.012	0.012	0.012	0.012	0.012	0.012	0.012		0.035	0.035	0.035	0.035	0.035
Capital														
Total assets	US-\$	1042	1042	1005	1044	1020	1042	1064		3235	3235	3235	3235	3257
Farm buildings	US-\$	39	39	39	43	43	43	43		479	479	479	479	479
Machinery	US-\$	45	45	45	94	94	94	68		108	108	108	108	130
Land value	US-\$	402	402	402	402	402	402	402		402	402	402	402	402
Livestock value	US-\$	556	556	519	557	533	556	556		2246	2246	2246	2246	2246
DAIRY ENTERPRISES														
Adult cows only	No.	3	3	3	3	3	3	3		3	3	3	3	3
Total Herd size	No.	5	5	5	6	5	5	5		6	6	6	6	6
Animal breed	Description	Local	Local	Local	Local	Local	Local	Local		Graded	Graded	Graded	Graded	Graded
Milk yield (Non-ECM)	Kg/ cow/ yr	564	564	564	586	564	564	628		2400	2400	2400	2400	2625
Daily lactation	Kg/cow/day	2.7	2.7	2.7	2.7	2.7	2.7	3.0		8.0	8.0	8.0	8.0	8.8
Intercalving period	Months	16	16	16	16	16	16	16		14	14	14	14	14
Days in milk	Days	210	210	210	210	210	210	210		300	300	300	300	300
Feeding														
Total grazing land	Ha	20.24	20.24	20.24	20.24	20.24	20.24	20.24		3.04	3.04	3.04	3.04	3.04
Concentrate	Ton/ cow/ yr	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.84	0.84	0.84	0.84	0.84
Minerals	Ton/ cow/ yr	0.03	0.03	0.03	0.03	0.03	0.03	0.03		0.03	0.03	0.03	0.03	0.03
Herd production														
Insemination method	Description	Natural	Natural	Natural	Natural	Natural	Natural	Natural		AI	AI	AI	AI	AI
Breeding costs	US-\$/service	0	0	0	0	0	0	0		27	25	27	27	27
Health parameters														
Vet+Med expenses	\$/animal/year	8.06	8.06	8.84	19.31	10.05	8.06	8.06		61.09	57.00	61.09	61.09	61.09
Cow mortality	%	0.05	0.05	0.05	0.05	0.05	0.05	0.05		0.10	0.10	0.10	0.10	0.10
Heifer mortality	%	0.10	0.10	0.10	0.08	0.10	0.10	0.10		0.10	0.10	0.10	0.10	0.10
Calf mortality	%	0.20	0.20	0.10	0.10	0.19	0.20	0.20		0.15	0.15	0.15	0.15	0.15

Notes: ECM = Energy Corrected Milk; Exchange rate used: 1 US-\$ = 1866 Ugandan Shillings

4.5.2 Policy Impacts: Dairy Enterprises

Household income

The KY-3 household currently obtains a total income of 0.33 US\$/capita per day.

For KY-3, with indigenous cows, these policies have a very slight impact of 2 percent higher household income for the >Water scenario. These low policy impacts are mainly due to low farm input purchased as well as to the low share of the household income comes from the dairy (only 20 percent). In the >Water scenario, the farmer puts in more family labour, which is a non-cash expense.

However, if KY-3 held graded cows, the scenario of FeedP-30% has the highest impact of increasing household income by 10 percent. This is basically due to both the higher reliance on external farm inputs as well as a relatively higher dairy contribution to the household per capita income.

Dairy competitiveness in the local market

KY-3 currently achieves a return to labour of 0.046 US-\$ per capita per hour put in the dairy.

For KY-3, with indigenous cows, the policy reducing the feed price (FeedP-30%) brings the dairy return to labour up a slight 6 percent. Notice that this farm uses little common salt as the only purchased feed.

However, if KY-3 had graded cows, a 30 percent lower feed price caused would mean a return to labour increase by 25 percent.

