



White gold: Opportunities for dairy sector development collaboration in East Africa

Final Draft for Discussion

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Centre for
Development
Innovation 

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Disclaimer: *The views expressed in this draft report are those of the authors and under no circumstance can be attributed to the organizations associated in IADG that asked for this report.*

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Executive summary

This report presents findings from desk studies and country visits on the six East African countries (Burundi, Ethiopia, Kenya, Rwanda, Tanzania, and Uganda) made on request of the Inter-Agency Donor Group on Pro-poor Livestock Development, as per study terms of reference. It includes recommendations on areas of donor support and collaboration, a regional dairy sector analysis, country dairy profiles, and current donor programs in the dairy sector.

Highest leverage areas that require philanthropic capital include use of pooled funds and implementation approaches that focus on outcomes rather than outputs. Strategies to deal with raw milk markets and identification of sector challenges have received less attention than they deserve. Milk prices are too high for most consumers and attention to the inefficiencies in the milk chain should considerably reduce consumer prices. In addition, the studies also investigate how target countries are positioned in terms of global partnerships in dairy. Required are industry data and information services, infrastructure and institutional capacity building programs for dairy industry professionals and business management, developing inclusive models for market formalization to increase good quality milk consumption, business integration, gender equity, farmer education and knowledge transfer in best dairy practices.

Given the needs and challenges facing the East African region described below, donors could assist and collaborate with governments and other stakeholders, as follows:

- Assist target governments to develop tangible dairy sector investment incentives.
- Promote innovation by entrepreneurs through pooled investment grants and challenge funds. Coordinated donor efforts can yield positive results as showcased in the Uganda dairy rehabilitation program that was implemented from 1986 to 2004, where the shared value and zero funding gaps yielded desirable dairy sector growth exceeding 4% per annum.
- When investing in the dairy value chain the potential of shared value across the chain should be apparent and convincing. Cost/benefit ratios for partners/institutions along the chain should be derived to provide information on the functionality of the institutions and provide an indication of potential on shared value achievement.
- When funding projects, donors should recognize that dairy business is not short term but long term. Success depends on selecting suitable areas with fertile land and water resources, and potential for abundant fodder production, such that if dairy farming is practiced as a business, other types of agriculture can be outcompeted; target educated farmers who have potential to innovate and early adopt; sustainable extension provision, and continuous capacity building in best dairy practices; supply loyalty schemes; and adoption of commercially oriented cooperative models. On the other hand, success factors for milk buyers will include reliable market through wet seasons, seasonality and quality premium incentives and timely milk payments. Budgeting for this process should start with outcomes needed and work back to determine cost benefit analysis and what it entails.
- Private or public sector allocation of specific value chain meta-institute funding should be the responsibility of functional stakeholder platforms as organized by the Dairy Genetics East Africa programs in Uganda and Tanzania; they should be responsive to the prevailing stage of dairy development in each context.
- Facilitate dairy sector development programs that support technical capacity building, infrastructure development (e.g., roads & electricity supply), and investment programs for productivity enhancing technologies at farm level, bulk milk transportation tanks and milk cooling facilities at MCCs or milk bulking centers.
- Support development of data collection and collation systems and studies (e.g. on marketing & milk demand projections) to inform sector management, investors, and developing partners.
- Develop project implementation plans with target communities and stakeholders rather than imposed or prescribed a good model is the ASARECA model. In general, project planning should be participatory and inclusive of the private sector and key stakeholders to avoid poor implementation and guarantee sustainability.
- Support development of adequate commercially run learning facilities such as practical training centers sustained by tuition fees or mandatory milk levies, particularly for work experience on different size commercial farms, MCCs, processors, and retail outlets. This should include facilities for capacity building in extension, organizational skills, dairy technology, financial literacy, and business management. Such colleges can be run on regional basis through decentralized regional campuses.
- Following priority setting in line with private sector needs, strengthen publicly funded dairy research across the region, including a focus on applied research especially focusing on immediate production

constraints. Strengthen extension and establish farmer demonstration farms. Stakeholder participation in defining research priorities should be promoted.

- Considering that more than 70% of smallholder dairy farmers are women, promote greater women inclusion and empowerment in the region through co-ownership of land, property inheritance rights and productive resources, reducing drudgery by access to finance for mechanization, and facilitating equitable earning through inclusive business models, access to credit, fair compensation, and access to jobs along the dairy value chain. Engage gender specialists and organizations to assist in facilitating gender equity in the dairy value chain.
- Facilitate involvement of youth in the dairy sub-sector e.g., in starting dairy farms, assisting farmers in fodder production, milk transportation, and testing. Also, mainstreaming youth into dairy activities in preparation to take over as the older generation retires or adult men get engaged in urban employment.
- As a result of limited milk supply to the processing plants, processing inefficiencies, high packaging and transportation costs, the price of processed milk is high, and hence not affordable to the majority of consumers except those in the upper middle and high classes. An inclusive approach that allows trained and licensed milk traders who get access to credit to invest in appropriate equipment can help to improve the quality of milk and supply more milk for processing. Donors' assistance can come in form of part grants and part loans as done by AECF grants and RDCP II project in Rwanda. The milk trader inclusive approach will increase milk availability and improve milk quality. Similarly, small milk bulking and chilling enterprises should strategically form apex processing companies where farmers are key shareholders. The milk bulking and chilling enterprises growth and engagement in value addition failure leaves them at the mercy of milk buyers and does not create growth incentives. Formation of apex companies enables harnessing of larger financial returns as demonstrated by the growth of Githunguri Dairy and KDFD in Kenya, UCCCU and JESA Dairy in Uganda, Tanga Fresh in Tanzania, and Bukkeye Dairy in Burundi.
- There should be attention to environmental mitigation including development of eco-friendly pasture management and cattle feeding systems, utilization of dairy effluent for energy generation, and environmental management awareness and education. Donors can also assist in advocating for natural resource management, introduction of climate smart technologies and environmental custodianship.
- Donor funds should encourage entrepreneurship and not hand out free goods and services. Donor programs should not be prescriptive, but adopt a participatory approach that includes private sector to identify priority areas and implement feasible programs for community enterprise development.

Most of the above recommendations arise from the similarities in dairy value chains across the region, in which the informal sector dominates (80% or more of milk produced). However, prevailing policies and the development stages of individual country dairy value chains determine the complexity of the key players and support services available. Clearly, the existence of more value chain players and support services indicates a progression towards formalization of the system and increased investment in the sector. For example, a simple chain structure (producers, collectors/aggregators, milk buyers/processors and sellers, and consumers) is characteristic for the emerging Burundi dairy sector, and is present in all countries, next to formal chains. In such a structure support services are not in demand as the producers are largely subsistence.

