USAID FROM THE AMERICAN PEOPLE	**Rwanda Dairy Competitiveness Program II (RDCP II)**	LAND O'LAKES, INC. INTERNATIONAL DEVELOPMENT Innovative Solutions for Global Prosperity

BASELINE SURVEY REPORT
RWANDA DAIRY COMPETITIVENESS PROGRAM

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Abbreviations and Acronyms

AFDB	African Development Bank
AI	Artificial Insemination
ANP	Akagera National Park
ASIP	Agriculture Sector Investment Plan
BDR	Rwanda Development Bank
BRALIRWA	*Brasserie de Limonade du Rwanda*
BRD	Rwanda Development Bank
CBOs	Community Based Organizations
CBPP	Contagious Bovine Pleuro-pneumonia
COMESA	Common Market for East and Southern Africa
CoP	Chief of Party
DDG	Deputy Director General
DE	Design Effect
DP	Development Partners
DQAL	Dairy Quality Analysis Laboratory
E.C.F	East Coast Fever
EAC	East Africa Community
EDPRS	Economic Development and Poverty Reduction Strategy
EPR	End of Project Report
EWSA	Electricity and Water Sanitary Authority
FAO	Food and Agriculture Organization
FGDs	Focus Group Discussions
FHH	Female Headed Households
Fig	Figure
FMD	Foot and Mouth Disease
GMP	Good Manufacturing practices
GoR	Government of Rwanda
HDI	Human Development Index
HH	Head of Household
HIV/ AIDs	Human Immuno-deficiency Virus/Acquired Immune Deficiency Syndrome
HI	Heifer Project International
IAKIB	Ihurirory'AborozibaKijyambereBafatanyije
IAR	Ishyirahamwery'Aborozi mu Rwanda (Association of Livestock Breeders)
IFAD	International Fund for Agricultural Development
IMF	International Monetary Fund
IRs	Intermediate Results
ISAR	*Institut des Sciences Agronomiques du Rwanda*
ISAE	*Institut Supérieur d'Agriculture et de l'Elevage*
KII	Key Informant Interview
KWAMP	Kirehe Community-Based Watershed Management Project
LISP	Livestock Infrastructure Support Project
LMP	Livestock Modernization Program
LOL	Land O' Lakes

LSD	Lumpy Skin Diseases
LWF	Lutheran World Federation
MCCs	Milk Collection Centers
MDGs	Millennium Development Goals
MINAGRI	Ministry of Agriculture and Animal Resources
MINECOFIN	Ministry of Economic Planningand Finance
MPPs	Milk Processing Plants
MSMEs	Micro, Small and Medium Enterprises
NGOs	Non-Governmental Organizations
NUR	National University of Rwanda
PADBEL	*Projet d'Appui au Développement de l'Elevage Bovin Laitier*
PAPSTA	*Projet d'Appui au Programme Strategique des Transformation Agricoles*
PM & E	Participatory Monitoring and Evaluation
PRA	Participatory Rural Appraisal
PRSP	Poverty Reduction Strategy Paper
PSTA	*Plan Strategique de la Tranformation Agricole*
R – to – C	Resource – to – Consumption
RAB	Rwanda Agriculture Board
RDCP	Rwanda Diary Competitiveness Program
RSOQ	Rwanda Seal of Quality
SACCOs	Savings and Credit Cooperatives
SACR	Send-A-Cow Rwanda
SCC	Somatic Cell Count
SMEs	Small and Medium Scale Enterprises
SWAP	Sector-Wide Approach
TB:	Tuberculosis
TBD	Tick – borne disease
ToR	Terms of Reference
UHT	Ultra-Heat Treated
UK	United Kingdom
USA	United States of America
USAID	United States of America aid
USD	United State Dollar
USG	United States Government
WEACS	Wakala East Africa Consulting Services Lt

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We beg for the understanding of all those not mentioned in this short acknowledgement. To everyone, who assisted us, in this most important study, we are indeed very grateful.

EXECUTIVE SUMMARY

The Rwanda Dairy Competitiveness Program II (RDCP II) is a USAID funded 5-year program managed by Land O'Lakes Inc. International Development. The project is designed to reduce poverty through expanded marketing of quality milk that generates income and employment, and improved nutrition of rural households. It aims at achieving this by linking existing and new smallholder dairy producers to expanding market demand in Rwanda and within the region, driven by improved quality, reduced transaction costs and increased investment all along the dairy value chain.

The baseline study reported herein was designed to collect all relevant data that describe the current status or bench marks and establishes clear indicators pertaining to the two major intermediate results set by RCDP II, notably (i) Rwandan Dairy Products Meet COMESA Standards, and (ii) Expanded Investment in Dairy Processing and Marketing.
The core objective of the project is to increase the competitiveness of Rwanda dairy products on regional markets to positively impact rural household incomes associated with dairy related enterprises.

Summary results of major findings

1. Farmer profile

78% of Households are the male-headed households (MHH), husband and wife living together were highest (75%) followed by women-headed households (WHH) where women were living alone (widows) at 14%, and the rest were women-headed HHs, women living with husbands, male-headed HH with no wives, and child-headed HH, where children had neither fathers nor mothers, at 7%, 3% and 1%, respectively.

83% of the respondents are in the "poor" and "relatively poor " categories, while 8% are in the very poor and poorest categories. Rich categories also account for 8% of the respondents.

80 % of respondents can read and write while 56% farmers have completed primary school education.

2. Milk Production

The survey showed that the total milk production for surveyed households per year was 2,290,659 liters from a total of 749 households. The average milk production for 2011, was 8.37 liters per household per day, and the average number of cows per household was 3.48 for milking and non-milking cows, whereas the average daily production per cow per day in surveyed households was 2.40 liters.

3. Cost of Production for Dairy Farming

The Rwandan dairy sub sector is characterized by low inputs. Only a small proportion of smallholder dairy farmers purchase dairy inputs such as feed supplements (concentrates), veterinary medicine and various equipment required, mostly due to the fact that they are not readily available. When these are available they are unaffordable by most smallholder farmers. The average cost of dairy inputs per HH/year is in the range of RwF 146,749. The direct consequence of this is the low average milk production of 8.38 liters per HH/day.

4. Livestock extension

On average a dairy farmer was reached 2.5 times by an extension agent in a year on average cost of Rwf 6,602. 61% of farmers reported to use veterinary drugs and vaccines.

5. Milk testing and milk quality

47% of milk sold by farmers was not tested at point of sale. The average total bacterial counts of milk leaving the MCC ranges between 500,000 and 700,000 total bacteria count per ml and reach processing plants with 800,000 to 1,300,000 TBC per ml while RBS/EAC/COMESA recommended standard is less than 1,000,000 TBC per ml of milk sample.

6. Smallholder Dairy Farmers' Cooperatives

The survey revealed that 48% of all respondents across the four milk sheds belonged to smallholder dairy farmers/producers' cooperatives with the highest percentage of

these being in Eastern milk shed (67%) followed by North-Western (58%) , Southern (57%) and Kigali milk shed (8%). There are 12 dairy farmers cooperative Unions and 81 smallholder dairy cooperatives with a total membership of 13,413 countrywide.

7. Milk Collection Centers (MCCs)

There are 61 Government financed MCCs with a total cooling capacity of 195,000 liters in all milk shed while 35 new MCCs will have been constructed and equipped by end of 2013, additionally there are a number of privately owned milk collection centres spread out throughout Rwanda. The total milk sold by the MCCs in 2011 was 16,067,127 MT.

8. Milk Price and sales at farm level

The prices of milk and milk products are generally low, except in urban and peri-urban area. In more remote areas, where there is a serious problem of access to MCCs, milk is sold at give-away price of less than Rwf 100/liter. The average milk price across the milk sheds is estimated at Rwf 209 per liter.

The average milk sales per household per day is 6.27 liters equivalent to 1,310 Rwf.

9. Processors

Only about 2.6% of the milk produced in Rwanda is processed. There are more than 20 processing enterprises including large milk processing plants and cheese making SMEs. The actual utilized capacity for all milk processing plants is estimated at 32,000 liters per day which is equal to 15% to 20% of the total installed processing capacity of 160,000 liters per day.

10. Milk supply and consumption

The total milk production is estimated at 445,035,740 liters. And for a population of 10,500,000, the milk consumption per capita is 42 liters. which is far lower than 200 liters recommended by WHO.

2012 EADD survey confirmed that there is an over-supply of 52 million liters in the country, the oversupply being mainlys caused by lack of a dairy milk and milk marketing strategy, low incomes of the majority of Rwandese.

11. Milk import and export

The annual milk and milk product imports is estimated at USD 1,498,792 per year while the total value for exports was estimated at USD 85,979 in 2011.

12. Baseline Value of key indicators

Table 1. Baseline Value of other key indicators

Key indicators	Baseline Values
Value of dairy products exports as a result of USG assistance	85,979 USD (BNR,2012)
Change in net dairy income among targeted households	Total income/ HH/year : 478,309 Rwf = 759.26 USD Average cost /HH/year : 146,749 Rwf = 232.947 USD Net income/ HH/year : 331,560 Rwf = 526.313 USD
Value of incremental milk sales (collected at farm- level) attributed to FTF implementation	Volume milk sold/HH/year: 2,289 liters Total income/ HH/year : 478,309 Rwf = 759.26 USD Average selling price : 209 Rwf/L
Change in liters of milk marketed by Milk Collection Centers (MCCs)	16,067,127 Liters/year
Value of inputs and services used by members of targeted cooperatives	146,749 Rwf/HH/year
Gross margin per dairy cow	141,315 Rwf/cow/year

1.0 INTRODUCTION

1.1. The Rwanda Dairy Competitiveness Program II (RDCP II)

1.1.1. Background

The Rwanda Dairy Competitiveness Program II (RDCP II) is a USAID funded 5-year program managed by Land O' Lakes Incorporated. The project is designed to reduce poverty through expanded marketing of quality milk that generates income and employment, and improved nutrition of rural households. It aims at achieving this by linking existing and new smallholder dairy producers to expanding market demand in Rwanda and within the region, driven by improved quality, reduced transaction costs and increased investment all along the dairy value chain.

The overarching goal and mission for RDCP II is to increase the competitiveness of Rwandan dairy products in regional markets to positively impact rural household incomes associated with dairy-related enterprises. RDCP II will be addressing the various challenges that the Rwandan dairy industry faces.

RCDP II feeds into the medium-term national development planning frameworks, including the pipeline second generation Economic Development and Poverty Reduction Strategy (EDPRS 2), as well as the third generation Draft Strategic Plan for Agricultural Transformation (PSTA III), both lined up for 2013 to 2018. More specifically, RCDP II objectives are in line with sub-sub-program 1, sub-program 5, Strategic Program 1, aimed at *"Improving Milk Production in Quality and Seasonality and Productivity"*, and sub-sub-program 1, sub-program 4, Strategic Program 3, on *"Dairy Value Chain* of the draft PSTA III.

1.1.2. RDCP II Core Project Objectives and Expected Outputs

The core objective of the project is to increase the competitiveness of Rwanda dairy products in regional markets to positively impact rural household incomes associated with dairy related enterprises.
On the other hand, the primary Life of Project outputs, as identified in the RDCP II Cooperative Agreement are:

- 60 percent increase in the volume and value of dairy products sold;
- 30 new products awarded with the Rwanda Seal of Quality;
- 60 percent increase in net household income;
- 7,500 new dairy-related jobs created;
- $20 million(USD) in non US government resources leveraged;
- Policy reforms advocated for or enacted.
- 60 % increase of Gross margin per dairy cow

1.2. Baseline Survey Objectives

Specific objectives of the baseline survey include among others, but not limited to:

- Provide a more precise definition and understanding of the socio-economic status and vulnerability of potential program participants;
- Identify and recommend opportunities and synergies for better results and linkages;
- Identify problems and constraints that may occur during program implementation; and
- Provide actionable recommendations and improvements to program implementation.

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2.0. APPROACH AND METHODOLOGY

The baseline study was designed to collect relevant data that describe the current status or bench marks and establish clear indicators pertaining to the two major intermediate results set by RCDP II, notably (i) Rwandan dairy products meet COMESA standards, and (ii) Expanded Investment in dairy processing and marketing.

2.1. Study Approach and Methodology

The study used a triangulation of quantitative and qualitative methodologies. The quantitative data were derived from structured interviews with farmers members of dairy cooperatives, owners/managers of Milk Collection Centers, dairy traders, input suppliers and processors using prepared questionnaire specific to each of the above categories.

Household survey

Interviews were conducted at household level with farmers members of dairy cooperatives. Membership lists were used as sampling frame from which farmers were randomly selected. 17 districts from 4 milk sheds targeted by RDCP II were covered in the sampling process.

Initially a sample of 384 (n) was calculated using Fisher's formula for sample calculation. But as this study had to be carried out in 17 purposively selected districts, representing areas targeted by RDCP II, a design effect (DE) was used to correct the loss of sampling efficiency. To correct for the difference in design, the calculated sample size was multiplied by the design effect (DE) equivalent to 2.

→ n x DE = 384 x 2 = **768**

The sample was further increased by 9% to account for contingencies such as non-response or recording error.

→ n x DE + 9% = 768 x 1.09 = 837=840

Key informants interviews

For other categories the intention was to interview 30% of actors in each category of informants. As processors group was not very large, all big processing plant were covered. Other categories which may have a relatively high number of actors (such as milk sellers), a reasonable sample was to be selected.

Focus Group discussion were conducted at district level and addressed clearly identified issues. The selection of participants was done depending issues to be discussed.

Below are the number of respondents reached in each category:

- Smallholder farmers (HHs) : 749
- Milk Collection Centers (MCCs): 20
- Milk and Milk Products Traders: 48

- Input Suppliers: 23
- Processors: 08
- FGD: 10 groups/meetings
- Key informants: 60

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2.1. Data collection

Quantitative data was collected using a pre-tested questionnaire. Three teams of 9 enumerators covered each milk shed one at a time under the supervision of team leaders/supervisor. Filled-in questionnaires were collected on a daily basis and sent to Kigali for data entry. Data collection and entry were done simultaneously. Five data entry technicians handled the data entry and analysis under supervision of the team statistician.

2.3. Data Handling, Processing and Analysis

Editing and coding data were carried out progressively during the field survey. Data derived from FGDs and KII were sorted according to key themes and sub-themes. A double data entry system was used in order to control errors. A data entry matrix was developed using SPSS and fields were protected for non-eligible values.

A final dataset in SPSS was produced and the final data spreadsheet was prepared and analyzed using the SPSS and excel. Frequency tables, cross-tabulations and descriptive statistics, different types of graphs and histograms were produced and used in reporting and interpreting the survey data.

2.4. Data Collection Process Limitation

Limited time due to the farming activities in season A and logistical constraints hampered the survey study plan of action precluding the extensive PRA participant probing. This had a negative effect on results particularly where data was segregated according to sex. For example many women could not be interviewed as they were pre-occupied with cultivation and planting of crops unlike men who were always available when needed.

2.5 Timing and Limitation of the Study

The study was delayed for 2 month (July/August, 2012), a period when all household surveys were restricted in the country to avoid any disturbance that may impact the National Census Survey which was conducted countrywide in August 2012.

2.6 Production of Reports

The data was analysed and the draft reports presented to the client for comments and quality control. The final report –includes the main survey report as Part I, and Appendices as Part II, plus an electronic copy of the baseline data.

3.0. SURVEY RESULTS AND DISCUSSION

3.1. Farmer Profiles

As presented in Figure 1, a higher proportion of respondents were males across all milk sheds (70% vs 30%), and the highest ratio of males to females was observed in North-Western (76% vs 24%) and the lowest seen in the Southern milk shed (56% vs 44%). This might be attributed to the fact that the survey was undertaken during the planting period, and most of the women were busy planting maize/beans across all the milkssheds.

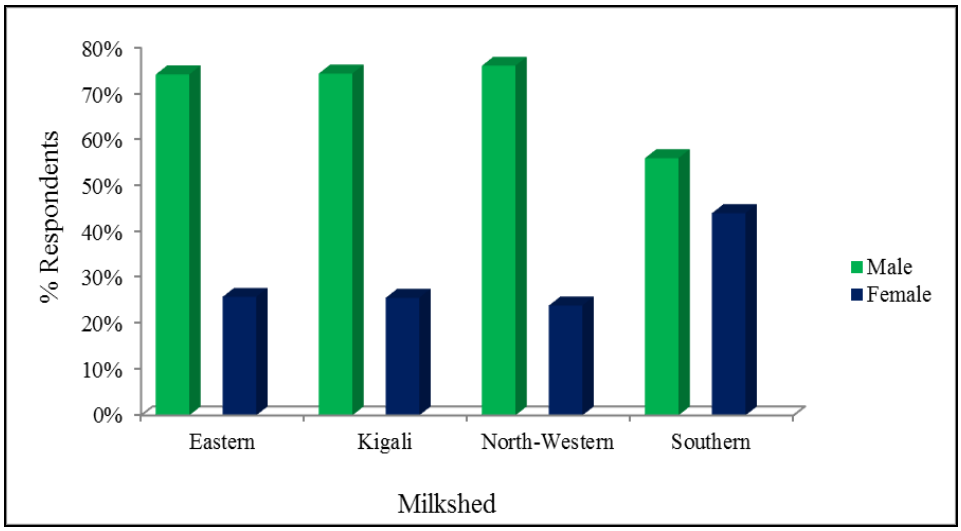

Figure 1: Sex of farmers by milk shed.