It is evident that the higher the engagement farm-market, the more easily can policymakers impact the economics of dairy farms. On the other side, this higher engagement makes poor farmers more vulnerable. For example, see that the scenario >Credit assumes a loan taken under the existing conditions for KY-3 to build housing for graded animals. This move hurt the profitability of the farm by bringing its return to labour down by 70 percent.

Dairy competitiveness internationally

Presently, KY-3 has cost of milk production at about 8 US-\$/ 100 kg ECM milk.

For KY-3, with indigenous cows, the policy FeedP-30% reduces costs of milk production by 15 percent while >Water increases it by 25 percent. In the >Water scenario, the farmer puts in more family labour, which is a non-cash expense. Besides, putting more family labour in the dairy seems acceptable considering the lack of better economic alternative.

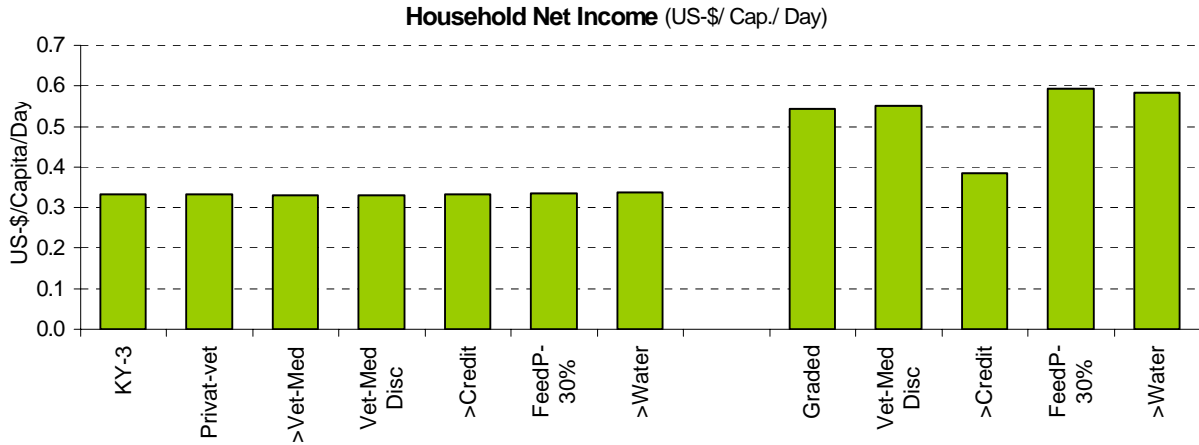
However, if KY-3 had graded cows, the policy FeedP-30% reduces costs of milk production by 10 percent while >Credit increases it by 40 percent. Notice that this negative effect of more credit, mostly to build a shed, is so high in the first year due to high interest rates and short repayment terms (of 1 to 1.5 years). Farmers expect that by the third year after the loan is initially taken, the farm cash production costs will be back to the Graded levels (about 6 US-\$ per 100 kg ECM).

Lastly, notice that >Water increases labour costs (non-cash cost) while >Credit increases farm liabilities to be repaid under specified conditions (cash cost).