Unlike Burundi, the Kenya dairy value chain is characterized by many players and support services. It has a range of producers, small, medium, and large scale; bulking units (MCCs), a wide range of transporters including processor-transporters; processors of a wide range of processing capacities, even some with regional expansion ambitions; milk distributors at wholesale and retail levels; informal milk traders; and diversified consumer markets. The support services include feed and forage supply, AI, veterinary services, and dairy product diversity and are more developed than in all the other countries. Ethiopia, Tanzania, Rwanda, and Uganda dairy structures lie between those of Burundi and Kenya with regards to dairy development trajectory.

The overarching challenge across the countries is to transform the informal sector to a formal commercialized sector that has traceability safeguards. This requires a fact based analysis of formal and informal sectors, as well as a differentiated approach in the transformation process. In many situations the informal sector is very efficient for consumers to buy milk at a reasonable price and for producers to sell milk and receive a fair price. In order to support the transformation from the informal to the formal sector, challenges that need to be addressed are largely similar across the countries, but the severity of each generic challenge depends on the stage of dairy development. While Kenya is ahead of all the other countries in per capita milk consumption and supply, milk supply is still lower than expected. Burundi, Ethiopia, Rwanda, Tanzania, and Uganda have per capita milk consumption of 50 liters per annum or less.

Invariably, the low milk supply is a consequence of a wide range of issues: inappropriate cattle breeds for dairy production; low productivity of the cows that is partly a consequence of low feed supply, diseases, and farmer education; variable quality and high cost of inputs; inadequate and low quality feed leading to seasonality in production; inadequate in-country and trans-boundary disease control; high milk losses of up to 50%; poor milk quality; low adoption of dairy industry technologies; low capacity utilization among processors; inadequate capacity of farmers and research and extension providers; lack of incentives to stimulate production e.g., differential milk pricing and quality based milk payment systems; limited market access; inadequate access to financial services; poor leadership and governance of farmer groups, inadequate organization of farmers and coordinating bodies; research inappropriate for the private sector; lack of extension services; and insufficient and uncoordinated donor support.

Countries such as Burundi and Tanzania are still trying to build their dairy herds through increased use of AI, whereas Kenya embarked on this program over 40 years ago. Hence, Kenya has a comparatively lower need to increase and improve the dairy herd. The challenge for Kenya and all the other countries is to tap the full genetic potential of the dairy breeds through productivity improvements.

Across these countries, the challenges mentioned are evident, but as noted above the gravity differs by country. Individually, the countries have some unique challenges; for example, because of the risk of sporadic civil unrest, Burundi and Rwanda have been unattractive to donors and foreign investors, while Ethiopia and Tanzania emerged from socialist approaches that led to retrogression of dairy development.

The largest opportunity in the region is the huge potential to produce large quantities of milk through simple improvements. These include improved cow productivity, cold chain for collection of afternoon milk, and reduction in milk losses. There is a potential large market, provided milk quality is improved, reduced transaction costs lead to lower consumer prices, and milk consumption is promoted by both governments and industry bodies. This could be done through school milk feeding programs and milk consumption campaigns and product diversification that increase demand, and hence stimulate supply while contributing to improved human nutrition. The milk consumption increase may also come naturally with the growth in the urban population and a middle class with disposable income that is evident in cities across the region.

Across the countries, per capita milk consumption has been projected to grow with targets set in national dairy strategies including that for Rwanda. Hence, a larger demand for milk can be expected. There is also potential to increase the diversity of dairy products across most of the countries. In this regard Kenya leads with at least 11 types of dairy products compared to the rest of the countries, which have seven or less. The region has great potential to produce dairy products, such as milk powder, which have potential for export. A regional and international analysis is needed for the dairy processing industry: Are UHT milk and milk powder the right products to produce in East Africa in comparison to the world market? Probably, East Africa should concentrate on a range of consumer products for the internal market and neighboring countries (e.g. DRC, Djibouti, Somalia and Southern Sudan). Also, strategies including seasonal imports of milk powder to increase utilization rate of processing capacity and increase demand for processed products should be considered. In Kenya Brookside Dairies buys milk powder from Pearl Dairies in Uganda and locally produced New KCC milk powder to sustain local market demand.

Ethiopia, Kenya, Rwanda and Uganda have focused on dairy by developing national strategies that give emphasis to the dairy sector and its potential for GDP growth. Across the countries a strategy focusing on the dairy and promulgation of a dairy act of parliament can enhance not only growth but competitiveness of the dairy sector. Unfortunately, in some countries, there are either no dairy acts or outdated ones.

Good examples of dairy sector development that are anchored on benefiting the poor are those of Ethiopia and Rwanda. Ethiopia has the Growth & Transformation Program that is transforming the agricultural sector in general and dairy in particular and is anchored on pro-poor policies to support such development. The Government of Rwanda (GOR) has developed the Vision 2020, in which dairy supports the vision's pillars, and key strategic documents that are addressing poverty reduction, agricultural growth and, specifically, dairy sub-sector growth.

Environmental issues receive increasing attention across the countries. For example, Tanzania has appropriate policies and strategies for environmental and water resource management in place. However, the relationship between the environment, natural resource management, and dairy farming activities has not been articulated. This is an agenda for action across the countries. Also, this could be an interesting area for donor assistance and cooperation.

It is acknowledged that participation of women in dairy is still low and moving towards gender balance will take long, because traditionally women do not own cattle across the countries. However, women substantially participate in dairy activities even as they do not own cattle. When the operations become

larger, women are increasingly excluded. However, positive attempts have been made by the Ethiopian government in its GTP that stipulates gender mainstreaming and women participation in dairy technology usage. Also, the Rwanda "One Cow One Poor Family - Gir Inka" program has affirmatively distributed cows to women. Unfortunately, the dominance of men in the households leads to the cow ownership de facto reverting to the men. The inclusion of women in dairy could be addressed more effectively through affirmative action such as imposition of quotas by governments and organizations supporting dairy development. As women stay behind because men leave for work in the cities, women should gain access to dairy farming receiving appropriate support (see above).