Generally, the male-headed households (MHH), husband and wife living together were highest (75%) followed by women-headed households (WHH) where women were living alone (widows) at 14%, and the rest were women-headed HHs, women living with husbands, male-headed HH with no wives, and child-headed HH, where children had neither fathers nor mothers, at 7%, 3% and 1%, respectively. The situation across the milk sheds is presented in Figure 4 above. The figures on household types is on the lower side compared to the EICV3 Thematic Report Sex data by (NISR, 2012) which reported that in Rwanda, some 28% of households are permanently headed by females.

Looking at their poverty status, female-headed households are only slightly more likely to be poorer than their MHH counterparts, with 47.0% of FHH poorer compared with 44.9% of all HHs. Generally, the report shows clearly that FHHs had a higher poverty rate than other HHs at 51% (NISR, 2012).

3.2 Level of Education

Generally, the literacy level was high across the milk sheds at 80% (can read and write) and only 20% (can't read and write). Respondents within Kigali milk shed had slightly higher level of literacy (87%) than the rest, and the lowest level of literacy was seen in

Eastern milk shed (75%) (Figure 2). The observation is in conformity with the national literacy data as presented by the recent human population census (NISR, 2012).

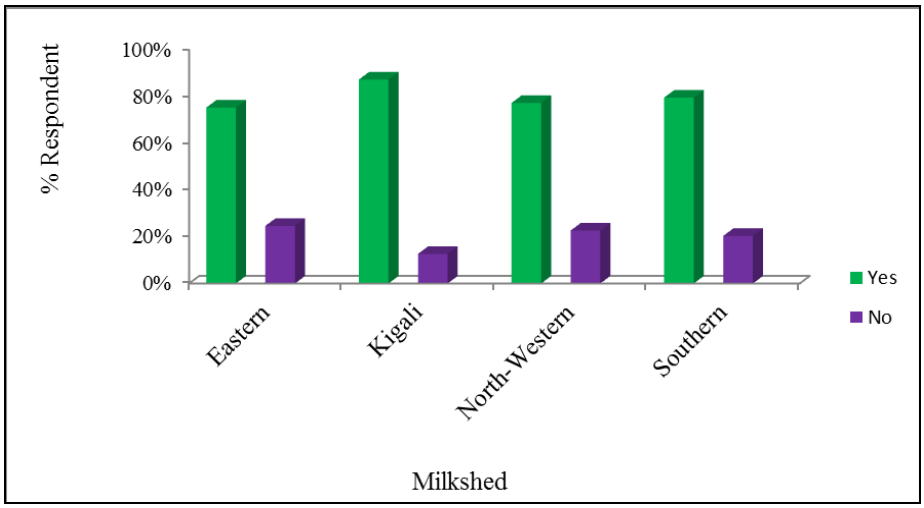

Figure 2: Literate vs illiterate by milk shed

The highest proportion of respondents were primary school leavers (56%), followed by secondary school leavers (26%), and those who attained tertiary education were the least (7%), whereas, the remaining 11% had non-formal education (technical trainings).

It is also worth noting that, the highest number of respondents (17%) with tertiary education were found within Kigali, whereas, the lowest were seen in North/Western milk shed. On the other contrary, a majority (60%) of the primary school leavers was from North-Western and the lowest (49%) were observed in Kigali milk shed.

The level of education of the spouses followed a similar trend to that of the respondents. Overall, the order was primary school, secondary school, non-formal and tertiary levels at 57%, 20%, 19%, and 4%, respectively. The highest (12%) in the category of tertiary education was seen in Kigali, and the lowest was in Eastern and Southern milk sheds.

3.3. Milk production survey results

The survey showed that the total milk production for surveyed households per year was 2,290,659 liters from a total of 749 households. The average milk production for 2011, was 8.37 liters per household per day, and the average number of cows per household was 3.48 for milking and non-milking cows, whereas the average daily production per cow per day in surveyed households was 2.40 liters.

The survey results clearly showed that zero grazing/stall feeding was the commonest practice across the four main milk sheds of Rwanda, with an overall average of 80%, as compared to 3% and 17% for semi-intensive and extensive/free range production systems, respectively. The recent EICV results (NISR, 2012) shows that stall feeding is practiced by an average of 92% of all livestock keepers in Rwanda.

Comparatively, the zero-gazing system was most commonly practiced within the Southern and Kigali milk sheds, with 98% and 90% of the respondents, respectively, followed closely by North-Western milk shed, and the lowest being Eastern, with 86% and 44% respondents, respectively (Figure 3).

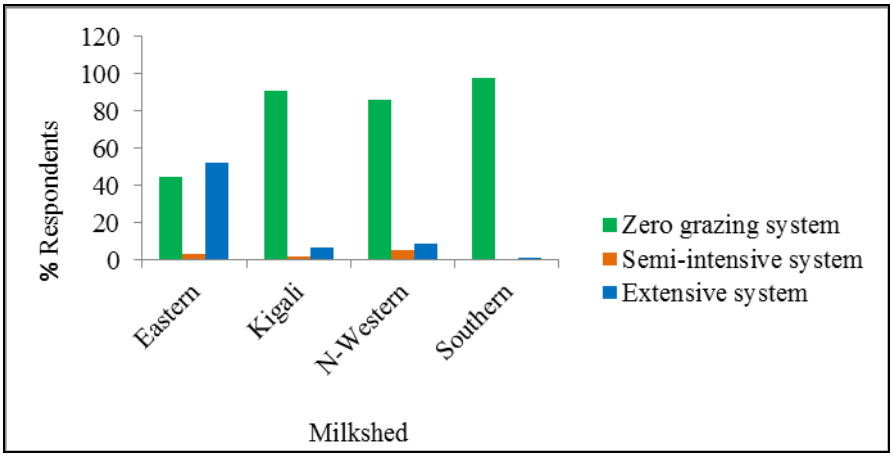

Figure 3. Dairy Production System by Milk shed

Whereas the semi-intensive dairy cattle production system was least practiced across the milk sheds, with an overall average of only 3% of the respondents, extensive/free range dairy cattle production system was still practiced within the less densely populated areas of the Eastern milks shed (52%).

The generalized scenario is that within milk sheds there are serious problems of land shortage that go with high human population pressure, typical of Southern, Kigali and North-Western milk sheds, strict dairy cattle intensification is an inevitable practice, unlike in the Eastern milk shed where in most districts, especially those bordering the Akagera National Park (ANP) (Kayonza, Gatsibo and Nyagatare), some grazing land is still available.

3.4. Breeds of Cattle kept by farmers

Baseline survey results show that majority of the interviewed farmers in the Eastern milk shed keep Ankole cattle (82%), while crossbreds were mentioned by 37% of the interviewed farmers in the Eastern province. On the other hand, interviewed farmers in the North-Western milk shed keep Brown Swiss and their crosses with Ankole (Figure 4). Cattle with Sahiwal breed characteristics are kept by a majority (98%) of the interviewed farmers within the Eastern milk shed. While Jersey breed was reported to be owned by 50% of the interviewed farmers, Friesian was common with farmers (35%) in Kigali City milk shed.

It is clear (Figure 5) that ecological factors influence the preference of a particular breed by farmers in each Milk shed. While the majority of farmers in the Eastern milk shed prefer Ankole and crossbreds (48.8 and 49.6%, respectively), a majority of farmers in the

North-Western milk shed prefer Jersey breed. The Jersey is most common within the North-Western milk shed, where it was introduced by HI from 2002.

The Ankole breed is prevalent in the Eastern milk shed, particularly in Nyagatare and Gatsibo districts, because they are commonly reared under extensive production system. However, due to increasing land pressures the recent trend has been destocking and adoption of crossbred cattle, particularly those with Sahiwal blood. Brown Swiss is common with farmers in Gishwati and adjoining areas. The breed originated from Masisi area in Eastern DRC where the breed spread from.

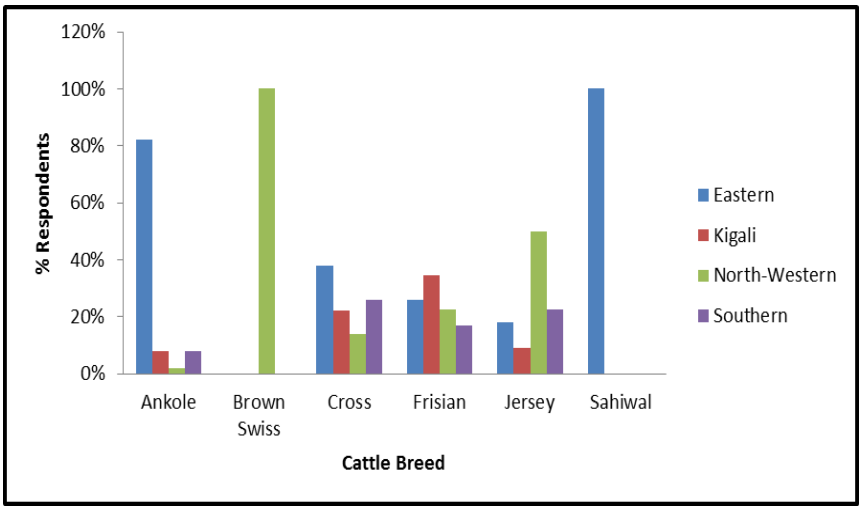

Figure 4. Common dairy cattle breeds by milk shed.

The Friesian is preferred more by farmers in the more intensive dairy system of Kigali City milk shed probably due to its high milk yielding capacity and financial ability of the farmers most of whom are business men/women or civil servants. Other preferred breeds are the Brown Swiss and crossbreds of all types.

Asked why they preferred certain breeds than others most farmers gave the following reasons; easy to maintain, resistance to diseases and high milk yield as the main reasons in the same order of importance (Figure 5). Other reasons were either social-cultural (Eastern province) in case of the Ankole and prestige, while the other reason for keeping cattle in Kigali City of economic, hobby and prestige,

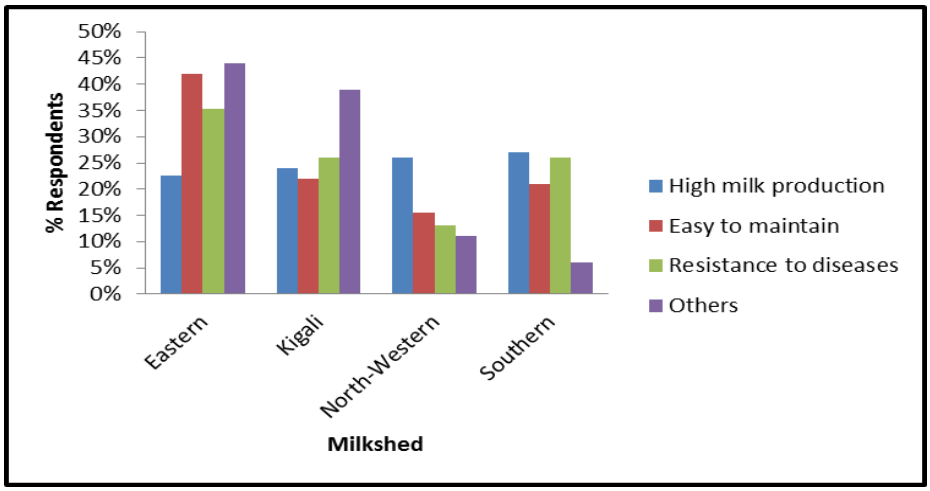

Figure 5. Reasons for breed preference per Milk shed.

3.5. Replacement stock

While most farmers in the Eastern milk shed raise their own replacement stock, farmers in the other milk sheds externally source theirs (Figure 6) or get them from different sources.

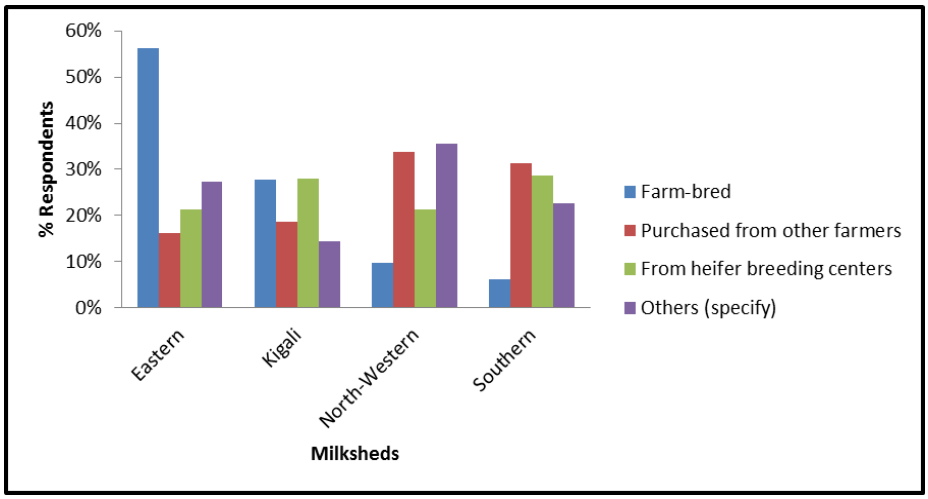

Figure 6. Source of breeding cattle by Milk shed

3.6. Breeding Methods

Results from the household survey showed that the majority of the farmers across the four milk sheds use both natural and artificial insemination methods to breed their cattle (Figure 7). Kigali City and Southern milk sheds showed the highest but equal adoption of artificial insemination (AI) and the North-Western milk shed with the lowest adoption rate.

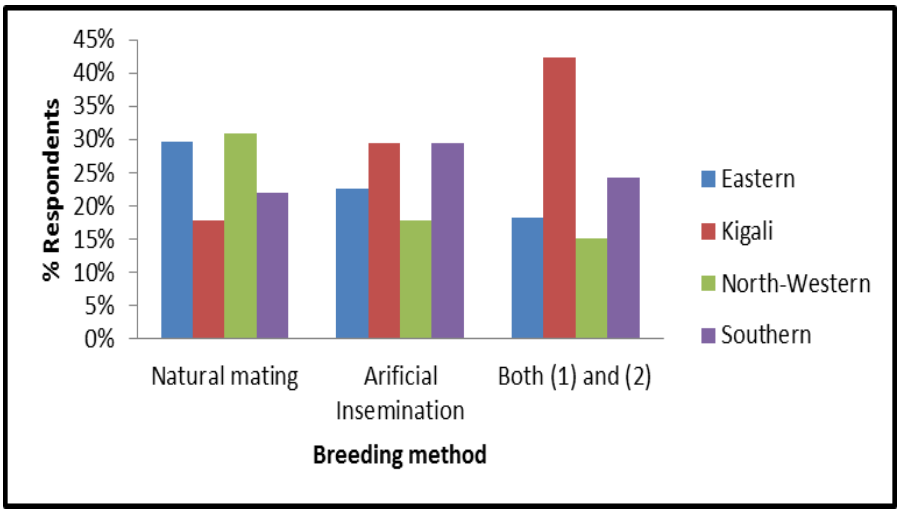

Figure 7. Breeding methods by milk shed

The majority of farmers in the Eastern and Kigali milk sheds use farm raised bulls while those in the other milk sheds either depend on their neighbor's bulls and/or other sources (Figure 8).