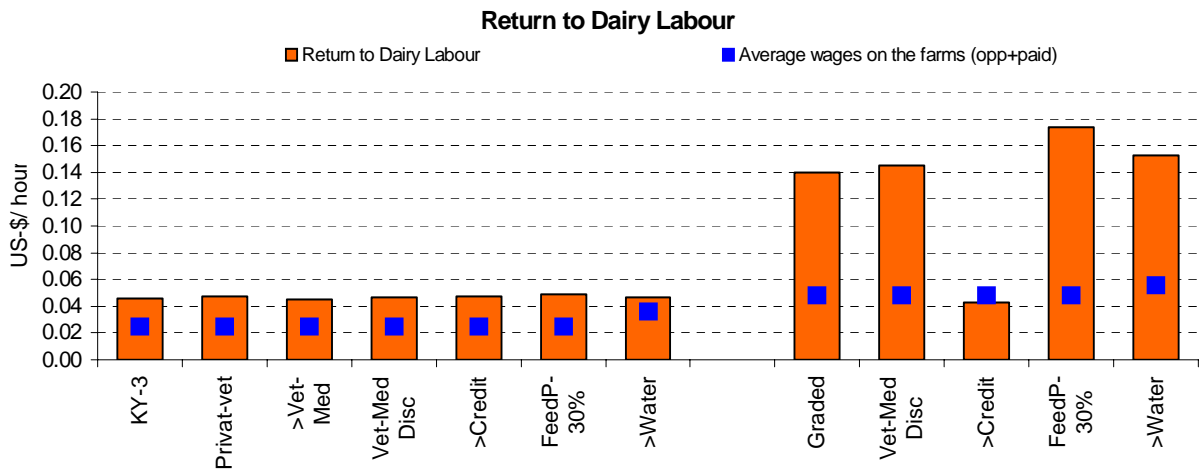
Explanations of variables; year and sources of data:

- Household per capita income: Income from farming and off farm activities/ number of people (adult equivalents).
- Return to labour: Entrepreneur's profit plus labour costs divided by total labour input.
- Average wages on the farms: total labour costs (wages paid plus opportunity costs) divided by the total number of hours worked as Man-hour equivalent. Number of hours worked were estimated by farmers and local dairy experts.
- Cost of milk production: Costs of the dairy enterprise - non milk returns like livestock, manure, etc.
- IFCN method: See Annexes 2 and 3

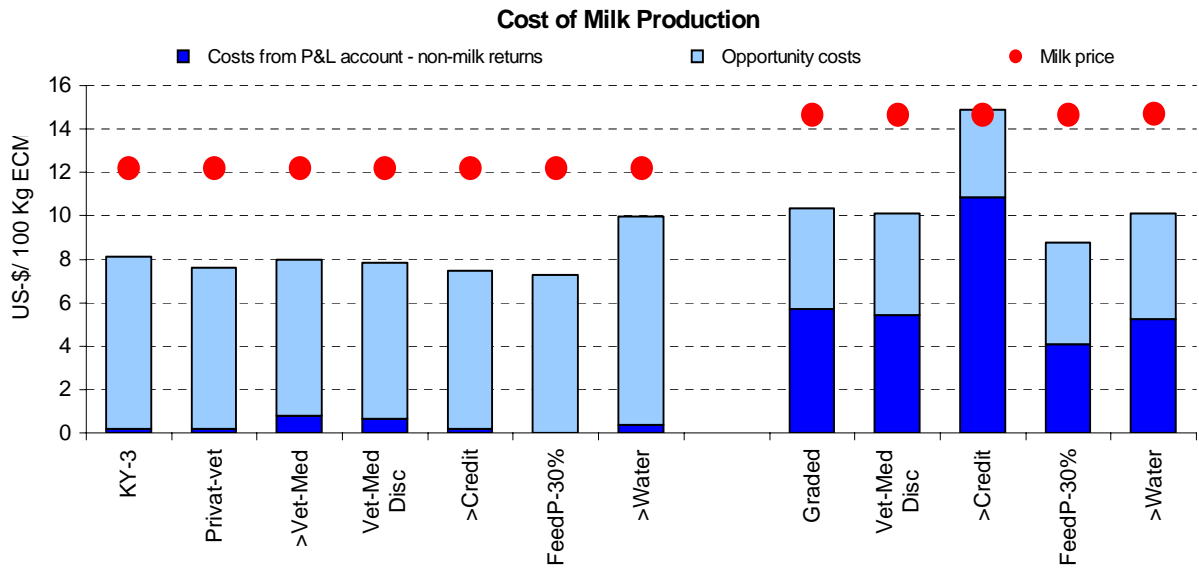
Household income situation



Dairy competitiveness in the local labour market



Dairy competitiveness internationally



Local cows

Graded >75%

4.6 Policy Impacts: Summary and Key Points

Household Income (Family Poverty Status)

The policies resulting in higher milk price (*Sch-Milk*, *>Demand* and *>Q+Price*) have the highest impact on the household income. As a reference this study shows that an increase of 30 percent in the milk price paid to the KY-3 farmer increases the household income by 7 percent.