The main emerging regional dairy issue is the recent interest in investment in the dairy sector by regional (e.g., Brookside of Kenya) and international milk processors (e.g., Friesland Campina, Nestle and TetraPak). This interest is a reflection of the confidence the processors have in adequacy of milk supply or potential for increased milk supply. This is likely to change the nature of dairy business in the region in that it will promote milk quality improvement and a commercial orientation along the whole dairy value chain. To this end, lead milk processors in Kenya, Rwanda, and Uganda are currently exploring quality based milk payment systems. Also, the entry of international dairy companies such as Friesland Campina is a game changer as it forces East Africa operators to develop efficient and competitive supply chains and create supplier loyalty and traceability as opposed to random milk buying. It would lead to milk quality improvements and stability in milk supply chains through introduced incentives. Since all this is just initiating, the logistics for this integration and time frame to impact smallholder dairy remain speculative.

There are prospects for sustainable growth across the region, provided inclusive models are adopted that promote dairy development across the levels of production (i.e. small, medium & large scale). The need to create economies of scale in milk collection and processing through promotion of farmer growth, transition from subsistence to commercial, adoption of production enhancing technologies, from smallholder to large scale is critical to drive sustainable regional dairy sector growth. Of importance is the acceptance by the countries of a market led economy that transforms subsistence farmers to commercial production to promote growth of the dairy sector. This is important in countries such as Ethiopia and Tanzania that used to have socialist agendas that slowed down dairy development. The countries further recognize that a model for sustainable dairy sector growth takes into account the supply and demand sides that have to grow in synchrony.

Clearly, for growth in milk supply the public sector and donors need to invest substantial public funds in, among others, feed supply, breed improvement (especially development of appropriate tropical dairy breeds such as Girolando in Brazil and Sahiwal x Holstein crosses in India), disease control, data collection/records and extension services. When this supply base is established an increase in demand can be satisfied because the base to increase milk supply exists. The other commercial activities including value addition and product diversification can now further increase demand that can be met from the elastic production base.

Donor dairy support in the region has emanated from internal donor policies and government dairy development plans. In some countries there has been focus on the dairy value chain as a key contributor and a key driver of economic growth, particularly in rural areas. The national dairy strategies of the East African countries emphasize the importance of public-private-partnership in achieving the national dairy strategies' objectives. Across the countries, several NGOs and donors have contributed directly to dairy development through projects. Most are in line with the plans of the governments and in some cases, for example in Rwanda, the plans have to be approved by the district where a project will be implemented. Most donors consult governments before deciding on the value chains or areas to support and ASARECA model is participatory and involves the stakeholders in prioritizing areas of need/support. However, much as the donors consult the relevant government authorities, there have been allegations that some donors come with blueprints that they "persuade" countries to adopt.

In general, it is perceived that there is room for donors to embed their projects in the framework of government dairy sector programs, supporting dairy value chain development jointly with the private sector, without losing sight of their individual objectives. It is also clear that across the countries the key donors supporting dairy are few, and hence they could easily create a donor platform or forum to share responsibilities and areas of focus along the dairy value chain or in disparate geographical locations, as done by the USAID Kenya Dairy Sector Competitiveness program, the Bill & Melinda Gates Foundation funded Kenya East African Dairy Development program, and the IFAD funded Smallholder Dairy Competitiveness program. These programs worked in different milksheds equitable development programs and shared value in implementation. Opportunities for donors to collaborate exist in-country and across the region to address regional agendas and issues affecting the dairy sector, including trade.

Platforms should be created for donors to share information on developments across the region and apportion areas of intervention. A lot of donor efforts in the region have been on activities along the entire

dairy value chain, but this has not given adequate focus on some nodal parts of the dairy value chain that can be fulcrums for development. For example, few donors are supporting milk consumption campaigns that can increase demand for milk and improve human nutrition. In addition, there has been little focus on increasing productivity of cows through developing robust, effective, sustainable feed supply and conservation programs. Increased donor support to address water and fodder availability through commercialization of the latter will significantly contribute to milk supply, for example SNV Kenya under KMDP has initiated commercial fodder production and organized learning trips to Netherlands, and introduced forage seeds and harvesting equipment companies to Rift Valley dairy farmers. Further, donors have not adequately supported data collection and data set maintenance systems development and yet all planning and projections are based on data that in many instances is not verifiable, and hence not valid.

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List of abbreviations and acronyms

ABS TCM Ltd	African Breeders Service Total Cattle Management Limited
ACDI/VOCA	Agricultural Cooperative Development International and Volunteers in Overseas Cooperative Assistance
ADC	Austria Development Cooperation
ADLIP	Agriculture Development led Industrialization Policy
AFRISA	Africa Institute for Strategic Animal Resource Services
AGOA	African Growth Opportunities Act (AGOA) of the USA, COMESA and EAC
AGP	Agriculture Growth Program
AI	Artificial Insemination
AKEFEMA	Association of Kenya Animal Feed Manufacturers
ALPPIS	Addis Livestock Production and Productivity Improvement Services
ASAL	Arid and Semi-Arid Lands
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
BAP	Burundi
BMGF	Bill & Melinda Gates Foundation
BOA	Bureau of Agriculture
BOAM	Business Organizations and their Access to Market
BRAC	Bangladesh Rural Advancement Committee
BTC/CTB	Belgian Technical Cooperation
CAADP	Comprehensive African Agricultural Development Program
CAHW	Community Animal Health Workers
CCF	Christian Children's Fund
CIDA	Canadian International Development Agency
CKW	Community Knowledge Worker
COMESA	Common Market for East and Southern Africa
CSA	Central Statistics Agency
DAI	Development Alternatives Incorporated
DANIDA	Danish International Development Agency
DAR	Directorate of Animal Resources
DCL	Dairy Corporation Limited
DDA	Dairy Development Authority
DRC	Democratic Republic of Congo
DTI	Dairy Training Institute
DVC	Dairy Value Chain
EAC	East Africa Community
EADD	East Africa Dairy Development
EAFIA	Ethiopia Animal Feed Industry Association
EAIR	Ethiopia Agricultural Institute of Agriculture
EATA	Ethiopia Agricultural Transformation Agency
ECBA	Ethiopia Cattle Breeders Association
ECF	East Coast Fever
EDDP	Ethiopia Dairy Development Project
EDGET	Enhancing Dairy Growth in Ethiopia
EMPPA	Ethiopia Milk Producers and Processors Association
EPRC	Economic Policy Research Centre
EQSA	Ethiopia Quality Standards Authority
ETB	Ethiopia Birr (currency)