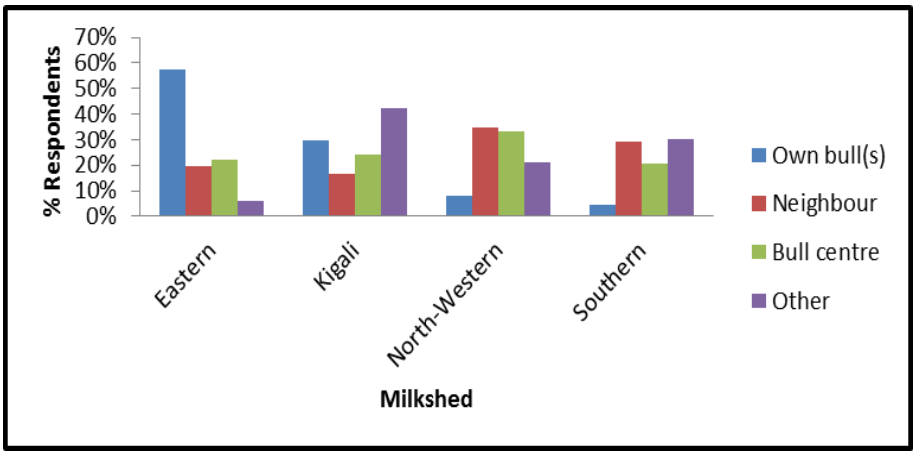

Figure 8. Source of bulls cattle per Milk shed

Except for Kigali City, the majority of farmers in the milk sheds depend on bulls to detect heat in their cattle (Figure 9).

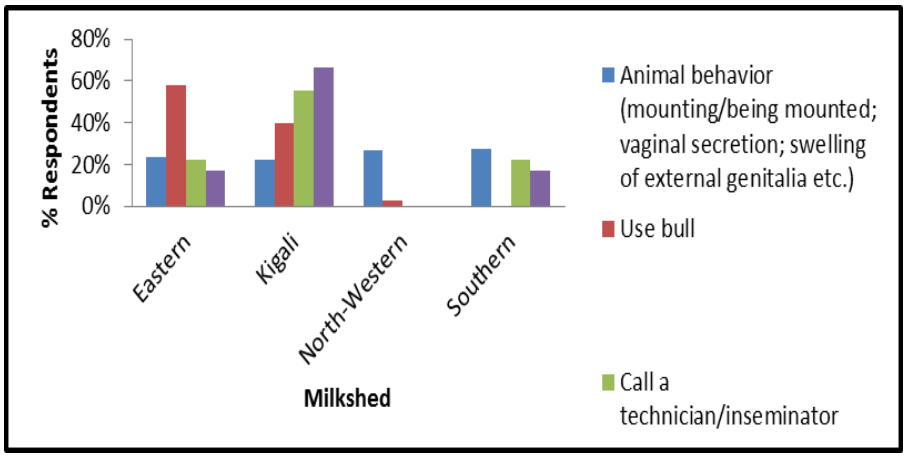

Figure 9. Heat detection methods used by farmers in all milk sheds

Less than 30% of the farmers in all the four milk sheds breed their animals at the right age of 18 to 31 months of age with the Eastern milk shed performing poorly (Figure 10). Ideally, depending on the purity of the breed, feeds and feeding and other management practices, the appropriate breeding age for dairy breeds range from 15 months for the Holstein Friesian and 18 months for the Jersey. However, in most tropical countries including Rwanda, a majority of the cattle are indigenous breeds and their crosses with exotic breeds experience delayed mating as a result of lower growth rate. Like in many other developing countries, it is recommended to breed animals at a later age to avoid pregnancy and calving complications. It is therefore recommended to breed heifers at 18 to 31 months.

Farmers across the four milk sheds use indigenous technical knowhow (experience and physiological changes) conventional pregnancy tests/diagnosis to confirm their cow's pregnancy (Figure 11).

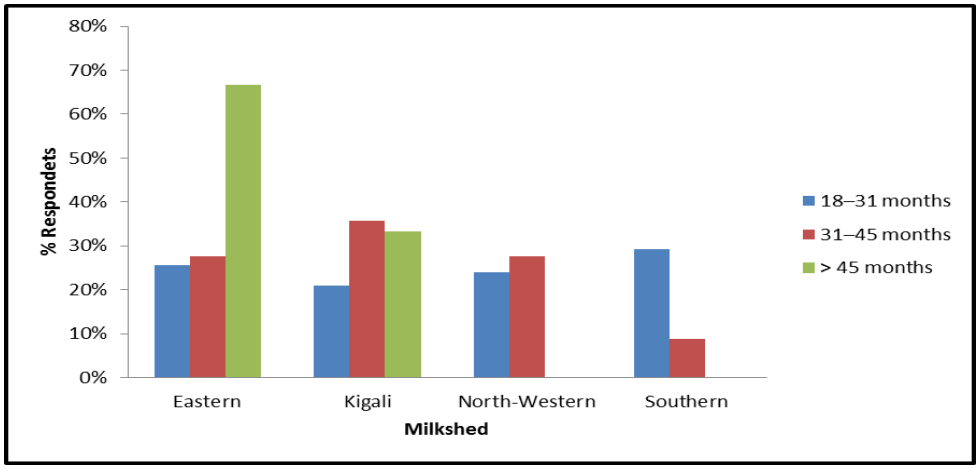

Figure 10. Age at first mating for heifers per milk shed

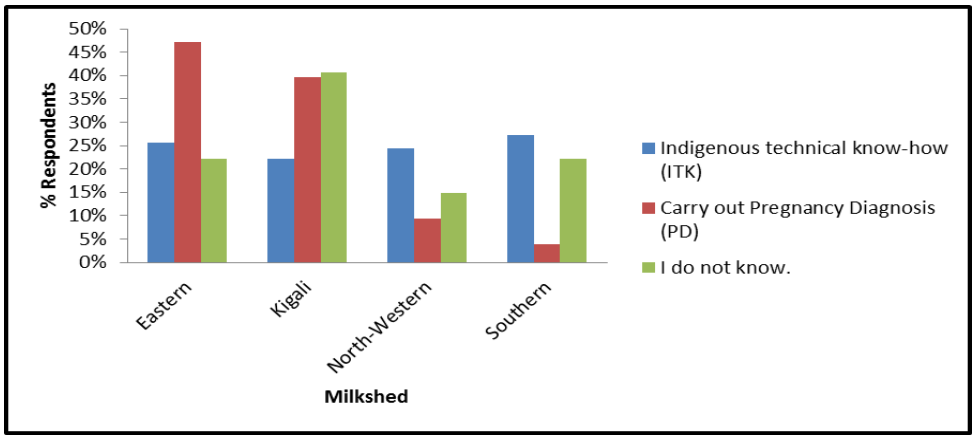

Figure 11. Pregnancy detection methods by farmers in the four milk sheds

3.7. Routine Dairy Management Practices

The calving interval was highest in the Eastern Milk shed where 40% of the cows had a calving interval of above 18 months (Figure 12) while 24. % of the cows in the Northern/Western milk shed had the lowest calving interval of 12 months. The range figures are appropriate as the majority of the farmers use experience when answering this question farmers do not records.

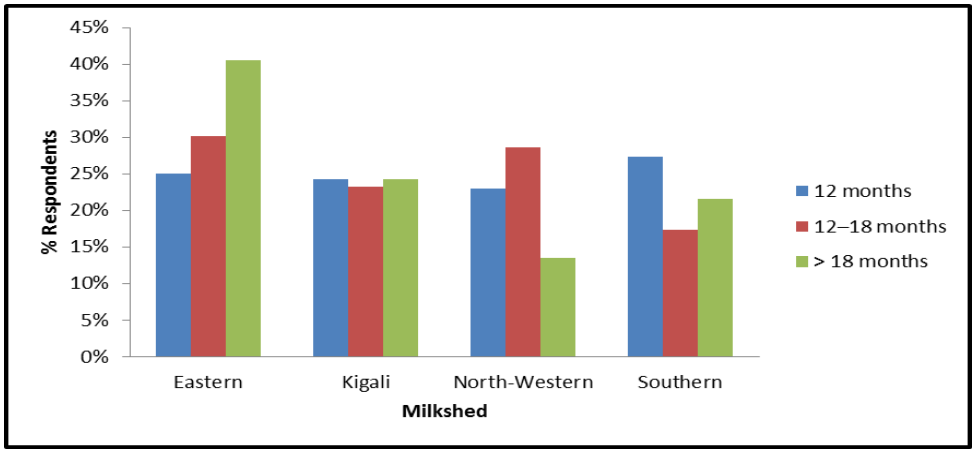

Figure 12. Calving interval per Milk shed

The baseline study results showed that 35% of the interviewed farmers in the eastern province reported a higher dry period for their cattle. The lowest dry period of was reported by 30% of the farmers in the in the Southern milk shed (Figure 13).

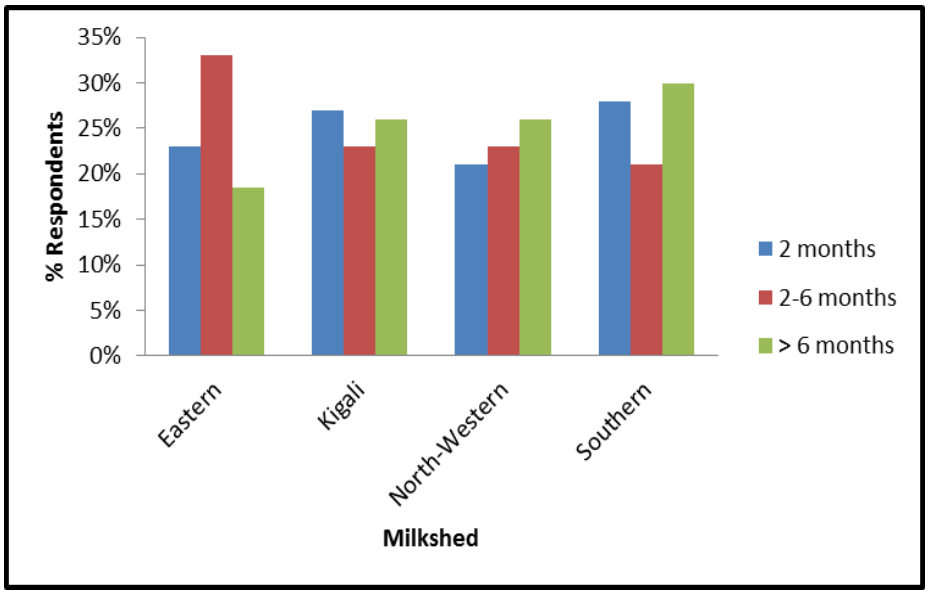

Figure 13. Length of dry period in each milk shed.

Culling practice was low among the surveyed farmers (Figure 14) led by the Eastern Milk shed at 33% . It was also observed that 21.50% of the interviewed farmers in the North-Western milk shed reported low conception rate for their cattle. Whereas, , most farmers reported weaning ages ranging from 3 to 6 months, Kigali City milk shed farmers (42.60%) indicated weaning their cattle at exactly 3 months.

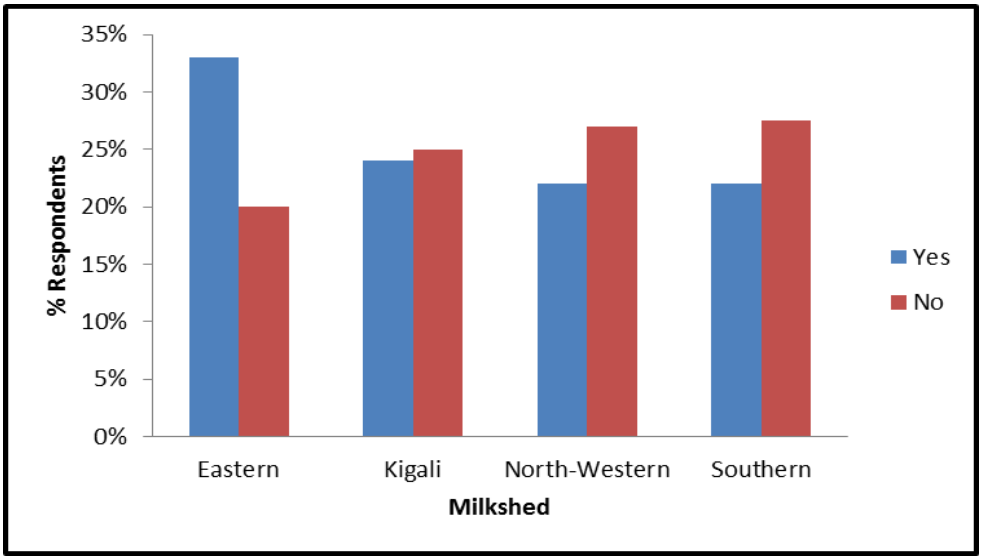

Figure 14 Culling practice by milk shed

3.8. Fodder Establishment

Fodder establishment was common across all the milk sheds with a majority of the respondents (93%) occurring within the Southern, followed by Kigali (86%), then North-Western (81%). The least number of respondents were seen in the Eastern milk shed (58%).

Following earlier observations, the situation is associated with the availability of land coupled with human population pressure. The most populated areas of the Southern, Kigali and North-Western practice intensive crop production with all land used yearlong and year after year with no land reserved for grazing.

Smallholder dairy farmers practice complete zero grazing depending mostly on established fodders grown along some small pockets of land not under crops, and mostly along contour ridges of anti-erosion structures including progressive and radical terraces, within the medium and high slopes of the Southern and North-Western milk sheds, respectively.

Established fodder was found to vary across milk sheds with the Eastern milk shed having more acreage under established fodder than its counterparts. The Southern milk shed had the highest number of households who have established fodder (160 out of the 544 households), followed by Kigali (143 out of 546), North-Western (139 out of 546), and Eastern milk shed had the lowest number of farmers with established fodder (103 out of 546) in 2011. When districts are considered, fodder establishment is commonest within Gasabo and Kicukiro, with respondents almost at par, respectively being 57% and 52%, followed by Nyagatare district.

This is mainly associated with the farmers' need for intensifying dairying aimed at maximizing milk production in order to exploit the milk markets of Inyange and Nyagatare milk - Savannah dairy processing plants (MPP). On the other hand, this may be associated with the high level dairy extension service provided in these areas.

Apart from established fodder, it is important to note that, a bigger portion of the feedstuffs originate from natural green fodder cut from uncultivated land, different types of crop residues and milling by-products.

3.9. Use of purchased cattle feeds

The use of purchased cattle feeds across milk sheds depends on land availability for fodder establishment, as shown, on average, about 50% of all respondents mentioned that they purchased cattle feeds. As clearly shown, relatively lower percentage of respondents (35%) within the Eastern milk shed purchase cattle feeds as they still have some grazing land where they practice some free ranging or semi-intensive production system, on the one hand, and have comparatively bigger land areas for fodder establishment, on the other, unlike those in Kigali, North-Western and Southern, where there were 61%, 53% and 51% respondents, respectively.

The purchased dairy cattle feeds include among others green fodder, crop residues, hay, silage, concentrate supplements, brewers' waste, molasses and others. Whereas, the first category of purchased feeds including green fodder, hay and silage are sourced from neighboring farmers who either have bigger plots of established fodder who own cattle themselves, or crop farmers who establish fodder crops especially elephant grass and Guatemala for sale to livestock keepers. The green fodders are either sold in the field (*in situ)* or as cut and carry.

Hay is sold out as standing hay in reserve grazing areas especially in Eastern milk shed, and some baled hay is sold from Karama RAB station, where RAB is planning to develop forage conservation as both a farmers' demonstration and as a commercial enterprise with investment in specialized machinery such as tractor-hitched mowers, hay rakes and balers. Table 2 shows average quantities of green fodder purchased per household and their values in 2011. The quantities and value of purchased green fodder vary across milk sheds. Households in Kigali which used purchased green fodder purchased significantly larger quantities of green fodder and incurred higher costs than their counterparts in other milk sheds.

Table 2. Quantities and values of green fodder purchased per household by season in 2011

		Eastern	Kigali	North-Western	Southern	Sample size
Wet Season:	N	6	23	21	14	64
Quantity in Kg		247.7	340.7	204.6	233.0	263.8
Value in Rwf		13,350	16,311	6,440	6.414	10,630
Dry Season:	N	16	28	19	15	78
Quantity in Kg		226.6	542.5	193.5	230.1	332.6
Value in Rwf		15,932	35,034	8,545	10,187	19,885

N = Number of respondents

The crop residues purchased are mainly maize and sorghum stovers, rice and wheat straws, bean and other leguminous crop residues and others. Most of the crop residues are purchased from neighbors, big farms owned by cooperatives, especially the rice cooperative farms such as Gikonko, Rwamagana, Cyabayaga and other rice schemes. This is common across the four milk sheds, depending on sites where such cooperatives operate.

Appendix 21 shows quantities and values of crop residues, silage and hay purchased per household during the rainy and dry season in 2011. Irrespective of milk shed the quantities and values of crop residues purchased vary with season. Households purchased significantly higher quantities and incurred higher costs in purchasing these feeds in the dry season than in the rainy season. In terms of the number of household which purchased these feeds, crop residues were purchased by significantly more households than hay and silage. Irrespective of milk shed, the number of households which purchased crop residues in 2011 is insignificant. None of the sampled households in the Eastern and North-West milk sheds purchased hay and silage in 2011.