However, if KY-3 had 3 graded animals and better management, this study shows that the household income could rise up to 60 percent above the current level (KY-3). In addition to this genetic improvement, increasing in milk price by 30 percent, as suggested by these policies, would bring the household income up to 95 percent above KY-3 current levels (almost double).

Key points: (1) household income of KY-3 can increase by 60 percent through genetic

improvement and better management; and up to 95 percent if any or all three policies mentioned above can bring the milk price up by 30 percent. And (2) Even in the best case shown here, the per capita income for this household does not reach the one-Dollar-a-Day international poverty line. Therefore, bringing this household out of poverty will require larger farms and/ or their participation in other economic sectors.

Return to Labour (Local Dairy Competitiveness)

Like in the household income, the policies resulting in higher milk price (*Sch-Milk*, *>Demand* and *>Q+Price*) have the highest impact on the dairy profitability. As a reference this study shows that an increase of 30 percent in the milk price paid to the KY-3 farmer increases the wage level by 37 percent.

However, if KY-3 had 3 graded animals and better management, this study shows that the return to labour could rise up to 200 percent above the current level. Moreover, the increase in milk price of 30 percent, mentioned above, bring the return to labour of this graded-better-managed KY-3 up to 350 percent above the current levels.

Key points: (1) Dairy local competitiveness and so profitability of KY-3 can increase by 200

percent through genetic improvement and better management; and up to 350 percent if any or all three policies mentioned above can bring the milk price up by 30 percent. And (2) Even in the best case shown here, the return to labour for KY-3 remains below the wages paid for other off-farm work. Under these conditions, it makes sense that the family hires a herdsman and works off-farm. As shown here, KY-3 will have to upgrade both management and genetics, if its dairy enterprise is going to pay higher wages than other jobs for the family labour imputed.

Costs of Milk Production (International Dairy Competitiveness)

Farms like KY-3 are quite low cost producers already (very competitive) and lowering their production costs even more would be very difficult. This study shows that promoting farm vertical integration (adding value to the farmers milk before it is sold out as in scenario *Sch-Milk*) has high processing profits, which in turn decreases milk production costs. Although the milk price remains unchanged, the farmer makes a net income from processing and/or directly delivering a litre of milk. When this extra net income (from value adding) is deducted from the cost of producing that litre of milk, the cost of production sinks considerably. (For more on this calculation, see the IFCN methods in Annexes 2 and 3).

Key points: (1) this study shows that genetic and management improvements increase both

household income and dairy profitability. However, these upgrades will increase the cash cost components of producing milk (the darker section of the bar). Policy makers should consider the need for working capital for KY-3 farmers making these development steps. And (2) If market regulations result in a more internationally

competitive milk price for KY-3, this farm type could afford to increase costs of production and remain a strong, competitive milk producer worldwide.

5. CONCLUDING REMARKS

Although small-scale dairy farms in Uganda make an extremely low per capita income, they are very competitive milk producers at both locally and internationally. Particularly dairy farmers in Kayunga are extremely low-cost producers, which puts them in an ideal standing to capitalize on existing and emerging market opportunities. Exploiting this national competitiveness could result in (a) improving the livelihood of thousands of poor livestock keepers, (b) producing quality and affordable milk for the many thousands of urban and rural consumers in Uganda, and (c) why not to increase dairy exports in the region.