EU	European Union
FAO	Food Agriculture Organization
FMD	Foot and Mouth Disease
FTC	Farmers Training Centre
GDP	Gross Domestic Product
GoB	Government of Burundi
GoE	Government of Ethiopia
GoK	Government of Kenya
GoT	Government of Tanzania
GoR	Government of Rwanda
GoU	Government of Uganda
GTP	Growth and Transformation Plan
GIZ	Gesellschaft für Internationale Zusammenarbeit (German Development Cooperation Agency)
HH	Households
HI	Heifer International
ICRAF	International Centre for Research in Agro Forestry
ICT	Information Communication Technology
IFAD	International Fund for Agricultural Development
ILDPA	Integrated Livestock Development Project
ILRI	International Livestock Research Institute
IMF	International Monetary Fund
IRIN	Integrated Regional Information Networks
ISABU	Institut des Sciences Agronomique du Burundi
IWMI	International Water management Institute
JICA	Japan International Cooperation Agency
KAGRC	Kenya Animal Genetic Resources Centre
KARI	Kenya Agricultural Research Institute
KDFF	Kenya Dairy Farmers Federation
KDPA	Kenya Dairy Producers Association
KEBS	Kenya Bureau of Standards
KEVEVAPI	Kenya Veterinary Vaccines Production Institute
KLPO	Kenya Livestock Producers Association
LAM	Livestock Analysis Model
LGSEA	Livestock Genetics Society East Africa
LIVES	Livestock and Irrigation Values-Chains for Ethiopian Smallholders
LMD	Livestock Market Development
MAAIF	Ministry of Agriculture Animal Industry and Fisheries
MC	Mercy Corps
MCCs	Milk collection centers
MFI	Microfinance institutions
MINAGRI	Ministry of Agriculture and Animal Resources
MOA	Ministry of Agriculture
MOFED	Ministry of Finance and Economic Development
MOP	Microfinance Outreach Plan
MRI	Medical Research Institute
NAADS	National Agricultural Advisory Service
NABC	Netherlands African Business Council
NAEB	National Agricultural Export Board
NAGRC-DB	National Animal Genetic Resource and Database Centre
NAIC	National Artificial Insemination Centre
NARO	National Agricultural Research Organization

NDA	National Development Authority
NDS	National Dairy Strategy
NGO	Non-Governmental Organization
NLDP	National Livestock Development Project
NOGAMU	National Organic Agriculture Movement
NRS	National Regional State
NVI	National Veterinarian Institute
OCIBU	Office du Café de Burundi (Coffee Board)
PARSE	Projet d'Appui à la Reconstruction du Secteur l'élevage
PNSA	National Food Security Program
PRIME	Pastoralists Areas Resilience Improvement and Market Expansion
PSF	Priority Solidarity Fund
RAB	Rwanda Agriculture Board
RALIS	Rwanda Agricultural Inspection and Certification Services
RDB	Rwanda Development Board
RDCP II	Rwanda Dairy Competitiveness Program II
RIM	Network of Microfinance Institutions
RNDP	Rwanda National Dairy Platform
SACCO	Savings Credit Cooperative Organizations
SALL	Sameer Agricultural and Livestock Limited
SAN	National agricultural strategy
SCC	Somatic Cell Count
SNV	Netherlands Development Organization
SWOT	Strength Weakness Opportunity and Threats
TOT	Training the Trainers
UBOS	Uganda Bureau of Statistic
UCCCU	Uganda Crane Creameries Cooperative Union
UDPA	Uganda Dairy Processors' Association
UHT	Ultra Heat Treatment
UIA	Uganda Investment Authority
UIRI	Uganda Industrial Research Institute
UNADA	Uganda National Agro-input Dealers Association
UNBS	Uganda National Bureau of Standards
UNDATA	Uganda National Dairy Traders Association
UNFFE	Uganda National Farmers Federation
UNIDO	United Nations Industrial Development Organizations
USA	United States of America
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
UVA	Uganda Veterinary Association
WASPs	Water Service Providers
WFP	World Food Program
WWS	World Wide Sires

Part I: Background and overall analysis

In this part of the report, the country dairy profile summaries are presented to provide a basis for the regional analysis. This regional analysis is presented before the second part that describes the country dairy profiles in detail. This approach was taken in order to project the issues in a regional context and enable readers to have, among others, some insight into the regional trends and identify the opportunities for donor funding and collaboration.

1 Introduction

1.1 Background

In May 2013, the 14th Annual Meeting of the Inter-Agency Donor Group (IADG) on pro-poor livestock research and development focused on the topic "Development of Livestock Value Chains through strengthened Public-Private Cooperation". A number of development agencies (IFAD, ASARECA, BMGF, ILRI, Netherlands government) informed the meeting on their activities in the dairy sector in East Africa. It was agreed that better coordination by development agencies on dairy development would be good for all parties and for the development of the dairy sector as a whole in East Africa. The Netherlands offered to take the lead in organizing a trajectory geared at exploring possibilities for coordination and for creating synergy within the different countries and possibly across countries. It was suggested to include the following countries: Tanzania, Kenya, Uganda, Rwanda, Burundi, and Ethiopia. Focus was to be on commercializing dairy value chains. It was also agreed that, building on the experience gained in the East Africa trajectory, Australia would do the same for Southeast Asia.

The aim was to organize a workshop (or consultation) in the first quarter of 2014 in East Africa, with possible participation of key policy makers, lead persons in the industry and farmer organizations, and high level representatives of relevant development agencies and knowledge institutes. This workshop is now scheduled for the first three days of April 2014.

The purpose of this (concept) background document, according to the terms of reference (see Appendix 1), is to provide a sound and inspiring basis for a constructive, open discussion on actions by the various stakeholders. It is also expected that the final document will serve as an important and highly valued reference document for all stakeholders.

1.2 Report structure

This report contains six country profiles and a more general regional analysis, that for the reader's convenience is presented first. In summary, the approach for this study emphasizes collation of information from major original studies and reports on the sector in the six countries over the past 10 years, complemented with stakeholder consultation focusing on validation and gap filling, rather than new data collection and analysis (see Appendix 1 for details). Based on available reports from governments and other sources, the country reports describe the structure, emerging issues, challenges and opportunities of the dairy sector (10 years back and 5-10 years ahead).

The report is divided into two parts. The first part gives the background to the study, the terms of reference, summaries of the individual country dairy value chains, the regional dairy profile that embeds country value chains comparative analysis, and finally gives recommendations for improved coordination of donor investments, priorities and dairy actions in East Africa. In order to give a preamble to the regional analysis, the report starts by presenting a summary of the recommendations and key findings from individual country dairy profiles. The summaries highlight the issues enshrined in the terms of reference; for example, the key dairy value chain players in each country, production systems and key donor funded programs are presented. Further, apart from other objectives, the intention is to identify generic issues across the countries, gauge the stages of development in individual countries, and hence proffer potential development pathways. Where generic issues or challenges exist, the possibility of regional approaches to address them is explored.