On the other hand, concentrate feeds and minerals are purchased from established livestock feed manufacturers including SOPAR and livestock feed compounders mainly based at Nyabugogo and other places close to cereal milling plants.

The major problems associated with the concentrate feed supplements are (i) long distances involved (ii) failure to meet compositional standards in terms of recommended rations for different categories of cattle (calves, heifers, milking cattle etc.), as emphasized during discussions with RAB (see Key Informant report) (iii) high prices paid.

Other key dairy cattle feed supplements including molasses and brewers' waste are used especially with farmers in the neighborhood of the processing factories such as farmers of Rubavu and Kicukiro districts close to BRALIRWA, and districts neighboring the only sugar processing factory at Kabuye for the molasses.

There are also cases where traders purchase the products in bulk, especially molasses and sell to smallholder cattle keepers at trading centers scattered within districts such as Kabuga, Kabeza, Kicukiro etc. The mineral and vitamin cattle feed supplements are rarely used for two major reasons (i) they are not readily available, mainly sourced from AgroTech, Kigali, and its 15 branches countrywide (see Key Informant report), and some traders who import from neighboring countries within EAC, especially Uganda and Kenya, (ii) high and unaffordable prices (iii) the problem of lack of compositional standards, i.e. some of these products are mostly not genuine (pirate).

At the level of districts, it has been observed that the district of Gasabo and Kicukiro of Kigali milk shed purchased more feeds at 42% each followed by Nyagatare district (35%) of Eastern milk shed. Also, this could be associated with the need for maximizing milk production aimed at exploiting the milk market at the main milk processing factories of Inyange and Savannah of Kicukiro and Nyagatare districts, respectively.

An important feature mentioned by most of the key informants and farmers alike concerning the use of purchased feeds is that, this depends on the available milk market. With favorable milk prices, the farmers are willing to purchase feed supplements with the purpose of increasing milk yields per individual cow/productivity. It was clearly mentioned by smallholder producers in Nyagatare and Gatsibo districts, that they do not need to purchase feed supplements because the milk prices are low to the extent that they can't break-even.

3.10 Water supply

Availability of clean water is key for the production of quality wholesome milk required for a competitive milk market. The survey assessed the source of water for the smallholder dairy farmers within the four milk sheds.

Table 3 shows that across milk sheds, a majority of the respondents indicated tap water (ex EWSA) (47%) and water from boreholes (45%) as the major sources of water used in the dairying operations. However, water from dams was used within the Eastern milk shed (4% respondents).

Whereas, tap water was used across all milk sheds, it was used by a majority of the farmers (85%) within Kigali milk shed followed by North-Western (44%) and the least

was Eastern milk shed (24%). In the Eastern milk shed, whereas a majority of 59% relied on boreholes, 24% used tap water, and 13% used water drawn from dams. Rainwater was mentioned by an average of less than 1% of the respondents (0.8%).

Table 3. Source of water for dairy operations (%).

Water source	Eastern	Kigali	North-Western	Southern	Average
Borehole	59.40	8.90	50.60	58.00	45.30
Dam	13.50	1.20	0.00	1.10	4.20
Surface water (river, Lake)	2.10	1.80	3.40	2.30	2.40
Tap water/National water supply(EWSA)	24.00	85.70	44.40	38.50	46.90
Rain water	0.50	1.80	1.10	0.00	0.80
Others	0.50	0.60	0.60	0.00	0.40

3.11 Livestock Extension, Veterinary Services, Drugs and Vaccines

3.11.1. Livestock extension

The importance of livestock extension and veterinary services in maintaining healthy dairy herds cannot be overemphasized. Providers of livestock extension and veterinary services in Rwanda can be categorized into government employees, community providers and private providers.

Livestock extension and veterinary services are mostly provided by the government but the role of the private sector in the provision of these services in increasingly becoming important. There are several NGOs in the country that provide livestock extension services including HI, Send a Cow Rwanda, LWF, EPR and IAR.

Livestock extension providers provide advice to farmers on proper animal housing, husbandry and calf rearing including feeding and dehorning, appropriate feed rations for mature cattle especially pregnant cows, record keeping and fodder conservation while veterinary service providers are responsible for various services including disease diagnosis, treatment of animals, disease control, heat detection, artificial insemination, pregnancy diagnosis, sale of veterinary drugs and advice on proper use of vaccines and drugs.

About 75% of the interviewed dairy farmers in the target areas received advice from extension agents. The proportion of those who received extension advice varied from 18.1% in Kigali to 19.6% in the Southern milk shed On average each dairy farmer was visited 2.5 times in 2011 at an average cost of Rwf 6,602.

3.11.2. Veterinary services.

Overall, there are few providers of extension and veterinary services in Rwanda. This has implication on the geographical coverage and frequency of provision of their services.

3.11.3. Veterinary Drugs and vaccines

Apart from variation in advisory services, availability of veterinary vaccines and drugs also varied across the milk sheds. About 61% of the sampled dairy farmers reported to use veterinary vaccines and drugs in 2011 and 62% of those who used them indicated that vaccines and drugs are readily available. However, the availability of these vaccines and drugs vary across milk sheds with North-West milk shed having the highest proportion farmers who reported that vaccines and drugs are readily available (Figure 15).

The availability of veterinary vaccines and drugs depends on their supply in the market. The suppliers of veterinary vaccines and drugs indicated that they are compelled to import some of the vaccines and drugs which are not available locally. Major sources of imported vaccines and drugs reported by the interviewed suppliers are Belgium, Germany, India and The Netherlands. They indicated high prices and taxes as major constraints in the importation of these vaccines and drugs.

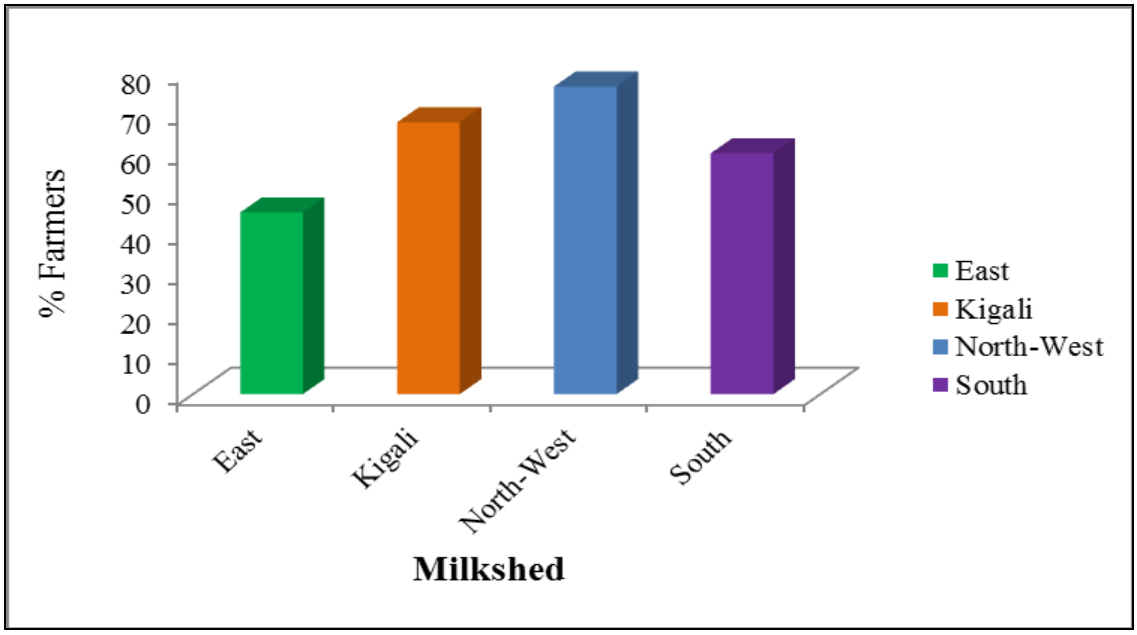

Figure 15.% of Farmers Reporting Ready Availability of Veterinary Drugs and Vaccines

3.11.4. Diseases and Disease Control

According to the findings of the current survey, there is highest diseases prevalence within the Eastern milk shed (24%), Kigali and Southern milk sheds (5.6%) in the second position, whereas, it is lowest within the North –Western milk shed.

Affected animals are treated at 85.3 % on average. The highest level of treatment is observed in the Eastern province (94.8%), whereas the lowest being in the North-Western milk sheds, expressed by 58.6% of the respondents. The most economically important diseases are described below.
The most common diseases are: Tick-born, Foot and mouth disease, Brucellosis, mastitis, and worm infestation.

3.12. Milking Techniques and Milk Hygiene

The survey confirmed that, hand milking is the universal technique that is used across all milk sheds as mentioned by 98.6% of all respondents. The small proportion (1.4%) of the respondents that practice machine milking are mostly in Kigali milk shed, and they are the well-to-do dairy cattle farmers.

These practice highly intensive dairy production system, characterized by having over 50 purebred and high grade milking cows, high milk yield per milking cow, and large volume of milk produced.

Such farms are also characterized by having very well maintained established fodder, practice efficient feeding techniques including use of chopped fodder, use of high quality silages (corn, elephant grass), and high quality concentrate feed supplements.

As far as milk hygiene is concerned, almost all (average 98.5%) respondents across the milk sheds wash hands with detergent prior to milking. The preparation of the cows prior to milking by way of cleaning the udder is variable within and between the four milk sheds, but the most popular practice is the use of luke-warm water (80%).
Whereas, the remaining 20% of the farmers use either milking jelly/salve alone, use a combination of udder cleaning with luke-warm water and milking salve or direct milking. The use of milking salve is commonest in Kigali and North-Western milk sheds, whereas the highest incidences of farmers who carry out direct milking (24%) occur in the Eastern milk shed.

It is important to note that a majority of the smallholder dairy cattle farmers (93%) use plastic-ware for milk handling including milking, transporting and preserving the milk. While, stainless steel and aluminum utensils are used, they are only used by a very small proportion of 4% and 2%, respectively.

As can be seen from Table 4 responsibility to wash the milk utensils varies between milk sheds. Whereas, a majority of respondents mentioned that women (45.5%) are responsible, 25.6% mentioned men, workers and children were mentioned by 23.1% and 5.8%, respectively. A majority of women (73.2%) were mentioned for the Southern milk shed, whereas, a majority of men (51.7%) were mentioned for North-Western milk sheds.

Table 4. Responsibilty for washing milk utensils (%)

Responsible	Eastern	Kigali	North-Western	Southern	Average
Husband	34.70	3.60	51.70	8.30	25.60
Wife	39.90	38.30	32.80	73.20	45.50
Child	4.10	8.40	2.90	8.30	5.80
Worker	21.20	49.70	12.60	10.10	23.10
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

3.13. Milk Quality Testing

Testing the quality of milk is rare across all the milk sheds, despite the fact that there has been deliberate GoR efforts to introduce with USAID financing during execution of RCDP I, implemented by LOL, in establishing the Dairy Quality Analysis Laboratory (DQAL) based at Masaka (Appendix 11).
The survey results showed that on average, only 10.7% of the respondents across the milk sheds tested the milk for quality attributes. The farmers, who carried out milk quality test, used simple lactometer and alcohol tests to assess whether the milk had been adulterated or fermented.

As shown on Figure 16, the majority of respondents (68%) mentioned that their milk was never rejected by traders during the past 12 months, whereas the “frequently rejected” category was 25%, the “rarely rejected” category was only 7%. However, this should be taken with caution, as the rate of rejection is based on the type of trader who purchases the milk, and this in turn depends on the form of end- product desired.

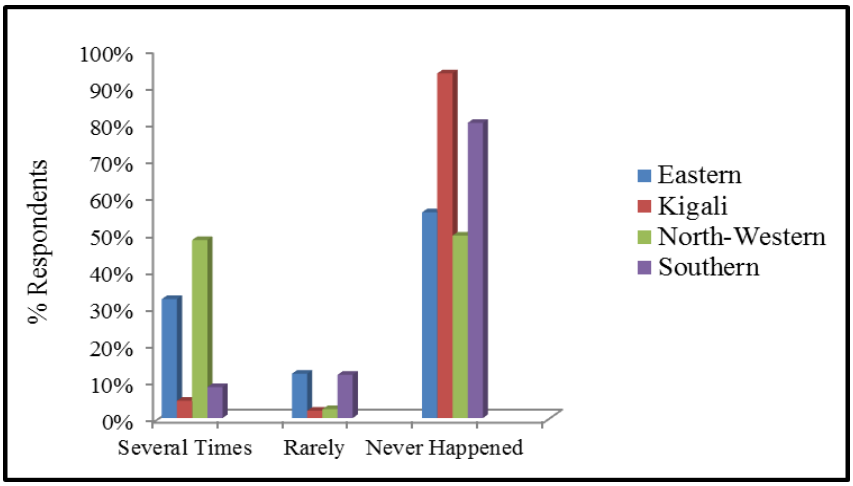

Figure 16. Frequency of milk rejection due to poor quality

It is also worth noting that, about 53% of milk sold was tested at the point of sale, and the highest percentage was for Eastern milk shed at 69%, whereas, the least was for Kigali milk shed (21%) (Figure 17).The major contributing factor is that whereas dairy farmers in Eastern milk shed sell most of their milk to the MCCs, where almost 50% of all MCCs are located, most of the milk originating from Kigali milk shed is sold to local traders/vendors owning coolers and sell unprocessed milk *(amasukano).*

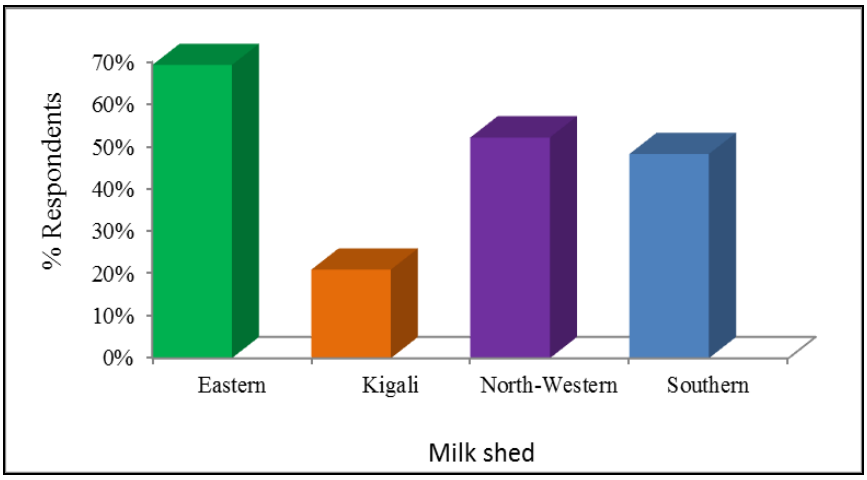

Figure 17-.Frequency of milk testing system at point of sale.

A recent survey of milk quality and composition characteristics carried out by DQAL November, 2012 reported that most milk produced doesn't fit in the category of high quality milk (Grade I). The survey showed that 73% of milk tested in Gatsibo was in Grade I and 53% in Rubavu. All other districts were below 45%. See details on Appendix 11.

As regards the type of tests performed for the milk delivered at MCCs, the key ones are (i) Somatic Cell Count (SCC) (36%), (ii) Antibiotic residues (33%), (iii) Bacteriological quality (27%), and (iv) Composition (21%).

The distance covered from the farm to the milk delivery point was variable between and within milk sheds. 50% of milk delivered was within a distance less than a kilometer from the farms to either MCC, vendor's point of aggregation, milk processing plant (MPP), selling point (cooler)/trader etc. Whereas, 23% of the respondents delivered the milk within a distance between 1 and 5 km, 12% had to cover over 5 km, 16% delivered milk at the farm gate.

It is also worth noting that, whereas, a majority of farmers of 67% in the North-Western milk shed delivered milk to distances not exceeding 1 km, 27% of farmers in the Eastern milk shed delivered milk to distances exceeding 5 km.

52% of the respondents across all milk sheds mentioned that they encountered problems in disposing milk, and 67% of these were from the Eastern milk shed followed by North-Western.
Farmers with less problems were from Southern and Kigali at 23% and 29%, respectively. The problems encountered were variable between and within milk sheds and included lack and/or erratic transport availability (bicycles prohibited to carry milk by traffic police), poor market and low milk prices, delayed post-delivery payment (Inyange/Savannah) and others.