To achieve these developments, the Ugandan dairy sector will need clear-cut policies and a sharp focus on those with the highest potential impacts. Such policies, as shown in this study, should focus first on the main problem affecting Kayunga dairy farmers which is their low milk prices and secondly the lack of access to affordable farm inputs and services required for dairy business development.

Milk price, as shown above, can be affected by policies that promote increased consumption of milk and dairy products, access to national and international markets, more milk value-adding by farmers themselves and farmers delivering their milk directly to processors/ consumers. The policy of increasing milk quality control and regulations throughout the chain can have either a positive or detrimental impact on the farm-gate milk price. In the worst scenario, higher quality control at the processing and retailing segments of the dairy chain may mean (a) lower milk consumption in the urban markets and hence lower milk demand and so lower prices for the more-distant milk from Kayunga; and (b) milk traders will not be able to adulterate their milk any longer and their milk would be too expensive for their price conscious customers, hence they will have in turn to pay a lower price to their farmer-suppliers. This is, therefore, the most 'delicate' dairy policy being implemented in Uganda at the moment.

Concerning the farm input challenge, this study shows that creating an effective farm input chain may have a slight impact on the economics of small-scale Kayunga farms now (because of their low input strategy to low risk), but it is a crucial prerequisite for dairy development in the region. Let it be dairy farm intensification or up-scaling, a successful dairy sector cannot be created in the absence of reliable and competitive livestock services.

Once Kayunga dairy farm output and input markets start improving, farmers are expected to intensify their operations in a stepwise approach. As already seen in this study, farmers will carefully and slowly introduce exotic blood, consider feeding concentrates, and cultivating some forage. Such intensification steps will increase costs of milk production and hence Kayunga dairy farms will become less competitive in cost-per-kg milk produced. With higher costs, profit per unit will shrink and farmers will need to expand production by either further intensification or up-scaling. Under either strategy, Kayunga dairy farms will increasingly connect with local and international markets. The nature of these connections will determine the type of dairy development policies and their impacts on these farms and their households. Presently, the links between Kayunga dairy farms and markets are so weak that development policies hardly affect these subsistence farms and their families.

Lastly, the main single farming objective of subsistence farmers in Kayunga, like anywhere else, is to utilize their limited resources to meet basic needs and then produce some cash income. From this perspective, policies that facilitate their achieving such objective first make strong sense. For instance, we saw cases in which dairy competitiveness may deteriorate in order to increase resource utilization and increase household income: the promotion of one-cow farms around major urban centre (see MK-1) and the facilitation of using available family labour otherwise

economically wasted (see the >Water policy scenario). On the other hand, many of these policies can improve the farm dairy competitiveness, but they still fall short of improving the family income. Such policies merely set the foundation, on which greater improvement can be made. Therefore, policymakers must follow-up on these policies with other measures that reach beyond dairy competitiveness into improvement of the household income and so the family livelihood status.

ANNEX: 1 METHODOLOGICAL BACKGROUND

In this chapter, we will present the methods and sources of information used to collect data about the Uganda dairy sector and how the costs of production for the selected typical production systems are calculated.

This project has followed the framework used by the International Farm Comparison Network (IFCN). IFCN is a world-wide association of agricultural researchers, advisors and farmers. These participants select typical agricultural systems in key production regions in their individual countries. In 2006, the number of participating countries extended to 34 countries with 101 farm types that represent more than 80 percent of the world milk production.

The central objectives of IFCN are:

1. To create and maintain a standardised infrastructure through which production data of the major agricultural products (milk, beef, wheat, sugar, etc.) and from major producing regions of the world can be effectively compared and discussed.
2. To analyse the impact of the structure of production, technology applied and country-specific policies on the economic performance of agribusinesses, their costs of production and global competitiveness.

In order to achieve these objectives, IFCN employs the following methods and principles:

Direct contact with the production protagonists. A team of advisors and farmers is put together to set up the typical production models and to revise the final results. This approach brings the results closest to reality.