The second part of the report contains the details on dairy profiles of individual countries. These are presented after the regional analysis and other sections to provide additional background information. The information provided is not meant to be exhaustive, but rather to provide the basis from which the regional analysis and recommendations to donors can be derived.

2 Recommendations for regional dairy sector development collaboration

In this chapter recommendations to address key dairy development issues across the six countries (Burundi, Ethiopia, Kenya, Rwanda, Tanzania, and Uganda) are presented (Table 2.1). While the chapter is not exhaustive, it provides a framework for further discussion and action. The rest of the report chapters present the evidence from which the recommendations were derived.

First, the more general, regional recommendations are proffered. They cover the main dairy issues to be addressed, target areas of support for donor partners, and potential collaboration spheres. Second, a few key country specific recommendations are presented (Tables 2.2-2.7).

In table 2.2, environment is not yet given much attention. Production and environment are always two parts of the same coin. Attention for potable water for drinking of cattle and for cleaning on farm and at MCC, cooling plant, and processing plants requires planning and impact assessment. Attention is needed for soil fertility management, forage and milk production, and the manure cycle. Manure can be of great value for poor quality soils that often are misused by single crop production rather than proper crop rotation. depends on changes in the farming system. For the present “three cow farm” producing a few liters of milk per day, the primary reduction in terms of carbon footprint will be achieved by increasing production per cow and by better feeding.

In summary, **Donor collaboration** would be welcome in facilitating and funding the following:

- Development of data collection, marketing studies, projections in the future of milk demand and collation systems to inform sector management, investors and developing partners. With due attention to stratification of the sector, farming systems typology, herd size, breed types, etc.
- Documentation of successful value chain models and the critical or key success factors, similar to the Land O’Lakes Cooperative Development project for Kenya and Uganda,
- In an effort to reduce seasonal milk production fluctuations, support, among others, breeding strategies development (e.g., breeding management to ensure cows calve at the required time), water harvesting, irrigation and conservation of commercial fodder production pastures.
- Control of transboundary diseases (FMD, ECF and zoonoses) should be organized regionally and facilitated by resource pooling and development of regional institutes for key veterinary services such as vaccine production. Implementation of regional cattle and zoonotic disease mitigation strategies including traceability and animal movement surveillance and issuance of movement permits and timely vaccination.
- Up-scaling of dairy trade arrangements and regional integration for improving the business environment within COMESA and EAC.
- Training and support of hawkers and traders to work at a higher business level so that they can afford to purchase appropriate equipment (e.g. milk cans & saddled bulk transport tanks), test and maintain quality of dairy products.
- Training along the value chain e.g., establishment of publicly funded polytechnics for training of farmers, traders, and processors in dairy management, governance and leadership. Such dairy training institutes should have satellite centers as a systemic intervention for continued training.
- Development of third party certification and self-regulation systems; for example, in the feed supply and breeding sub-sectors and (para)veterinary services.
- Establish and participate in stakeholder platforms for engagement on dairy sub-sector issues.
- Involvement of youth in the dairy sub-sector e.g., in starting dairy farms, assisting farmers in fodder production, milk transportation and testing can help development in the right way. Also mainstreaming youth in preparation to take over as the old retire.
- Promotion of milk consumption through publicly funded school milk feeding programs and consumer campaigns.
- Environmental mitigation including development of eco-friendly pasture management and cattle feeding systems, utilization of dairy effluent for energy generation, and environmental management awareness and education.

Table 2.1		Issues, recommendations, and potential partners in addressing the dairy sector development issues and recommendations.		
Constraint/Issue	Priority	Recommendation	Potential Implementation Partners	Justification/expected impact
The informal milk market is above 80% of marketed milk in all the 6 six countries. This raises issues on low milk consumption, development of the dairy sector without clear understanding of the players & the possible danger poor milk quality can pose to public health.	1	Informal sector studies to understand milk quality and public health status and develop inclusive strategies for market diversification with differentiated products, niche sophistication branded location, price penetration & expansion. Market development to drive consumption is also important.	Governments, donors & farmer organizations	The assumption that boiling milk solves poor milk quality issues needs verification, as boiling or pasteurization does not remove bacteria, toxins & antibiotics. Also there are no references of countries that have fully developed their dairies against a background of informal marketing. Rather, in developed & developing countries there is recorded progression from informal to formal milk market. Formal markets will improve service delivery & production. It is strange that milk traders are not considered important partners. Those who are exposed to milk are also prone to zoonoses like brucellosis, TB, food poisoning bacteria etc.
Lack of appropriate policies & tax incentives. Inappropriate tariffs & barriers can impede foreign investors & affect regional dairy development	1	In general, donor funds should assist the target governments to develop tangible dairy sector investment incentives. Subsidies and tax incentives should be on industry growth, not on dairy income.	Public sector, donors & dairy stakeholders	This will hopefully lead to more investment in dairy sector & benefit smallholder farmers through e.g., reduced costs of production & increased income. Example is 40% tariff on Uganda milk kept out foreign investors.
Dairy extension service provision is weak as a consequence of lack of skills & inadequate financial and infrastructure support. Also, the facilitatory infrastructure including roads & electricity are inadequate.	1	Facilitation of dairy sector development programs should continue to support technical advice & capacity building, and infrastructure development, & assist in investment programs.	Public sector & donors	Supporting skills development strengthens extension provision. Infrastructure development, particularly roads & electricity are critical for speeding up milk haulage & cooling resulting in better milk quality and for extension reaching farmers.
All countries have challenges in dairy services delivery including feed & water quantity & availability, inputs supply & in veterinary & extension services delivery. Some countries have assumed that veterinary & extension services are demand driven therefore can be privatized yet farmers cannot afford to pay resulting in poor service delivery and inadequate extension staff.	1	Studies are needed to assess demand, willingness & ability to pay for services. Build local capacity & strengthen farmers' education facilities to train practical animal husbandry & dairy processing. Graduating farmers & participants should be linked to farmer friendly finance schemes to purchase & invest in production enhancing technologies.	Donors & farmer organizations	Market for services & quality of service delivery are dependent on leadership, formation of strong educated farmer cooperatives that focus more on value addition than simply trading in milk. Focus should remain on volumes of good quality milk. Educated & trained farmers with access to land should be assisted to get finance to invest in fodder establishment and conservation, youth & non-farmers, and non-livestock farmers can also engage in commercial fodder production.