3.14. Milk Collection and Chilling Centers (MCCs)

Large amount of milk in the rural areas is wasted because of the lack of an efficient cost effective milk collection system and poor infrastructure, particularly, the lack of a cold chain, thus low quality of milk reaching the milk processing plants. Traders also adulterate the milk with water and transport milk under unhygienic conditions, driving away many customers, a fact that affects the price of milk leading to great losses to the farmers and poor quality to milk processing plants. Low quality milk is rejected by the milk processing plants or processed into lower quality products like fermented milk but not in UHT and other high quality products.

There are 61 GoR sponsored MCCs in existence with a total cooling capacity of 195,000 liters (Appendix 8). There are another 35 (Appendix 9) budgeted for during 2012-2013 as well as several private sector operations throughout Rwanda. The highest concentration of MCCs is in the Eastern milk shed, especially, in Nyagatare District which also boasts a sizable milk processing plant (MPP). According to the LISP Manager, Dr. Michel Ngarambe, the construction of the new MCCs will be undertaken mainly in the Eastern milk shed (11 planned), and in the North-Western milk shed (9 planned).

Not all MCCs which have been constructed are operational. During the field surveys, an example of Nyanza MPP, which previously bought milk from seven MCCs, it now purchases from only 4 as it was mentioned that the remaining 3 (43%) are currently non-operational. In Nyagatare, out of 17 MCCs only 11 (65%) are currently operating. The reasons given for MCCs closing vary from poor governance, equipment malfunction, or no milk supplies because of competition from traders paying a higher price for milk.

The survey showed that, a total of 40 MCCs (Eastern, 16; North-Western, 14; Southern, 09; and Kigali City, 01) were operating at variable plant utilization capacity levels during 2011, and managed to sell a total of 16,067,126.5 liters (16,067 MT) of at an average of 1,123 liters per MCC per day (Appendix10). The milk reception and sales at the MCC level varied by season (wet vs dry) and by milk shed as presented on Appendix 10. The highest annual milk sales (7,958,766 l) were made in North-Western milk shed, followed by Eastern (5,431,322 l), Southern (2,482,990 l) and the lowest was Kigali milk shed (194,049 l).

The survey revealed that, overall across milk sheds, 48% of all respondents belonged to smallholder dairy farmers/producers' cooperatives, and the highest percentage was in Eastern milk shed (67%), followed by North-Western (58%), then Southern (57%), and Kigali milk shed has the lowest percentage respondents (8%) as cooperative members. This is explained by the fact that, a majority of dairy cattle producers within Kigali milk shed is either medium to large-scale farmers with specialized dairy cattle enterprises, and/or are salaried employees or business persons who perform dairying as a supplementary income activity, and these prefer to work as individual family businesses.

The survey data disaggregated by sex show that a majority of women respondents are cooperative members compared to men, that are 53% and 46% for women and men, respectively (Figure 18).

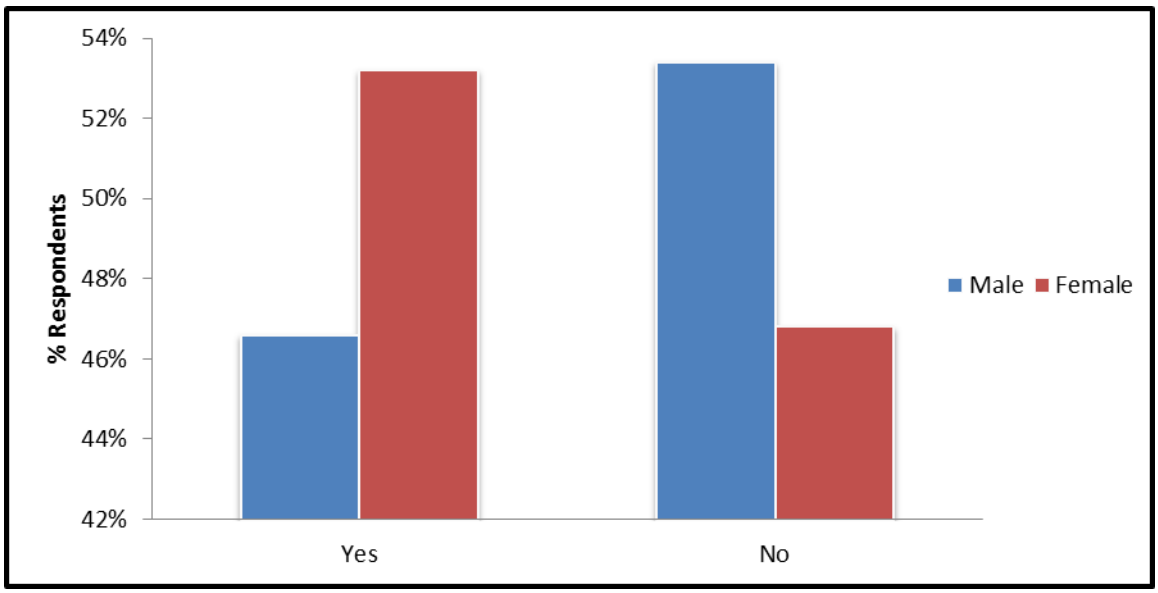

Figure 18. Cooperative membership by sex.

The main advantages of the smallholder dairy cooperatives as mentioned by the respondents include but are not limited to the following (i) general advocacy for cooperative members, (ii) easy and cost-effective delivery of dairy cattle health and production (acquisition of veterinary drugs & vaccines, technical advice on management, AI services etc.), (iii) easy access to credit services through joint collateral, (iv) increased bargaining power such as negotiating milk prices with MCCs and large buyers, and (v) bulk purchases of various inputs.

Recent reports on the smallholder dairy sector indicate a total of 12 registered smallholder dairy cattle cooperative unions (Appendix 11), of which two, IAKI and IABU of Kirehe and Burera districts, respectively, are not part of RDCP II.

There are a total of 81 smallholder dairy cooperatives with a total membership of 13,413, distributed in all districts of the four milk sheds (RCA, 2010; RAB, 2012; Personal communication RNFF Chairman, August, 2012) as presented in Appendix 7 The survey results show that 77% of all smallholder dairy cooperatives are based within the Eastern milk shed, whereas, 19% and 3% are within North-Western and Southern milk sheds, respectively. It follows suite that, the RDCP II project will invest proportionately more within the Eastern milk shed, where there more smallholder dairy cooperatives and higher dairy cattle numbers.

Investment in MCC

Whereas, an overall total of 61 MCCs have been constructed within all the milk sheds (Appendix 8), 35 new MCCs (Appendix 9 of these have been earmarked for reinforcement under the Livestock Modernization Program (LMP) supported by AfDB's Livestock Infrastructure Support Project (LISP), and overall 20 MCCs were covered during the baseline survey across all milk sheds.

All the MCCs were established between 1997 and 2012, with a majority of the old ones established under the support of the African Development Bank (AfDB)-supported "Dairy Cattle Development Project (PADBEL)", whereas, the more recent ones are supported by the GoR financing, the BRD credit together with beneficiary contributions (PADBEL, 2004; SNV, 2008; SNV, 2010; AfDB, 2011).The respondents mentioned that the initial capital investment for the establishment of MCCs originated from grants, mainly PADBEL (47%), beneficiary contribution (26%), BRD (16%) and others (11%) including USAID's Handicap International (Figure 19)

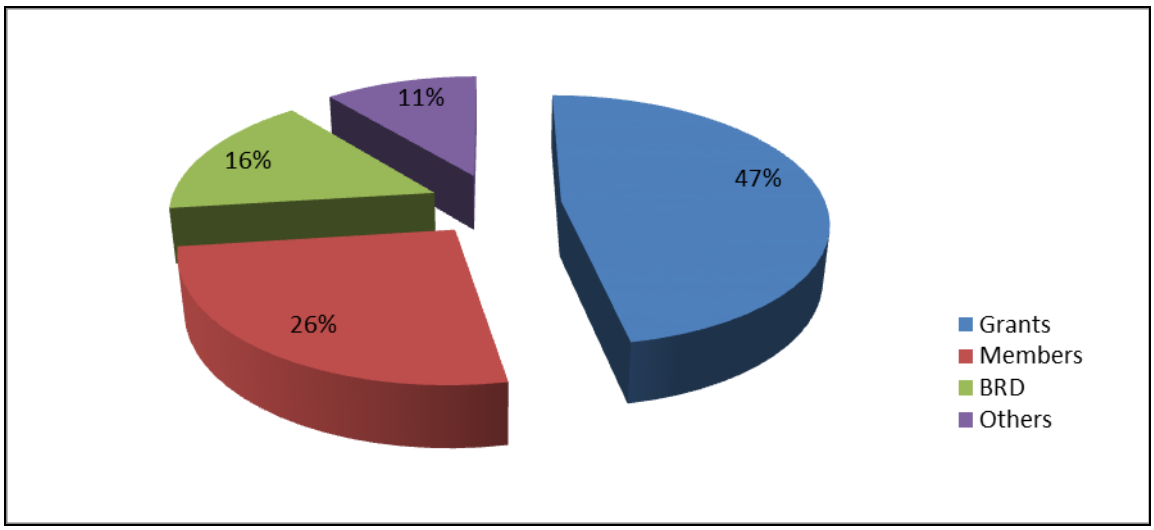

Figure 19 Initial Capital Investment for MCCs

Over 40% of all respondents belong to MCCs across the four milk sheds, with a majority (76%) occurring within the Eastern milk shed, followed by the North-Western (42%) and then Southern (38%) milk sheds. The respondents who belong to MCCs within Kigali milk shed are a bare 8%, and this is explained by the fact that there are only two (2) MCCs (Bumbogo and Rugende), and these are located in the sectors that are in the remote areas of the district of Gasabo, far from the main road to Inyange milk processing plants.

The survey revealed that (Figure 20), a majority of farmers (70%) delivered their milk to MCCs, whereas, only 10% of MCCs collected milk at bulking centers along the main roads e.g. IAKIB milk collection center of Gicumbi district collects milk at various bulking centers along the Rukomo-Gatuna highway, and the remaining 20% mentioned a combination of the two.

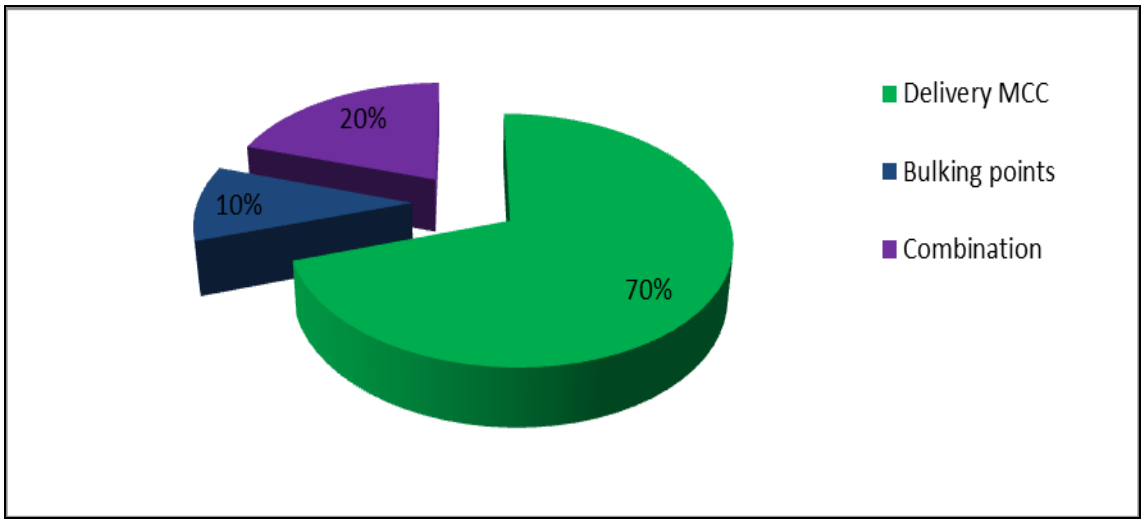

Figure 20: Milk Delivery to MCCs

3.15. Milk Traders

3.15.1. Milk Transporters and Traders

Transporters can be freelance operators that are contracted by MCCs or producers to haul their milk to the MCC. Transporters may also take ownership of the milk and serve as traders. Each business is present throughout Rwanda. Transport costs depend on the volume of milk and distance. Right now, transporters receive some of the highest profit margins in the milk value chain. Many transporters are using bicycles that carry two or three metal cans of 50 liters each.

Transporters lack the knowledge and requisite supplies to keep their cans clean. The use of three wheel motor bikes could improve the cost of transport. One way to lower the cost of milk is through having more milk come through at one time. With more milk bulked in one location, then a milk tanker can be used to reduce transport costs. Transportation of milk can be an independent business different from the cooperative or the processor. As more milk is produced in Rwanda, the number of transporters will increase (Unpublished NDS, 2012).

Table 5. Distribution of traders by milk shed

Milk shed	Assemblers	Wholesalers	Vendors	Total	
Eastern	0	0	6	6	
Kigali	1	1	11	13	
Northern	0	0	12	12	
Southern	0	2	6	8	
Western	1	1	7	9	
Total	2	4	42	48	

3.15.2. Type of traders

Traders of milk can be categorized into assemblers, wholesalers, vendors and retailers. Table 5 shows the distribution of the traders by milk shed. Vendors account for the largest proportion (83.3%) of the traders. Assemblers and wholesalers are very few and are only found in Kigali and the North-Western milk sheds (5.0%), whereas, wholesalers, comprise 8.3% of all traders interviewed. This is not surprising because in most milk sheds raw milk from farmers is sold through MCCs.

The products traded by these traders include raw milk and processed milk products. The traders can be categorized into three groups according to the dairy products they purchase and sell to their customers. The first group comprises of traders who have specialized in selling raw milk. They buy raw milk from dairy producers and sell it as raw milk to their customers. These traders account for 65.5% of the sampled traders.

The second group comprises of traders who sell both raw and processed raw milk. They buy raw milk from dairy producers and sell some of it as raw milk to their customers. The remaining milk is processed and sold to customers. The processing is normally done as a last resort for raw milk which cannot be disposed to avoid wastage.

They simply ferment the milk and sell it as fermented milk. These traders account for 22.5% of the interviewed traders. The third group comprises traders who buy processed milk and sell it to customers. These account for 12% of the sampled traders.

3.15.3. Type of ownership of milk trading business

Two types of ownership of the trading business namely sole proprietorship and cooperative ownership were reported by the sampled traders. Most of the milk trading businesses were solely owned by individuals as reported by 73% of the respondents. Most (58.8%) of the solely owned milk trading businesses were owned by men (Table 6).

Table 6: Sole proprietorship ownership of milk trading businesses by sex

Milk shed	Sex		Total
	Male	Female	
East	4	0	4
Kigali	9	1	10
North	2	2	4
South	4	4	8
West	1	7	8
Total	20	14	34

3.15.4. Age of milk traders.

Table 7 shows the distribution of the sampled traders by age. Most (91%) of the traders were the active age group of 50 years of age and below. The minimum and maximum age of traders was 21 and 58 years respectively. These results are not surprising because the nature of the business especially milk vending business requires energetic young people who can move around.

Table 7. Distribution of sampled traders by age

Age group	Frequency	Percent
Number and proportion of traders falling:		
Below 35 years	27	56.2
35-50 years	13	27.1
Above 50 years	4	8.3
Age in years:		
Average Age	32.68	
Minimum age	18	
Maximum age	58	

3.15.5. Sex of Milk Traders

It is interesting to note the high participation of women in milk and milk products trading. This is revealed in Table 8 that 59.5% of the sampled traders were females.

Table 8. Distribution of sampled traders by sex and milk shed

Sex	Milk shed					
	Eastern	Kigali	Northern	Southern	Western	Total
Male	0	9	4	4	2	19

Female	6	4	7	4	7	28
Total	6	13	11	8	9	47

3.15.6. Education of milk traders

Most of the sampled traders (93.6%) reported to have formal education with 63.6% of them having attained secondary education. Only 4.2% of the traders had no formal education (Table 9).

Table 9. Distribution of sampled traders by education (Number of traders)

Education level	**Milk shed**					
	East	Kigali	North	South	West	Total
Primary	1	2	4	1	3	11
Secondary	4	8	6	5	5	28
College/Tertiary education	0	2	1	2	0	5
No formal education	1	1	0	0	0	2
Total	**6**	**13**	**1**	**8**	**8**	**47**

3.15.7. Procurement of Milk by Traders in 2011

With the exception of vendors who reported to have purchased larger volume of milk during the dry season than wet season. The other traders reported to have purchased significantly more milk during the wet season than during the dry season. Table 10 shows the quantities of milk purchases by traders by season, 2011 (liters of liquid milk equivalent per trader per day). .