The principle of 'Total Costs'. IFCN considers both direct costs and margins, and the indirect (fixed) costs (i.e. depreciation and interests of the infrastructure used) and the opportunity costs for owned assets and production factors (i.e. family labour, land, capital).

A single and homogeneous method is utilised to calculate the costs of production for all participating countries. The IFCN standard is not the only truth, but a) it is scientifically correct, b) it includes all the existing production costs, and c) it creates transparency and international comparability in the arena of costs of agricultural production. Each IFCN member and client can reorganise the costs at his convenience and present them in the particular format of his country while he maintains an internationally comparable set of results.

The concept of setting (regional) typical agricultural models. A team of country experts, advisors and producers is formed to identify and set up the typical regional production models for each agricultural product. Typical production models must represent the common production structures in the region or country.

In the case of dairy production, for example, a working team composed of advisors, consultants and producers is formed as a panel. The first working step is to define the typical milk production systems of the major dairy regions in country. This model may be a 4-cow farm, feeding mostly cut grasses to fully confined animals, combine milk production with some other agricultural activities such as wheat and rice production in 3 ha of irrigated owned land, and milking is done by hand twice a day.

The second working step is to collect all the needed information from these typical models. For this, IFCN has developed a standard questionnaire. It is crucial that these data collected should neither reflect an individual farm (too many particularities may hurt the ability to generalise the results) nor be an arithmetic average (an average does not show much about the technology and the economics involved). The typical model should rather represent real and common situations of the region and show clearly the predominant technology and infrastructure. Such models will be preferred by analysts. The model TIPI-CAL (Technology Impact and Policy Impact Calculations)

is utilised for the simulations of these typical models and the calculations of their costs of production. TIPI-CAL can be easily shared with all IFCN members since it is a spreadsheet in MS-Excel. This model is a combination of production (physical data) and accounting (economic data). TIPI-CAL also consists of both a structure of costs of production and a simulation component (without optimisation). The simulations can be done for a period of up to 10 years in order to evaluate the growth, investments, policies or market conditions. For each year, TIPI-CAL produces a 'Profit and Loss Account', a balance and cash flow statement.

Allocation of costs of production. When the typical milk production systems have several agricultural activities besides dairy, fixed costs and expenses (i.e. depreciation) are distributed to each activity according to their use. For example, the depreciation of the machinery, which is used, for the dairy and the crop enterprises is allocated according to the hours worked in each.

Data about farm and off-farm household economics. IFCN takes into account all activities of the typical production systems, plus all the off-farm incomes and expenses realised by the owner and his family. This more complete picture of the typical model is necessary to obtain reliable information about the current economic situation of the model (including the household) and about the future of the farm (simulations).

All the methods and principles above have been applied in this project. Full panels were set up since these models will be first part of the IFCN activities for the year 2007. It was decided that two IFCN scientists first form panels of dairy experts to identify and build typical dairy farming models, and then visit each and every model, talk with the owners to collect and confirm panels' specific information, analyse the data and then have the results cross-checked by local experts and farmers.

The graphs of results follow the same structure as those in the 'IFCN Annual Dairy Report'. The main objectives of this report is to present the main economic results of the main typical milk production systems in Uganda and the farm level impacts of dairy development interventions.

For more information about IFCN, visit <http://www.ifcnnetwork.org> and <http://www.ifcndairy.org>

Cost Calculation

The cost calculations are based on dairy enterprises that consist of the following elements: Milk production, raising replacement heifers and forage production and/ or feed purchased for dairy cows and replacements.

The analysis results in a comparison of returns and total costs per kilogram of milk. Total costs consist of expenses from the profit and loss account (cash costs, depreciation, etc.), and opportunity costs for farm-owned factors of production (family labour, own land, own capital). The estimation of these opportunity costs must be considered carefully because the potential income of farm owned factors of production in alternative uses is difficult to determine. In the short run, the use of own production factors on a family farm can provide flexibility in the case of low returns when the family can chose to forgo income. However, in the long run opportunity costs must be considered because the potential successors of the farmer will, in most cases, make a decision on the alternative use of own production factors, in particular their own labour input, before taking over the farm. To indicate the effects of opportunity costs we have them separated from the other costs in most of the figures.