Unilateral donor support of dairy activities that can lead to overlaps	1	Coordinate donor support through stakeholder platforms. Ensure that all activities will contribute to a viable milk value chain.	Public sector, donors & dairy stakeholders	Coordinated donor efforts can yield positive results, as showcased in the Uganda dairy rehabilitation program that was implemented from 1986 to 2004 & yielded desirable dairy sector growth, exceeding 4% per annum.
There are allegations that some donors & NGOs have implemented projects without consulting governments & stakeholders leading to activities that are not congruent with national development strategies.	1	In general, in order to synchronize projects with national development strategies, donors & NGOs should consult governments before implementing projects. Specific to dairy, donors & NGO's should consult with stakeholder platforms & lead milk buyers to allay concerns about market distortion. In general, project planning should be participatory & inclusive of the target communities, private sector to avoid poor implementation & guarantee sustainability.	Governments & donors	If recommendation is honored, donor and NGO projects will yield results that add to national development goals. The ASARECA model has been lauded by several people interviewed in this study. However, national strategies may need review to see whether they are sufficiently based on a shared value concept and whether data sources used are reliable.
As a result of limited milk supply to the processing plants, the price of processed milk is high, and hence not affordable to the majority of consumers except those in the upper middle & high classes.	1	High prices of processed milk limit market expansion to all consumers. An inclusive approach that allows licensed trained milk traders who get access to credit to invest in appropriate equipment can help to improve the quality of milk and supply more milk for processing. Reduction in power cost, affordable packaging, improvements in road infrastructure & retooling for efficient processing will reduce cost of milk	Governments, donors & dairy stakeholders	This inclusive approach will increase milk availability & improve milk quality, supporting national health status.
Land holdings of less than 3 hectares per farm & tenure are seen as negatively impacting dairy production. The fear is that cost of production will eventually affect peri- urban small land holding farmers e.g. Githunguri farmers in Kenya.	1	This is a policy & incentives issue that requires studies & hosting stakeholder platforms to discuss strategies for voluntary land consolidation. There should be a drive to increase jobs by diversifying activities at rural level. Local government can give incentives for investors in order to generate employment and encourage other farmers to sell or lease out land. With good leadership & governance models such as Community Dairy Farms as introduced under EADD I can be supported.	Governments, Donors, & farmer organizations	If consumption is to increase cost of milk should not increase, but dairy cattle commercialization should. Cost of production can decrease with higher production, less disease losses, better feeds and scaling up. Farms with 2-3 cow have problems to replace dairy cows. Cost of replacements are far too high. Challenge is to get a better ratio between supply and demand for dairy heifers. This also relates to the indigenous cattle as a source for crossbred dairy animals and correct strategies to maintain the indigenous population.

				Commercialization of fodder production will also increase dairy production & profit. Milk producing areas will eventually shift to bigger land areas. Under EADD I farmers in Kenya were discussing pooled dairy farm management called Community Dairy Farms (CODAF) to avail land, increase economy of scale with more than 300 dairy herd & bring in good management for best dairy practices.
The hub model has been adopted in all 6 countries as a pro-poor inclusive model for market access but sustainability of the enterprises is questionable. The hub model should not be treated as a one size fits all.	1	Support further studies to detail advantages & disadvantages of the model & its applicability. Donor projects should facilitate & strengthen hub leadership & governance, hire competent staff who remain managing after the life of the project. Strengthen MLE programs to gather & share information on hub management aspects. Farmer loyalty schemes should be promoted through incentive packages. The Hub model should not just be appropriate where a chilling unit is in place. Cases of Traditional Hubs in Uganda are examples that peri--urban farmers can bulk & market milk due to proximity of consumers.	Government, donors & farmer organization	Hub model is not a growth model but needs integration for knowledge, leadership & sustainability. Knowledge, entrepreneurship, leadership and governance of dairy hubs need attention. Good managers are a prerequisite to success of the model; they facilitate change & increase milk supply.
Inadequate support of dairy value chain entrepreneurs	2	Donors should promote innovation by entrepreneurs e.g., through pooled investment grants and challenge funds.	Donors & dairy stakeholders	Promoting dairy value chain entrepreneurs and investment promotes growth of the dairy sector & ultimately benefits even smallholder producers e.g., through increased market access
There is concern that large milk processors, and medium and large scale commercial farmers are often excluded in dairy development projects because they are not poor and yet they can play a role in knowledge and technology transfer and help create economies of scale in milk supply to buyers, particularly MCCs and processors.	2	Large milk processors and medium and large scale commercial dairy farmers are key change agents that should be integrated in dairy projects, since they play a role in knowledge and technology transfer, supply of breeding stock, and achieving milk supply economies of scale. Related to this is that the pro-poor donor policy should be reviewed to include linkages and integration with such large processors and farmers.	Donors, NGOs and commercial dairy players	The viability of MCCs and processors could be improved and hence guarantee continued market access by the smallholder milk suppliers.]

<p>Afternoon milk is not often collected, loss through wastage & spoilage & mastitis, represent a significant volume of total milk produced but it is not marketed due to poor road & lack of cold chain infrastructure &, in other countries, security concerns.</p>	2	<p>Public-private sector partnerships for investing & expanding road and cold chain infrastructure should be increased. There should be increased investments in milk transportation equipment including bulk milk tankers. Promote farmer education on the importance of mastitis prevention & control.</p>	Government, donors, milk buyers and farmer organizations	<p>Improved efficiency in milk collection & reduction in loss through wastage & spoilage will significantly contribute to increased income from increased volumes of milk marketed. This could be a first step to quickly close the milk demand supply gap. Mastitis prevalence is reported to be in the range of 40% in Kenya to 80% in Ethiopia. In all countries national teat dip use is below 4% and water used is often not potable. Clinical mastitis cases increase with use of improved breeds and are related to poor milking hygiene & unsanitary milking (hand & machine).</p>
<p>There are increasing concerns on the welfare of exotic dairy breeds given to poor farmers who inter alia fail to manage them well due to lack of resources, low education & small land holdings. This is not a responsible public investment.</p>	2	<p>Pro-poor programs should invest in farmer selection, background training & subsidized extension packages that are offered with heifer-in-trust & cow gift programs to alleviate poverty. Proper linkages for feed, & water supply and disease control & insurance are key to success & sustainability.</p>	Donors, NGOs and Governments	<p>Animal rights & welfare is increasingly becoming a sensitive & important topic that can also lead to fair trade issues; hence, it requires urgent attention. Funding is based on public monies from governments or private organisations who cannot afford to be criticized for uneconomic and socially unacceptable investments.</p>
<p>Smallholder dairy farmers' goals & trajectories of growth have inherently been unclear & yet there are break-even herd sizes required for a viable commercial business.</p>	3	<p>Inclusive horizontal models in which smallholders grow into small commercial & subsequently large-scale farmers should be supported; smallholder dairy farmers should be facilitated to grow to levels where they can make a proper living out of dairy & can be shareholders in milk processing plants.</p>	Donors, governments & farmer organizations	<p>When smallholder farmers grow their dairy farms, larger returns are realized from larger milk volumes (RDCP II INSPIRED Study, 2012).</p>