Table 10 .Quantities of milk purchased by traders by season in all milk sheds (Liters/trader/day)

Type of trader	**Liters of milk purchased**		**Average of the 2 seasons (L)**
	Wet season	**Dry season**	
Assembler	6200	5945	6,072.5
Wholesaler	80	40	60
Vendor	27804	26765	27284.5
Retailer	120	80	100

The sampled traders reported to have purchased milk from three major sources including farmers, fellow traders and dairy processing plants. Dairy farmers were the major source of milk for the traders who sell raw milk while processing plants were the major source of milk for the traders who specialize in selling processed products such as pasteurized milk, yoghurt and cheese. The distance from the furthest supplier of milk to the business premises of the traders varied widely from less than 1 km to 40 km (Table 11). Traders in Kigali and North-Western milk sheds appear to source milk from longer distances than their counterparts in the other milk sheds.

Table 11. Distance to furthest supplier of milk from traders business premises (km).

Milk shed	Mean	Std. Deviation	Minimum	Maximum
Eastern	4.25	7.18	.01	15.00
Kigali	8.17	15.67	1.00	40.00
North-Western	4.31	3.10	.20	10.00
Southern	11.17	16.34	1.00	30.00
Mean	**6.49**			

3.15.8.Milk Prices

Figure 21 shows average prices of various milk products paid by season. With the exception of cheese, prices of other milk and milk products paid by the sampled traders in 2011 were higher in the dry season than in the wet season.

Data in Figure 22 reveals that price of raw milk varied by both milk shed and season. Irrespective of season, traders in Kigali paid higher prices for raw milk than their counterpart in the other milk shed. Regarding seasonal variation, prices of raw milk were higher in the wet dry season than in the wet season. The relatively high price of raw milk in Kigali is largely due to relatively high urban demand compared with the other milk shed while the high dry season prices irrespective of location are due to decline in the supply of raw milk in the dry season.

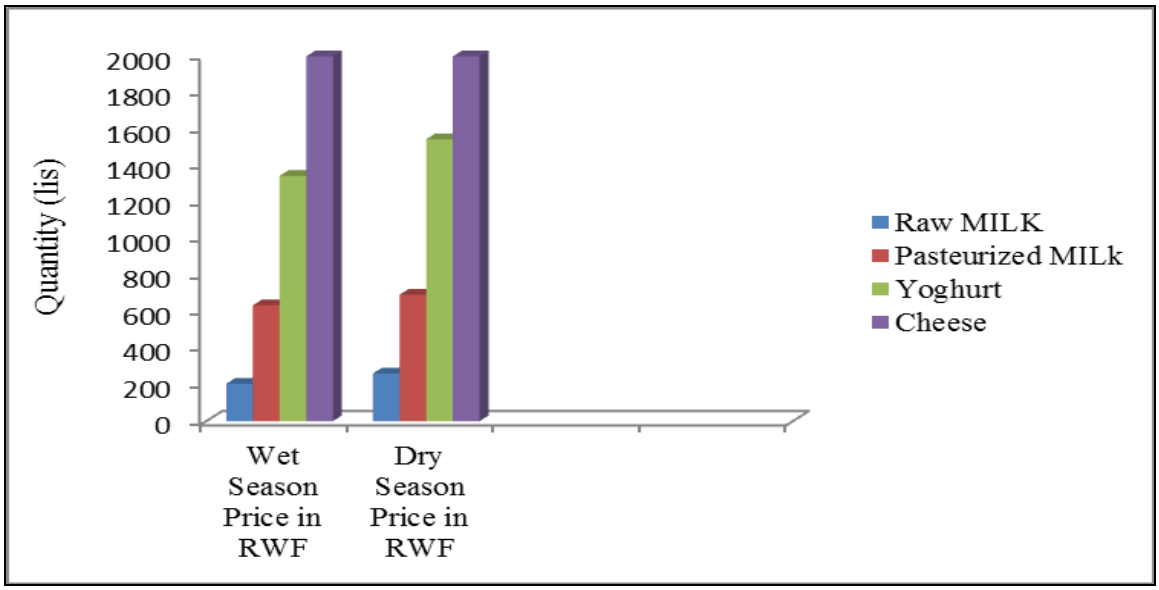

Figure 21. Milk and Milk Product Prices by Season.

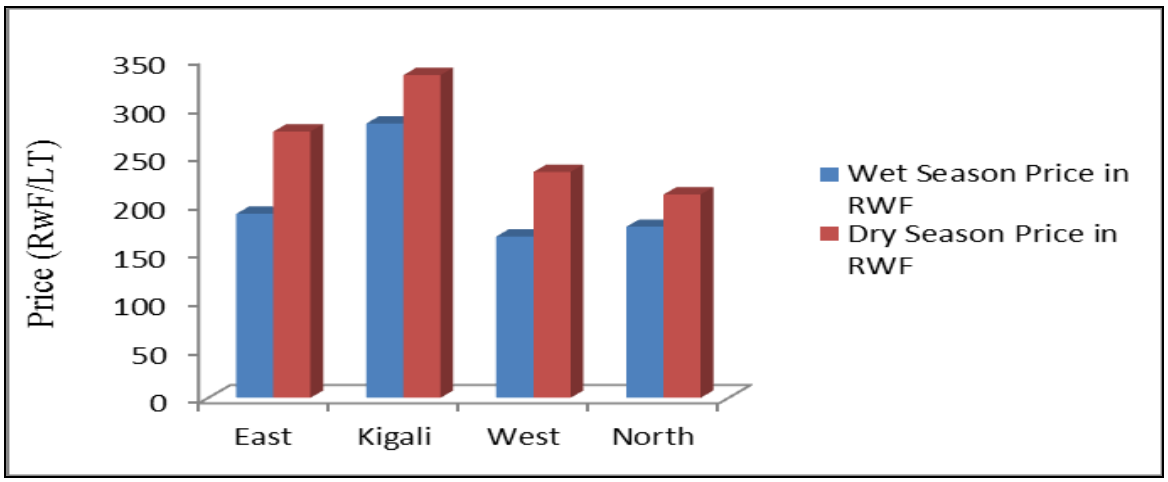

Figure 22. Average Price of Raw Milk by Milk shed.

3.15.9 Contractual Agreements with Suppliers of Milk

When asked if they have been buying milk and/or milk products from the same sources during the past two to five years, most (63%) of the interviewed milk traders responded yes. The remaining 37%, who responded no, indicated that they abandoned sources which were: (i) far away from their business premises (iii) unable to supply enough quantity of milk and (ii) unable to supply quality milk.

Overtime, some informal agreements based on mutual understanding have been established between the traders and their suppliers of milk. About 48% of the interviewed traders indicated to have informal agreements based on mutual understanding with the suppliers of milk.

The informal agreements specified at least one of the following aspects: (i) milk price, (ii) quantity of milk to be supplied, (iii) quality of milk supplied and (iv) frequency of supply as reported by 50%, 10%, 35% and 5% of the milk traders interviewed respectively.

3.15.10 Volume of sales by traders

Products traded by the interviewed traders include raw milk, pasteurized milk, yoghurt and cheese. The products were sold to different customers. Retailers and some vendors sold their products to ultimate consumers. Some vendors reported to sell their raw milk to cooperative societies.

Volumes of milk traded in 2011 varied with season. According to Figure 23 quantities of milk sold per trader varied with the type of trader and season. Assemblers and wholesalers sold significantly larger quantities than vendors and retailers. Irrespective of the type of trader, larger volumes of milk were sold in the wet than in the dry season.

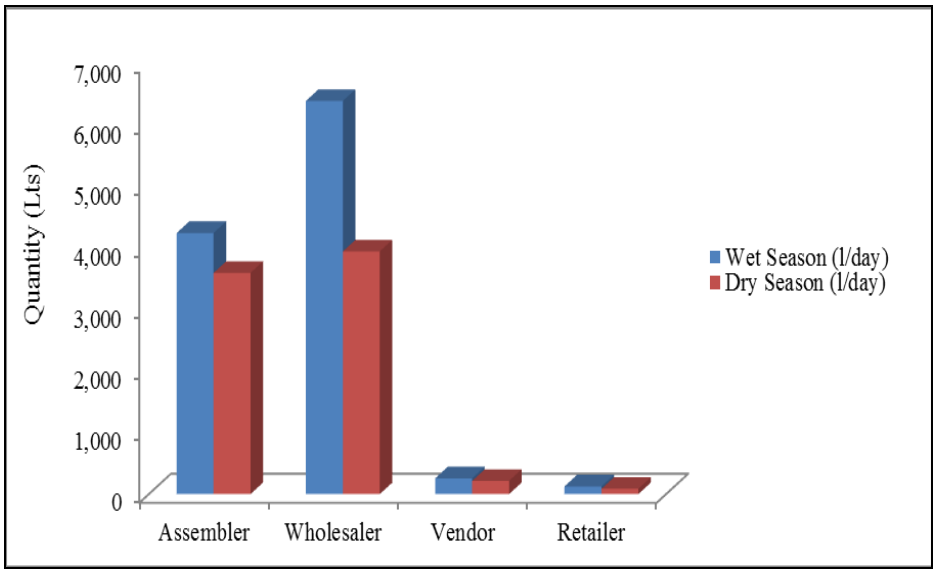

Figure 23 Volume of milk sold by traders by season, 2011

3.15.11 Methods of preserving raw milk by traders

The quality of milk consumed depends on the handling practices at the various stages in the milk value chain from production to consumption. The interviewed traders reported different ways of preserving, handling and controlling the quality of milk purchased from different sources. Table 12 shows the methods used to preserve raw fresh milk.

Table 12. Methods of preserving fresh raw milk by milk shed (%).

Method	Eastern	Kigali	North-Western	Southern
Refrigerating	83.30	100.00	72.15	100.00
Using cold water bath	0.00	0.00	10.8	0.00
Boiling	16.70	0.00	4.55	0.00
Other	0.00	0.00	12.5	0.00
Total	**100.00**	**100.00**	**100.00**	**100.00**

3.15.12. Quality Control and Checks

To ensure purchase of quality of milk from their suppliers, most (90%) of the interviewed traders indicated that they carry out quality checks. The remaining 10% reported that they purchase milk without checking for quality because they trust their suppliers. Quality control checks reported by 41.5%, 2.4%, 14.6% and 31.7% are visual observation, taste, use of lactometer and others respectively. This applied across all milk sheds.

3.15.13. Type of Milk Utensils Used by Traders

Table 30 shows that most of the interviewed traders reported to use plastic containers for handling milk. Other farmers used stainless steel and aluminum containers. Most of the traders who reported use of stainless and aluminum containers are in the Kigali milk shed. The use of plastic containers for handling milk has implications on the quality of milk because they are difficult to clean. The way the utensils are cleaned also has implications on the quality of milk. Most of the respondents use hot water with detergents to clean milk handling utensils (Table 13).

Table 13.Utensils used for fresh raw milk by milk shed (%)

Type of utensil used	Eastern	Kigali	North-Western	South
Plastic	50.00	38.50	69.75	87.5
Stainless steel	16.70	30.80	0.00	12.5

Aluminum	16.70	23.10	0.00	0.00
Other	16.70	7.70	30.55	0.00
Total	**100.00**	**100.00**	**100.00**	**100.00**

Table 14. Methods for cleaning utensils (%)

Cleaning method	Eastern	Kigali	North-Western	Southern
Use cold water and detergent	16.70	30.80	9.50	0.00
Use Warm water and detergent	16.70	30.80	0.00	0.00
Use hot water and detergent	66.70	38.50	61.90	100.00
Other	0.00	0.00	28.60	0.00
Total	**100.00**	**100.00**	**100.00**	**100.00**

3.15.14. Major constraints facing milk traders

The sampled traders report several challenges they face in their milk trading business. Table 15 shows that inadequate demand/market for milk was a major challenge faced by more than 10% of the interviewed traders. The other challenges were faced by less than 10% of the sampled milk traders. About 12% of traders did not face any major challenge in their milk trading business. Most of the traders who did not face any major challenge are in the Northern milk shed.

Table 15. Major challenges/constraints Facing Traders of Milk and Milk products.

Challenge/Constraint	Frequency	Percent
Stiff competition	2	4.9
Inadequate demand/market	8	19.5
High price of raw milk	4	9.8
Poor quality of raw milk	6	14.5
Unreliable	2	4.9
High Taxes	3	7.3
Inadequate capital	2	4.9
All of the above	5	34.2

3.16. Milk Processors

3.16.1. Milk processing and marketing

Most of the milk produced in Rwanda is marketed informally as raw milk. Raw milk is cheaper than processed milk and preferred by consumers as it is considered fresh with no additives. High prices for processed milk drive consumers to the informal markets where prices for whole raw milk are lower and the raw milk readily available.

The low demand for processed milk and milk products is one of the constraints facing milk processing in Rwanda. Only about 2.6% of the milk produced in Rwanda is processed. Milk processing is carried out by only 5 milk processing plants (MPPs) and 15 cheese producing SMEs (Appendix 12**)** as a number of milk processing plants are closed.

All milk processing plants are operating far below their optimal processing capacity, and they produce limited number of products, mainly pasteurized milk, fermented milk, UHT milk and yoghurt. The actual utilized capacity for all milk processing units is estimated at 32,000 liters per day which is equal to 15% - 20% of the total installed processing capacity of 160,000 liters per day, resulting in higher processing costs.

Virtually all the milk processed by the MPPs originates from MCCs mainly in the Eastern province. There are two main processing factories, Inyange and Savanna (owned by Inyange and under expansion to 40,000 liters capacity).
Except for the two MPPs, there is little quality control measures done by the rest of the MPPs. A number of the MPP equipment is old (e.g. the Nyanza plant which was constructed in the 1950s).

All sampled processors test milk for quality before buying it. The measures indicated by the processors include training farmers on proper milk handling and demonstrating on how to check for freshness of milk.
62.5% of the processors indicated that they rarely (less than three times per week) receive adulterated milk and 12.5% indicated that they often (more than three times per week) receive adulterated milk from their suppliers.

Apart from checking for adulteration, processors carry out tests on bacteriological quality, antibiotic residues, somatic cell counts and milk compositional quality. Table 16 reveals that bacterial quality and antibiotic residues tests are common tests carried out by the milk processing enterprises, particularly, the large milk processing plants. Only one of the processing plants (Inyange Industries) indicated to have facilities for the above mentioned tests. The remaining processing plants reported that they use laboratory facilities at Dairy Quality Assurance Laboratory (DQAL) based in Masaka and NUR Laboratory.

Table 16. Quality control tests carried out by processors.		
Quality control test	**Frequency**	**Percent**
Bacteriological quality	**5**	**65.2**
Somatic cell count	**2**	**25.0**
Compositional quality	**3**	**37.5**

In addition to the above tests, all processors reported that they grade milk received from their suppliers. However, none of the processors that grade milk pay high price for high grade milk.

The quality of milk reaching MPPs is generally low and has a high influence on the type of product that goes to the market. The average total bacterial count (TBC) for milk leaving the MCCs are between 500,000 and 1,430,000 per ml (DQAL, 2012-Unpublished) and reaches the processing plants (MPP) with a TBC 800,000 to 1,300,000 per ml. To qualify for Grade I, milk needs to be < 200,000 of TBC.
Most of the processors, with the exception of Inyange Industries, do not meet the RBS/EAC/COMESA harmonized standards and don't have quality certification from RBS.

The interviewed processors indicated that they take several measures to ensure that they produce high quality milk products. As mentioned earlier only Inyange Industries observe good manufacturing practices (GMP) including good hygienic practices, training workers on proper handling of milk and milk products, employ qualified staff, use certified materials for processing e.g. additives, train farmers on proper handling of milk and ensure purchase of quality milk through quality checks.

In terms of product certification, only Inyange Industries had quality certified products. Products which have quality specifications were reported to be yoghurt, cream and cheese (refer to Appendix 13).

Tables 17 & 18 below show milk products RBS specifications and standards for milk products.

Table 17. RBS Specification for milk products	
Standards Title/Product reference	**Ref. Number**
Pasteurized milk specifications	RS 42:2004
Unprocessed whole milk specifications	RS 41:2004
Butter specifications	RS 62:2004
Fermented/cultured milk specifications	RS 43:2004
Milk based infant food specifications	RS 167:2007

Table 18: RBS/EAC/COMESA Milk Standards	
Grade	Bacteria Count CFU/ml
I	<200,000
II	200,000 -1,000,000
III	1,000,000,000-2,000,000,000
	>2,000,000,000

Source: RBS, 2012 (RS 41:2012 Second edition).

Milk processing in Rwanda can be divided into informal and formal processing. Informal processing takes place at household and village levels involving unregistered small processing units. Informal milk processing is dominant in areas where road transport and delivery of raw milk to processing plants and/or consumers is difficult. Fermenting milk and cheese making are common products processed by farmers who cannot easily deliver raw milk to consumers and processing plants. Cheese making by cooperative societies is popular in Gishwati area where access to market for raw milk is difficult.