For the estimations and calculations the following assumptions were made:

Labour costs

For hired labour, cash labour costs currently incurred were used. For unpaid family labour, the average wage rate per hour for a qualified full-time worker in the respective region was used.

Land costs

For rented land, rents currently paid by the farmers were used. Regional rent prices provided by the farmers were used for owned land. In those countries with limited rental markets (like NZ), the land market value was capitalised at 4 per cent annual interest to obtain a theoretical rent price.

Capital costs

Own capital is defined as assets, without land and quota, plus circulating capital. For borrowed funds, a real interest rate of 6 per cent was used in all countries; for owner's capital, the real interest rate was assumed to be 3 per cent.

Depreciation

Machinery and buildings were depreciated using a straight-line schedule on purchase prices with a residual value of zero.

Adjustments of fat content

All cost components and forage requirements are established to produce ECM (Energy Corrected Milk with 4 percent fat and 3.5 percent protein).

Adjustment of VAT

All cost components and returns are stated without value added tax (VAT).

Adjustment of milk ECM 4 percent

The milk output per farm is adjusted to 4 percent fat and 3.5 percent protein ECM. Formula: $ECM\ milk = Milk\ production / ((0.383 * fat\ in\ percent + 0.242 * protein\ in\ percent + 0.7832) / 3.1138)$

Farm Economic Indicators (IFCN Method)

+ Total receipts =

- + Crop (wheat, barley, etc.)
- + Dairy (milk, cull cows, calves, etc.)
- + Government payments

- Total expenses =

- + Variable costs crop
- + Variable costs dairy
- + Fixed cash cost
- + Paid wages
- + Paid land rent
- + Paid interest on liabilities

= Net cash farm income

+ Non cash adjustments =

- Depreciation
- +/- Change in inventory
- +/- Capital gains / losses

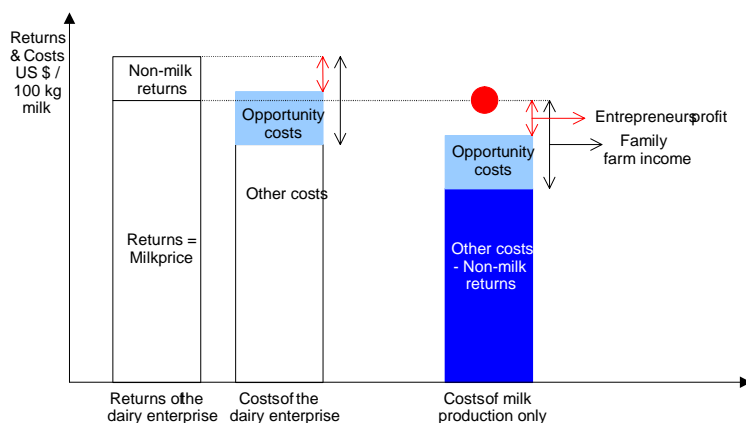
= Farm income (Family farm income in Dairy Report 2001)

- Opportunity costs =

- + calc. interest on own capital
- + calc. rent on land
- + calc. cost for own labour

= Entrepreneurs profit

ANNEX: 3 DESCRIPTION OF IFCN RESULT VARIABLES



Cost of Milk Production (only)

Method

The *total costs* of the dairy enterprise are related to the total returns of the dairy enterprise including milk and non-milk returns (cattle returns and direct payments). Therefore the non-milk returns have been subtracted from the total costs to show a cost bar that can be compared with the milk price. The figure beside explains the method.

Other costs: Costs from the P&L account minus non-milk returns (cattle returns and direct payments, excl. VAT).