Some processors view milk traders as a serious threat to dairy development	3	Support evidence based policy making. Governments & regulatory authorities should engage stakeholder platforms to rekindle the vision of the sector especially the role it plays in commerce. Adopt an inclusive approach where value chain actors can be formalized through training & financing incentives. Minimum standards for milk should be stated & enforced by Dairy Authorities sustained by reducing subsidy, milk & other industry levies such as inputs & licenses.	Donors can assist in baseline studies & strategic plan development for disadvantaged groups such as milk traders e.g. MESPT funded the baseline study for Kenya Milk Traders, SNV Uganda funded the UNDATA Strategic plan & DFID funded KDB/Sites for development of quality improvement training manuals.	As experienced in Kenya, Rwanda & Uganda, there is inertia in efforts to force the industry to formalize. A participatory approach to develop incentives & inclusive strategies to transition the sector is required. Kenya Dairy Board, Rwanda Government & Uganda Dairy Development Authority are now training and licensing milk traders. New models of formalization are emerging in all countries e.g. Blessed Dairies & Inyange milk selling franchise in Rwanda, Kenya Milk Traders Association & UNDATA in Uganda.
The milk bulking & chilling enterprises lack economies of scale. Their growth & engagement in value addition failure leaves them at the mercy of milk buyers & does not create growth incentives.	3	Small milk bulking & chilling enterprises should strategically form apex processing companies where farmers are key shareholders.	Governments, donors & farmer organizations	Formation of apex companies enables harnessing of larger financial returns as demonstrated in Kenya (e.g., Githunguri Dairy & Kenya Dairy Farmers Federation) & is happening with UCCCU in Uganda.
Integrated models for dairy are more successful & sustainable	3	Support dairy integrated models where smallholder farmers are in partnership with a processor or they unite to process themselves. Donors can fund studies to assist entry of big processors.	Farmer organizations	Integration with big established or international companies brings in knowledge, experience, finance and sustained market access. Studies such as dairy sector studies for Rwanda, Uganda & Tanzania by SNV and Agriterro for Uganda assist entry of international players.

N.B. Priority (1 =high; 2 = moderate & 3 = low)

Table 2.2		Key issues, recommendations & potential implementation partners in addressing issues for dairy sector development in Burundi		
Constraint/Issue	Priority	Recommendation(s)	Potential Implementation Partners	Justification/expected impact
There is need to address public good issues to encourage dairy sector growth. Supportive policies for dairy sector growth are not adequate.	1	<ul style="list-style-type: none"> ▪ Electricity supply should be increased in order to attract investment in milk processing plants and value addition. ▪ Balancing milk imports against local supply should be considered to preclude prejudice on local supply through supportive policies. ▪ Access to milk markets should be actively addressed, particularly for MCCs that are currently struggling to get buyers of large milk volumes. ▪ The cold chain for milk collection development and the dairy extension delivery policy that shifted the responsibility for extension services to the private sector should be reviewed. Most of the responsibility should be passed to the public sector, particularly at the current stage of dairy development where farmers do not have resources and advocacy skills to demand services. 	Government, donors & private investors	If the government assists in rebuilding of infrastructure devastated by the civil war this will encourage private sector investments. Local milk production has increased but markets are not organized & yet milk imports keep flowing in. Supportive policies including investment & tax incentives, & import tariffs can enable the dairy sector to grow. Public sector support in developing milk collection infrastructure and provision of extension services will not only increase dairy sector growth but will uplift the smallholder farmers & enable them to generate income.
Even before the Burundi civil war, milk collection centers had not been established, but with the current expanding milk production base the need for organizing the dairy value chain is now compelling.	1	<ul style="list-style-type: none"> ▪ In order to attract formal milk processing, milk bulking facilities should be increased, particularly at milk collection centers. ▪ The increased milk supply now warrants formation of national dairy coordinating and farmer advocacy bodies. 		
Lack of long term financing & appropriate loan products for dairy is a major impediment to dairy sector growth	1	<ul style="list-style-type: none"> ▪ Appropriate financial products should be developed for farmers to support dairy activities. To this end, the government, through supportive policies, & donors can facilitate development of such products with microfinance institutions and banks. 	Government, donors & private sector	Adequate & appropriate loan products will increase milk supply and markets for milk, particularly through increased processing capacity. Improving farmers' financial literacy may be a point of attention.

Table 2.3				
Key issues, recommendations & potential implementation partners in addressing issues for dairy sector development in Ethiopia				
Constraint/Issue	Priority	Recommendation(s)	Potential Implementation Partners	Justification/expected impact
There is need to increase the good quality milk supply base. The current herd has limited dairy genetics with low AI use and weak veterinary services delivery. In general, cattle feeding is inadequate & constitutes a major production constraint	1	<ul style="list-style-type: none"> ▪ More support is required to improve genetics and developing sustainable feed production systems to improve nutrition of dairy cattle and increase the milk supply base. ▪ Promote clean milk production and regulate veterinary drugs and vaccines supply through appropriate legislation, & enforcement 	Government, donors, NGOs and farmer groups	Improving AI delivery is key in improving milk production genetics &, coupled with good feeding & veterinary services, it can increase milk production. A strong supply base of quality milk is key to sustainable dairy sector growth.
Ethiopia has a warm milk chain that includes the "butter-line" that is peculiar but has not been adequately considered as a driver of dairy development.	1	<ul style="list-style-type: none"> ▪ Because of high demand for culinary purposes and the longer shelf-life of butter than that of milk, the "butter-line" should be developed through support to the entire butter production chain. 	Government, Donors, NGOs & private investors	Increased milk consumption from this chain will increase demand of milk products & create opportunities to earn income for rural smallholder farmers.
Ethiopia dairy sector has weak private sector contribution. In general, the private sector in Ethiopia lacks public and donor support.	1	<ul style="list-style-type: none"> ▪ Provision of public sector and donor support to private sector should be considered as limited subsidy to buy down risk. 	Government, Donors, NGOs and private sector	A strong private sector will provide efficient and competitive service delivery and offer sustainable services.
AGP/LMD and EDGET are the main donor supported dairy projects in Ethiopia that are implemented by CNFA and SNV, respectively. EDGET works at the production level whilst AGP/LMP is work at market access level.	2	<ul style="list-style-type: none"> ▪ Harmonizing implementation strategies of donor supported dairy projects would facilitate dairy sub-sector improvement. 	Donors & dairy value chain stakeholders	During the country visit, it was noted that there are differences in approach between the two projects, which is good as there are not duplication efforts. However shared value and collaboration can enhance mutual contribution to dairy sector development.