Formal processing involves small scale, medium and large scale processing units which process raw milk into pasteurized milk, yoghurt and cheese. There are five milk processing plants in Rwanda namely, Nyabisindu with a capacity of 15,000 l/day; Inyange (100,000 l/day) and Inyange Nyagatare (Savannah) (35,000 l/day In addition to these processing plants there are groups of farmers involved in cheese production.

3.16.2. Type of Ownership of the Milk Processing Enterprises

Both categories of processing enterprises were visited during the field survey. Different types of ownership of the processing enterprises were reported by the respondents. The cheese making enterprises are mostly owned by smallholder farmers as cooperative businesses while the processing plants were either under sole proprietorship or joint venture. Dairy farmers have obtained shares in some of the jointly owned milk processing plants.

3.16.3. Contractual Agreements with Milk Suppliers

Most (87.5%) of the processors interviewed have established agreements with their suppliers of milk. Most (71.4%) of the processors who have established agreements have entered into informal agreements based on mutual understanding between the supplier and the buyer.

The remaining 28.6% have entered into formal written agreements with legal implications. The agreements specified at least one of the following aspects: (i) milk price, (ii) quality of milk supplied and (iii) frequency of supply. This suggests that quality of raw milk is an important attribute considered by most of processors.

3.16.4. Processors Plant Capacity and Utilization.

Most (71.4%) of the interviewed processors indicated that they usually operate below capacity. Only 28.6% are able to utilize their installed capacity especially the processing enterprises with small installed capacity. Of the plants which operate below their capacity, 60% of them operate below capacity throughout the year while the remaining 40% operate below capacity during the dry season when there is scarcity of raw milk.
The major reason for under capacity utilization is inadequate supply of raw milk which becomes serious during the dry season.

Figure 24 shows the installed capacity of the sampled processing enterprise and the quantity of milk collected by each enterprise during the wet and dry. The figures clearly reveals that the processing enterprises operate below their capacity throughout the year but more so during the dry season.

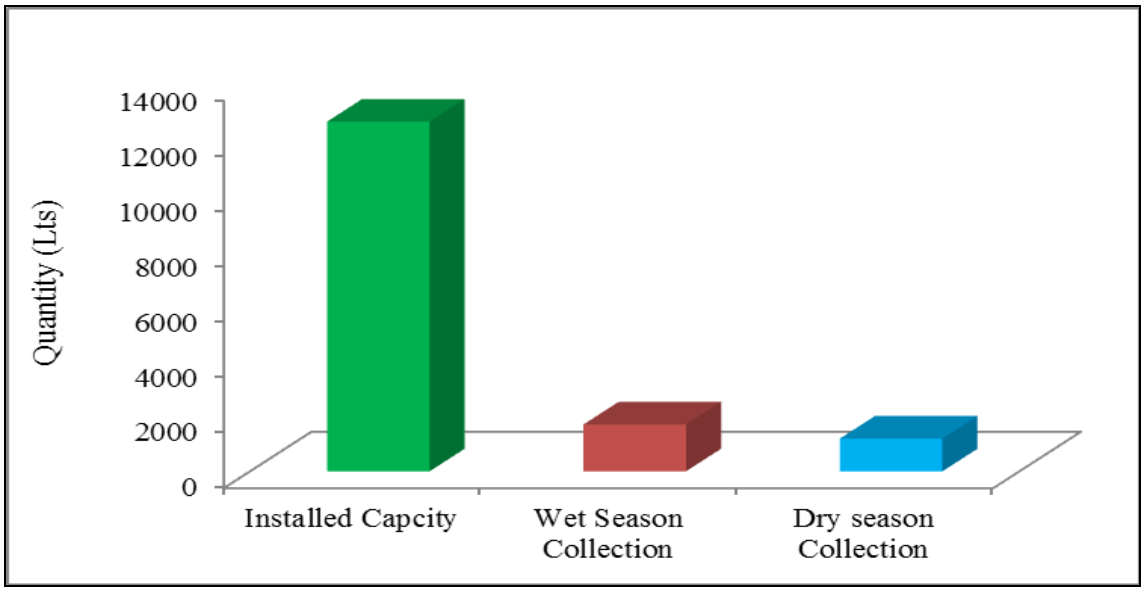

Figure 24: Average installed capacity of Milk Processing Enterprise and Milk per day by Season in 2012.

3.16.5. Milk Products Manufactured by Processors

Processing enterprises produce and sell a wide range of products to different types of customers. The products produced include pasteurized milk, UHT milk, yoghurt, cheese and fresh cream (Appendix 13). When asked if they have plans to expand the product range, most (87.%) of the processing enterprises indicated that they would like to include ice cream, cheddar cheese and biscuits as the new products. However, production of these new products will depend on acquisition of appropriate equipment and the market demand.

These products are sold to different customers including individual household consumers, traders, supermarkets, hotels and schools. When asked to indicate the category of customers they consider to be the most important, most (50%) of processing enterprises

indicated supermarkets to be the most important category of customers for processed product while 37.5% indicated that all categories of customers were important (Figure 25.

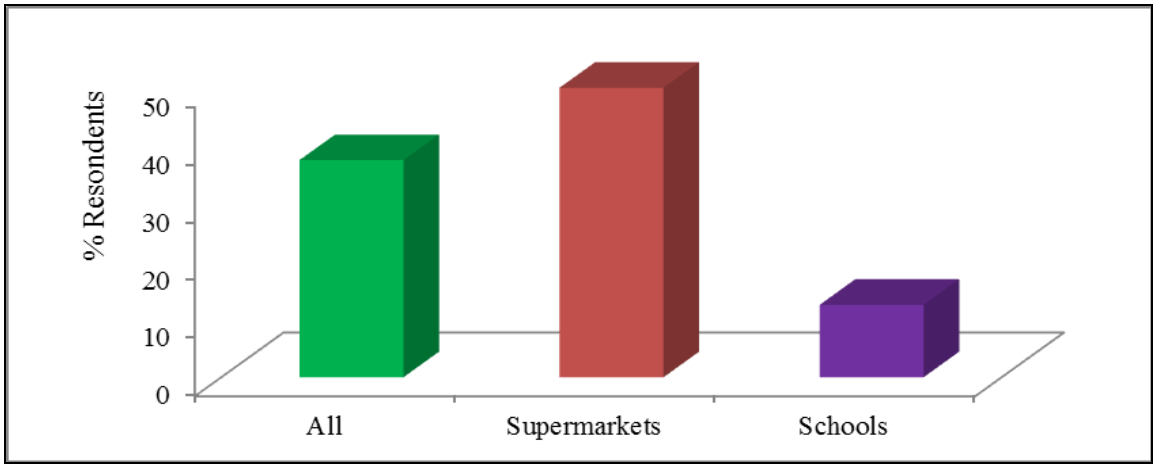

Figure. 25. Importance of Customers of Processed Milk Products

3.16.6. Demand/Market for Processed Products

When asked if there is adequate demand for all the processed products produced, 57% of the sampled processing plants indicated that they have adequate demand for their products. The processing enterprises with inadequate demand for their products are in the Eastern and Northern milk sheds and none in Kigali, Southern and Western milk sheds. Products that were reported to have inadequate demand are cheese and pasteurized milk.

3.16.7. Major Challenges/Constraints Faced by Milk Processing Plants

Figure 26 shows the major challenges that face the sampled processing enterprise in their business. The figure reveals that competition is the major challenge facing most of the milk processing enterprises. Other challenges faced by processors include but are not limited to packaging materials, access to finance to invest into processing equipment and milk marketing facilities and operating capital.

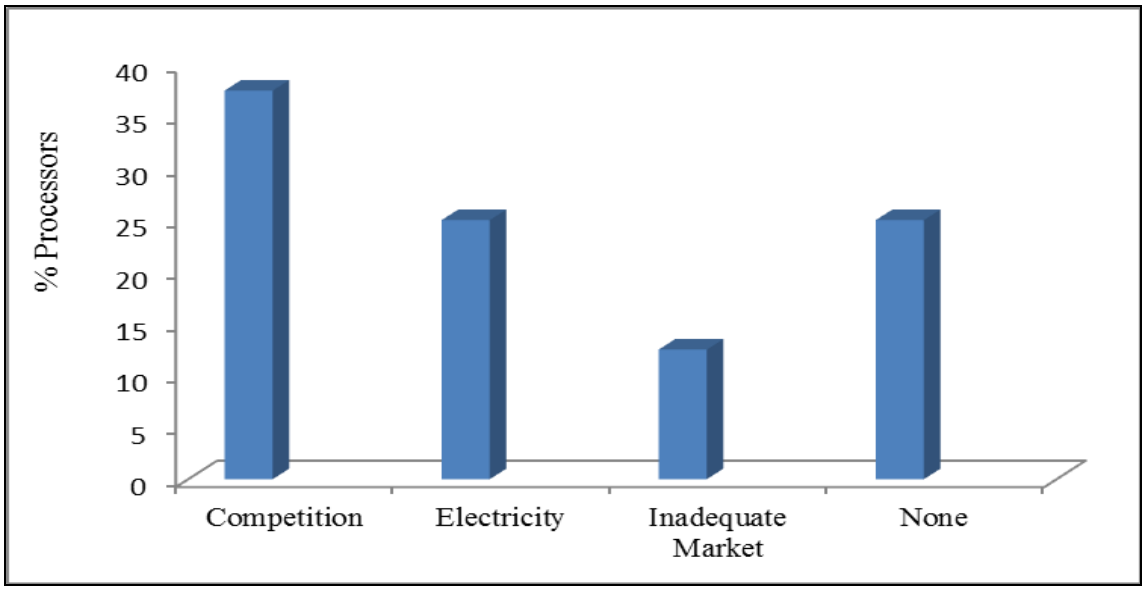

Figure 26. Major Challenges Facing Milk Processing Enterprises.

3.16.8. Environmental Compliance

Sampled processors were asked to indicate if their infrastructures were equipped with noise pollution control, air pollution control and waste storage/treatment facilities. About 12.5, 25%, and 87.5% of the interviewed processors reported to have facilities for noise pollution control, air pollution control and waste storage/treatment, respectively (Figure 27). It is revealed from the Figure below that there is more compliance to waste storage/treatment among milk processors than compliance to noise and air pollution control. This is probably due to the high cost of facilities for noise pollution and air pollution control.

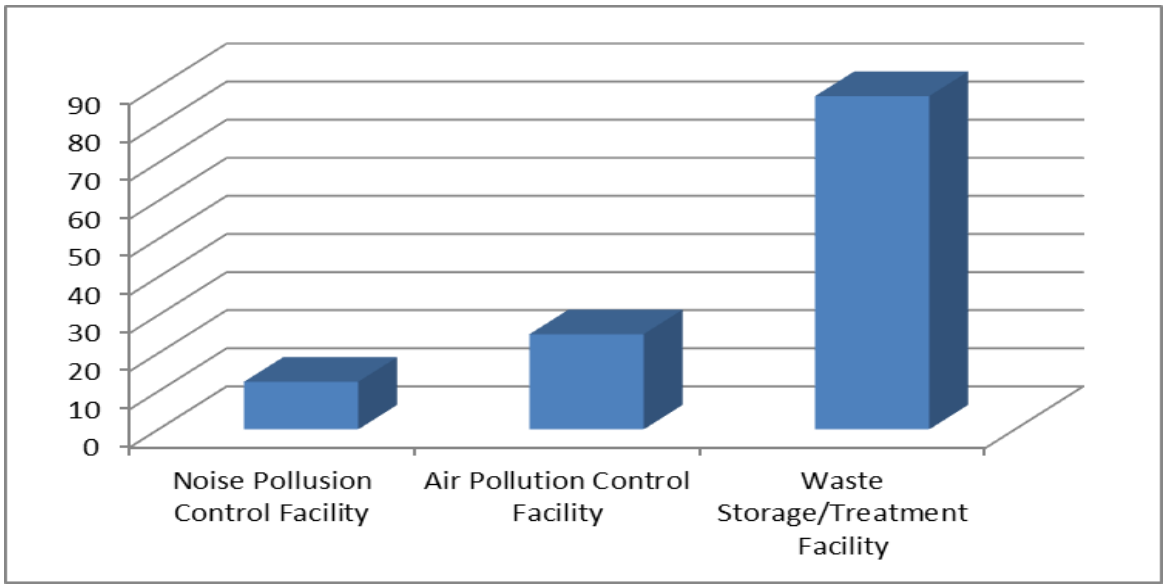

Figure 27.Processors with installed noise pollution control and waste storage/treatment facilities

3.17. Dairy Products Demand and Supply-Gap in Rwanda

Unpublished data from the Rwanda Agriculture Board (RAB) for all livestock products show that milk production increased from 152,511 to 404,704 MT from 2006 to 2010/2011. This growth is estimated to reach 445,035,740 liters in 2012 (Unpublished Dairy Master Plan, 2012) or 42 liters of milk per person per year. This amount is far below the FAO and WHO recommended minimum per capita requirement for milk consumption of 200 liters of milk/person/year.

Given the population of Rwanda of 10,500,000 as of 30th November, 2012 with 2.3% annual growth rate and the current per capita milk consumption of 42 liters of milk per person per year, potential demand will increase from 474.8 million liters in 2012 to 518.6 million liters in 2015 (Unpublished Dairy Master Plan, 2012).

However, the Consumer Survey by EADD (2012), combined with production data from the Rwanda Dairy Master Plan, identifies a supply-demand gap. Milk production already exceeds demand due to low per capita milk consumption. According to the EADD report cited above, there was an over-supply of 52M liters in 2011/2012, which is projected to reach 375 M liters by 2020 if no efforts are made to address the lack of milk market issues, an over-supply of approximately 375M liters of milk is anticipated. The oversupply is caused by lack of a dairy milk and milk marketing strategy, low incomes of the majority of Rwandese.

The excess supply can be exported to niche markets in neighbouring countries in the EAC and COMESA region. According to the unpublished draft NDS's report projection suggests that more dairy products will be required to meet rising demand in the region (MINAGRI and MINICOM, 2012).This provides an opportunity for exporting dairy products from Rwanda, especially to niche markets in neighboring countries such as Democratic Republic of Congo (DRC), Burundi and Tanzania, where dairying is not well developed**.**

3.18. Research and Training

Research and training services in dairy related aspects are provided by government organizations and NGOs in partnership with the government. The NGOs offer these services in partnership with MINAGRI. Table 19 summarizes institutions which are involved in research and provision of training to farmers and farm level service providers.

Table 19. Institutions providing research and training services

Organization	Type of Service
ISAR	Breeding, pasture improvement, nutrition research
ISEA	Training and research on various dairy aspects
GAHINI DIOCESE	Training of inseminators
ADRI	Training inseminators
Technoserve	Training on various aspects of dairy

3.19. Capacity Building Needs

The lack of capacity in terms of financial and human (skills) resources have been expressed during the baseline survey. This was observed across all milk sheds and along the different nodes of the milk value chain from milk production, marketing through to processing capacity constraints can be broadly categorized into the following (i) Inadequate knowledge and skills in basic dairy cattle development issues; (ii) Lack of access to appropriate financing products (dairy development credits); (iii) Lack of access to basic dairy inputs including concentrate feed supplements; and (iv) Lack of feeder roads, hence poor access to consumption centers including MCCs, markets, milk processing plants (MPPs).

Capacity building through research and training services in dairy related aspects are provided by the Rwanda Agriculture Board (RAB) and Non-Governmental Organizations (NGOs) in partnership with the GoR through the Ministry of Agriculture and Animal Resources (MINAGRI), and community-based organizations (CBOs). Table 20 summarizes institutions which are involved in research and provision of training to farmers and farm level service providers.

Table 20. Institutions Involved in Farmer Training

Organization	Type of service provided in training		
	Dairy breeding	Feeding	Cattle disease control
RAB	√	√	√
HI	√	√	√
SACR	√	√	√
Technoserve	√	√	√
SNV	√	√	√
ISAE	√	√	√
Umutara Polytechnic	√	√	√
UNR	√	√	√
Gahini Diocese	√		
ADRI	√		

The training requirements of smallholder farmers and other dairy development agents such as extension staff, staff from local NGOs, CBOs and FBOs are going to be

addressed through carrying out continuous training of trainers as lead farmers (LFs) on the described main areas of the value chain.

The smallholder dairy farmers expressed greatest needs in terms of increased knowledge and skills on (i) Feeds and feeding, (ii) Breeding management, (iii) Milking and milk hygiene, (iv) Milk marketing, (v) Milk processing, and (vi) Milk as a business, including Business plan preparation, financial management, and cooperative administration.