Opportunity costs: Costs for using own production factors inside the enterprise (land * regional land rents, family working hours * wage for qualified workers, capital: Own capital * 3 per cent).

Returns of the dairy enterprise

Milk price: Average milk prices adjusted to fat corrected milk (4 percent excl. VAT).

Cattle returns: Returns from selling cull cows, male calves and surplus heifers + /- livestock inventory (excl. VAT).

Other Returns: Selling/home use of manure

Costs by costs items

Costs for means of production: All cash costs like fuel, fertiliser, concentrate, insurance, maintenance plus non-cash costs like depreciation for machinery and buildings (excl. VAT).

Labour costs: Costs for hired labour + opportunity costs for family labour. (Man-hour calculations below)

Land costs: Land rents paid + calculated land rents for owned land.

Capital costs: Non-land assets * interest rate (equity * 3 percent, liabilities * 6 percent).

Quota costs: Payments for rented quota and depreciation for quota bought.

Cash and non-cash costs

Cash Costs: Cash costs for purchase feed, fertiliser, seeds, fuel, maintenance, land rents, interest on liabilities, wages paid, vet + medicine, water, insurance, accounting, etc (excl. VAT).

Depreciation: Depreciation of purchase prices for buildings, machinery and quotas (excl. VAT).

Opportunity *costs*: Costs for using own production factors (land owned, family labour input, equity).

Economic results of the dairy enterprise

Farm *income per farm*: Returns minus costs from P&L account of the dairy enterprise.

Farm income per kg milk: Farm income per farm (dairy enterprise) / milk production

Profit *margin*: Share of farm income on the total returns: Farm income divided by the total returns.

Entrepreneurs profit: Returns minus costs from P&L account of the dairy enterprise - opportunity cost allocated to the dairy enterprise.

Net cash farm income: Cash receipts minus cash costs of the dairy enterprise or: Farm income + depreciation

Return to labour: Entrepreneurs profit plus labour costs (wages paid plus opportunity costs) divided by total labour input.

Average *wages on the farm*: This figure represents the gross salary + social fees (insurance, taxes, etc.) the employer has to cover. Calculation: Total labour costs (wages paid plus opportunity costs) divided by the total hours worked. To calculate this, the number of hours worked by the employees and the family has been estimated by experts.

Labour input: The estimation of hours worked and the valuation of these hours is extremely difficult especially in family farms. In the IFCN network this method will be intensively discussed and improved during the next workshops.

Calculation *Man-hour equivalence*: Man-hours per year= Sum of the product (Labour input for each family member * wages for each family member) divided by the wage rate for the adult man.

Labour costs: Paid wages and opportunity costs for own labour of the dairy enterprise (in Man-hour equivalent).

Land costs: Paid land rents and opportunity costs for own land (calculated rent) of the dairy enterprise.

Stocking *rate*: Number of cows / ha land.

Capital costs: Paid interests and opportunity costs for own capital (excluding land capital and quota capital). For equity 3 per cent and for liabilities 6 per cent interest rate is used in all countries. This reflects the method of "capital using costs" developed by Isermeyer 1989.

Capital input: Total Assets (land, buildings, machinery, cattle)/ number cows.

ANNEX: 4 MILK PRODUCTION SYSTEMS IN UGANDA



MK-1: Small-holder intensive system



MK-15: Medium-holder intensive system



MK-45: Large-scale producers



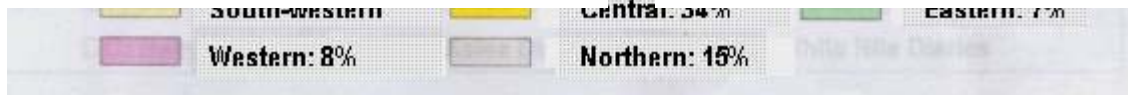
KY-3: Small-holder extensive



KY-13: Medium-holder extensive/ pastoralist



KY-40: Agro-pastoralist



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