3.20. Employment in the Dairy Sub-sector

3.20.1.Farm level

Dairy farming has the potential of generating self and wage employment. Self-employment is created through employment of family labour while wage employment is created through hiring permanent and temporary labour to supplement family labour. The results of the baseline survey indicate that 73.3% of the sampled dairy farming households hired labour to supplement family labour. The remaining 26.7% employed only family labour to undertake dairy production activities. The proportion of sampled household which hired labour in 2011 varied from 54.7% in the southern milk shed to 83.7% in the Kigali milk shed (Figure 28). Kigali and Eastern milk sheds have relatively more dairy farming households employing wage labour than their counterparts in the northwest and southern milk sheds.

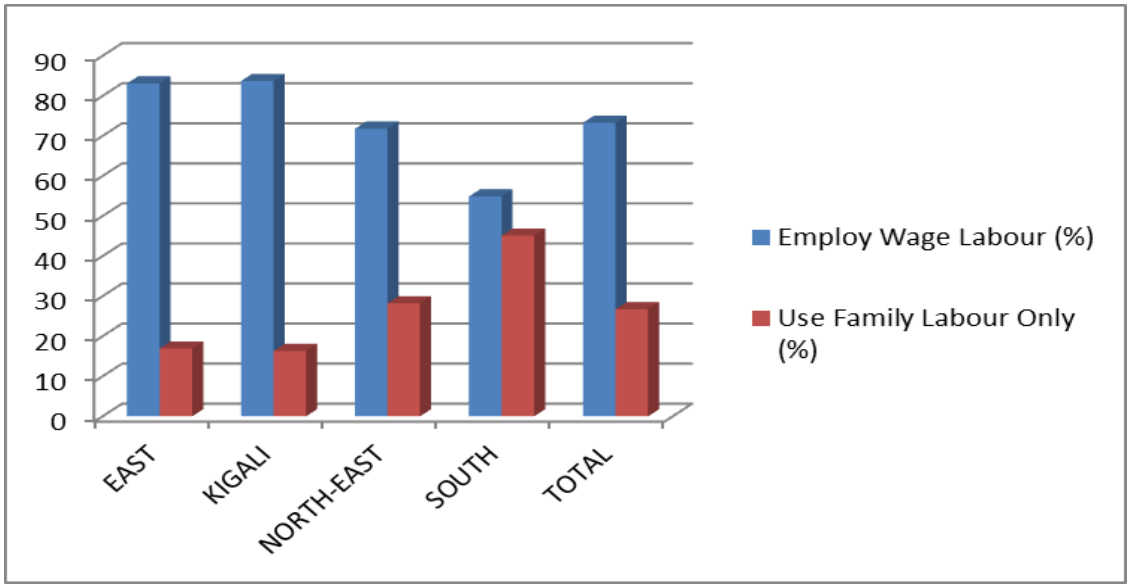

Figure 28. Proportion of Dairy Farmers Employing Wage Labour by Milk Shed

On average, dairy farming households that employed wage labour employed about 2 persons per household. On average, the number of wage employees per household varies by milk shed with dairy households in Kigali employing relatively more people than their counterparts in the other milk sheds. The maximum number of wage employees per household varies from 9 people in the north-West milk shed to 12 people in Kigali. The minimum and average number of salaried workers in all milk sheds is as shown in Table 21.

Gender differences were observed in wage employment across milk sheds. Except for Kigali City, where female employees account male workers account for a larger proportion of wage employment in all milk sheds.

In Kigali, female wage workers account for 58% of the work force. Female workers in Eastern, North/ Western and Southern milk shed female employees account for 10%, 25% and 53% of the wage employees respectively.

Table 21. Distribution of wage employees per household by milk shed

Milk shed	Number of wage employees		
	Average	Minimum	Maximum
Eastern	1.0	1.0	10.0
Kigali	4.0	1.0	12.0
North-Western	1.0	1.0	9.0
Southern	2.0	1.0	10.0
Total	2.0	1.0	15.0

The same data source shows that 49% and 44.8% of the sampled smallholder farmers and farm laborers respectively in Rwanda spend 6 hours searching for fodder to feed their animals. On the other hand labor for this activity on independent farms is 33.3% for 4 hours.

There are over 100,000 dairy farm households in Rwanda, and much of the labor input on these farms is family based self-employment. In addition, it has been estimated that dairy farming generates about 50 full-time wage-labour opportunities per 1,000 liters of milk produced on a daily basis (SNV, 2008).

Dairying also generates many indirect jobs in the supply of secondary inputs and services to farmers, although such employment has not yet been quantified. Given the very large share of dairy farming in the agricultural GDP and the rapid growth rate of the sector, through *"one cow per poor family"* households and other breeding and animal importation initiatives, it is reasonable to conclude that investment in dairying creates significant job opportunities in Rwanda.

Many people are employed in a wide range of enterprises involved in moving milk from the farm to the consumer, including retail outlets (such as milk kiosks) and mobile milk traders in the informal sector, and milk processors and distributors in the formal sector.
These traders and enterprises generate indirect employment by buying services and products, such as bicycle or milk equipment repair, and milk packaging material.

3.20.2. MCC level

At MCC Level Milk collection centers were found to employ more people than the individual traders. On average MCCs have 5 permanent employee per milk collection

center and about 6 temporary employees per milk collection center (Table 22). For both types of employment (permanent and temporary), the number of male employees is significantly higher than the number of female employees.

Table 22. Number of employees in MCCs by type and sex of employee

Milk shed	Permanent employees			Temporary employees		
	Male	Female	Total	Male	Female	Total
Eastern	3.0	2.0	5.0	1.0	1.0	2.0
Northern	2.0	2.0	4.0	0.0	0.0	0.0
Southern	4.0	2.0	6.0	6.0	20	8.0
Western	5.0	1.0	6.0	7.0	0.0	7.0
Average	3.0	2.0	5.0	5.0	1.0	6.0

3.20.3. Traders level

The milk and milk products trading business has the potential of creating employment in Rwanda especially among the youth. Apart from self-employment among the traders, the sampled traders reported to have employed other people to assist in their business.

Table 23 shows the average number of permanent and temporary employees by type of traders and sex. On average, assemblers and retailers seem to employ more people than their counterparts. There is no gender bias in employing people in the milk and milk products trading in the study areas.

Table 23. Number of employees by type of milk trading business and sex of employee

Type of trading business	Permanent employees		Temporary employees	
	Male	Female	Male	Female
Assembling	3	1	1	1
Wholesale	1	1		0
Vending	21	19	14	6
Retailing	1	1	1	1

3.20.4. Processors level

With regards to processors, Table 24 shows the number of employees per processing enterprise by gender and nature of employments. The table shows that there is gender bias in employment in the processing enterprises.

Table 24: Distribution of number of employees milk processing plants by type of employment.

Employee	Minimum	Maximum	Mean
Male	1	15	7
Female	1	10	3
Temporary male	1	11	3
Temporary female	0	2	1

3.20.5. Socio-economic issues in the dairy sub-sector in Rwanda

Up to 90% of Rwanda's population live in rural areas and is dependent on subsistence agriculture for its livelihood. Population growth and internal displacement have led to deforestation and soil erosion and decreasing agricultural productivity. As a consequence, food insecurity continues to be very high affecting at least 28% of households. The value chain starts with a farmer all the way to the retailer and final consumer. The dairy industry is a significant source of employment in Rwanda. Tens of thousands of Rwandans earn their living through dairying and related activities.

Recurrent droughts and volatile climatic conditions in recent years indicate that climate change could further increase the pressure on agriculture. Furthermore, the current economic growth has come almost exclusively from the manufacturing and service sectors, thus yielding few benefits for the rural poor (UNDAF, 2008-2012). According to the NISR (2012), the poorest people in the country's workforce are paid farm workers – and this is a category of worker that has grown by almost 361,000 since 2000/01 and is still growing.

Table 25 summarizes the current data on poverty in Rwanda (NISR, 2012). Workers whose main occupation is to work on a farm are much more likely to be poor than those working off-farm. Poverty is 62% for those working for a wage on a farm, and 46% for those working on their own farm, compared to just 22% working for a wage in another sector or 23% running their own business. The poorest people in the workforce are paid farm workers. This category of workers has grown by almost 361,000 since 2000/01 and is still growing.

The extremely poor, most of whom are in the rural areas are 21.1%, the poor 19.8% and the not poor 59.1%. The combined total for poor people is 40.9% which is high (NISR, 2012).

Table 25. Poverty status by main job (EICV3)

EICV3	Poverty level			Total	Total Number of persons ('000s)*
All Rwanda	**Extremely poor**	**Poor**	**Non-poor**		
Wage farm	21.1	19.8	59.1	100.0	4,960
Wage non-farm	38.1	23.7	38.2	100.0	490
Independent farmer	11.4	10.9	77.8	100.0	838
Independent non-farm	22.9	22.9	54.3	100.0	3,063
Unpaid non-farm, other and n.i	10.4	13.3	76.3	100.0	479

The household survey revealed (figure 29) that 83% of the respondents are in the "poor" and "relatively poor " categories, while 8% are in the very poor and poorest categories. Rich categories also account for 8% of the respondents. For specification and proper definition of each category refer to Appendix 23.

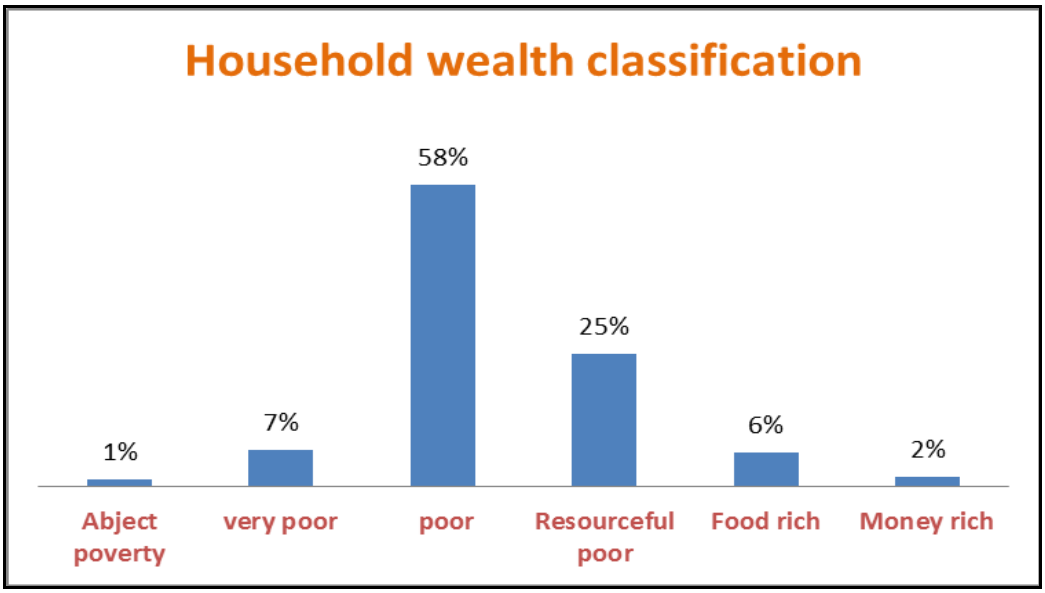

Figure 29. Proportion of Dairy Farmers Employing Wage Labour by Milk Shed

3.21. Policy and Regulatory Environment

Dairy sector policy in Rwanda is not yet in place. Thus, the dairy sector is currently governed by the laws and regulations that govern the agricultural sector as a whole. Investments in the dairy sector are handled like other investments in the agricultural sector. The Law on Investment Export Promotion which came into force in 2006 is intended to assist investors in obtaining the necessary licenses and providing other assistance and incentives to investors.

In general, the current policy and legal framework is intended to spur economic growth as outlined in the Vision 2020 document. All sectors in the economy including dairy are open to foreign investment which is regulated by different laws. The main laws governing investment in the dairy and other sectors of the economy in Rwanda are:

- The Law Governing Commercial Establishments
- The Investment Law
- The Law on Privatization and public Investment
- The Land Law, and
- The Law on Protection and Conservation of the Environment

The existing framework provides guarantees against the expropriation of private property except in public interest and with fair and prior compensation. It also guarantees the repatriation of capital and after tax profit.

All registered investors qualify for tax incentives in the form of profit tax discount ranging from 2% to 7% if the investor employs 100 to more than 900 Rwandans, respectively, for a period of at least six months during the tax period. In addition, the tax payer get tax incentives based of the value of commodities exported. For example, if the tax payer exports commodities or services that earn the country more than five million USD in a tax period, he/she is entitled to a tax discount of 5%.

Apart from the above tax incentives which cut across all investments, investments and inputs for the development of the dairy sector are charged zero import tariff. Also all finished dairy products from EAC/COMESA countries are charged 5% while finished dairy products from non-EAC/COMESA countries are charged 30% tariff.

Gaps in policies Governing the Dairy industry

Even if the existing policies and strategies have improved many things in dairy sub-sector, it is however important to mention that there are some gaps which still need particular attention from the Government of Rwanda and its stakeholders.

Low use of inputs

Although, the Government has significantly improved the use of agricultural inputs, a big gap is that feeds and other key inputs remain too costly or difficult to access by many dairy farmers. The analysis points out a number of gaps linked to low use of livestock inputs by dairy farmers compared to crop farmers who are given subsidized inputs like seeds and fertilizer.

4.0. CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

The current levels of production milk and milk products are constrained by a multitude of factors, mainly the lack of quality fodder coupled with non-use of concentrate supplements and poor genetic potential of the indigenous cattle. The inefficiencies in the milk and milk products marketing system is another key factor that limit the development of the dairy value chain. The inadequacy and inefficient operation of the MCCs as well as the MPPs need to be addressed if the desired goal of RCDP II is to be achieved.

Therefore, there is large potential for expanding milk production and trade in milk and milk products as long as the constraints identified by stakeholders are addressed. Imbalance in investment is evident in the dairy value chain's heavy investments in processing, but poor investments in production, germ-plasm maintenance, breeding, bulking and associated institutional arrangements which critically undermine performance of the entire dairy value chain resulting in underutilization of installed processing plant capacity.

4.2 Recommendations

- **Need for capacity building.** The smallholder dairy farmers expressed greatest needs in terms of increased knowledge and skills on (i) Feeds & feeding, (ii) Breeding management, (iii) Milking &milk hygiene, (iv) Milk marketing, (v) Milk processing, and (vi) Milk as a business, including Business Plan preparation, financial management, and cooperative administration.

- **Need for support to key stakeholders** such as public institutions, NGOs and private sector. In order that RDCP II is able to achieve the set indicators, it has to address all the identified constraints, through financial support technical backstopping provided to the main stakeholders, both GoR institutions such as RAB, RBS and others, and NGOs as well as private sector service providers. Besides the RDCP II direct support, it is going to get leverage through the GoR and other DPs engaged in dairy development and other related rural development and programs.

- **Need to strengthen smallholder dairy cooperatives and related CBOs.** Technical and social economic interventions will succeed more through collective actions of farmers through strong smallholder farmer cooperatives, unions, federation and

confederation in which the majority of smallholder farmers in all the milk sheds belong. As women dominate the cooperative member lists, there is to increase sensitization amongst women, so as to increase the success of program actions through sexed interventions within cooperatives.

- **Need for diversified dairy development technologies.** Intensive dairy production technologies aimed at addressing the challenges of intensive dairy production systems, especially, within the traditional extensive systems of the Eastern and North-Western (Gishwati area) milk sheds posed by limited natural resources endowment of the country.

- **Need for increased sensitization of beneficiaries on significance of milk and milk products quality along the entire dairy value chain.** The importance of quality milk and milk products is critical for the desired competitiveness at the marketplace. Therefore, awareness campaigns should be part and parcel of RDCP II implementation, so to achieve Intermediate Result (IR).

- **Need for efficient and effective Artificial Insemination activities.** The need to upgrade the local cattle through AI is critical in order to achieve the envisaged increases in productivity accruing from improved genetic potential of the crossbred herds. to intensify dairy cattle breeding The level of breeding practices is still low, particularly, due to lack of modern breeding techniques.

- **Need for improved milk hygiene and general dairy cattle management.** Both poor milk hygiene coupled with poor dairy cattle feeding, disease control and milk marketing, call for particular attention for the success of RDCP II.

- **Need to facilitate RDCP II beneficiaries for increased access to financial services.** In general access to formal financial services in Rwanda is low and unevenly distributed across the country. In rural areas where more than 90% of the poor live, only 25% of them have access to formal financial services. The situation is even worse with the dairy sub sector as compared to other sub sectors of agricultural value chains.

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