Table 2.4				
Key issues, recommendations & potential implementation partners in addressing issues for dairy sector development in Kenya				
Constraint/Issue	Priority	Recommendation(s)	Potential Implementation Partners	Justification/expected impact
Dairy regulatory framework remains weak against a background of poor quality milk.	1	<ul style="list-style-type: none"> ▪ Strengthen dairy regulatory frameworks to improve milk quality and administration of the dairy sub-sector. Introduce quality based milk payment incentives. ▪ Support & expand school milk feeding program should be supported and expanded by the local government or county. Government and parents should co-fund these programs as demonstrated by KDB in Metekei, Rift Valley Kenya. 	Donors & governments and private sector	There is need to promote increase in milk consumption and reduce public health hazards of consuming unhygienic and poor quality dairy products.
Kenya dairy sector is the most developed in the region and the ASARECA implemented the EAAP project that has selected Kenya as the Dairy Centre for Excellence.	2	<ul style="list-style-type: none"> ▪ Support innovative private sector investment models such as clusters and strategic investments. ▪ Kenya should attract regional clients to its dairy sector training programs, & dairy training institutes through improvements training infrastructure & training capacity. ▪ Create & support innovative platforms for promoting sector development. ▪ Allow & build capacity of private sector institutions to lead dairy growth. 	Donors & NGOs	Supporting private sector investment & capacity building will have a positive effect on service delivery to farmers and improve market access. However, donor support should target segments within the dairy sub-sector that are livelihood-oriented business segments. Interventions in the latter should be “commercial” not subsidy based. Attracting regional clients to training centres will enhance Kenyan influence in the region & open up opportunities to collaborate & share knowledge with regional compatriots.
As the Kenya matures in its dairy development, sustainable dairy business models are becoming more important than before.	2	Models of vertical integration as done by Githunguri dairy are worth understanding particularly the leadership & governance, farmer business proposition & sustainability. Promote & disseminate learning’s from the Land O’Lakes Cooperative Development Project that studied success factors for Githunguri & Limuru Dairies in Kenya.	Donors, NGOs & private sector	A predominantly processor oriented model linking the business hub to processor or a strategic investor should be promoted as it could be a more sustainable model of sub-sector development. If capacity building on governance & leadership is not successful, it is best to cut losses by probably by-passing the co-operative management through integration to better managed milk buyer entities.

Table 2.5				
Key issues, recommendations & potential implementation partners in addressing issues for dairy sector development in Rwanda				
Constraint/Issue	Priority	Recommendation(s)	Potential Implementation Partners	Justification/expected impact
Rwanda has achieved substantial public sector led dairy development, but for dairy sector growth sustainability private sector involvement needs to be considered.	1	Assist in sector studies that show the public good and private good activities. These should then be communicated to the Government of Rwanda (GoR) in stakeholder meetings. Facilitate stakeholder platform meetings that specifically address strategies for government exit and stepwise entry of private sector, particularly where farmers' milk is already being marketed. Strategies should also address ownership of state financed MCC assets so that farmers can develop a sense of ownership and development	Donors & NGOs	Privatization of private good services will incentivize dairy growth of Rwanda dairy sector particularly MCCs where there is milk collection and marketing.
Observance of milk quality standards, lack of dairy knowledge, and poor road infrastructure, particularly in the Gishwati milk basin, require attention.	1	<ul style="list-style-type: none"> ▪ With the expansion of milk processing plants, milk quality should be improved through development of appropriate legislation and enforcement of legislation. Self-regulation of the dairy sub-sector through the nascent Rwanda National Dairy Platform should be encouraged. ▪ Potable water should be more accessible to farmers and MCCs in order to improve milk quality. ▪ More dairy specialists should be trained such that individual districts have at least one government funded dairy specialist' ▪ Road infrastructure needs improvement to facilitate quick milk transport, particularly in the highlands areas in the northern and western milksheds. 	Government and Donors	Addressing the issues will greatly enhance Rwanda dairy sector development through increased production, reduction of milk wastage & spoilage, & improved market access.
Rwanda is on the right growth trajectory but good quality milk supply is inconsistent across seasons, in addition there is a limited range of value-added products	2	<ul style="list-style-type: none"> ▪ Seasonal milk production should be addressed through breeding strategies development and feed flow planning in which feed production per unit land and feed conservation are increased. ▪ Breeding using AI should be continued but delivery of AI services should be left to the private sector, except services such as liquid N supply. ▪ A dairy cattle recording system must be developed to facilitate traceability of, among others, breeding and milk quality interventions. ▪ Artisanal cheese production should be expanded and market access to regional markets where the cheese has price advantages should be improved. 	Government Donors, NGOs and farmer organizations	Addressing the inconsistency of production & quality issues will increase the competitiveness of the dairy sector and increase market access across the East African region

Table 2.6				
Key issues, recommendations & potential implementation partners in addressing issues for dairy sector development in Tanzania				
Constraint/Issue	Priority	Recommendation	Potential Implementation Partners	Justification/expected impact
Demand for processed milk and dairy products has been low, partly because of the decline in the number of MCCs, a consequence of the change from public to private sector controlled units.	1	<ul style="list-style-type: none"> ▪ Promote demand for processed milk products by industry organizations (TDB, TAMPA and TAMPRODA) through milk consumption campaign programs ▪ Promote a demand driven dairy sector by addressing systemic market failures such as poor milk marketing and provision of dairy inputs and services. 	Government, donors and NGOS	The country is in the pre-commercial stage, particularly with regard to supply fluctuations (surplus and deficiency); this should be partly addressed through improvement of feed supply milk buyers and market infrastructure.
Tanzania has limited institutional capacity to promote dairy development & growth	1	<ul style="list-style-type: none"> ▪ Build the capacity of cooperative unions as demonstrated in the building of Tanga District Coop Union. ▪ Continue strengthening the role of the Tanzania Dairy Board. ▪ Strengthen the Dairy Development Forum secretariat. ▪ Review sector development model to preclude operation in silos where technical experts are in line ministries and yet dairy sector development falls under districts ▪ Restructure dairy support institutions on the ground – research and extension services, to make them relevant to the current industry needs. 	Government, donors & NGOs	Strong institutions will enhance national capacity to manage the value chain and create a conducive policy and regulatory framework for successful development of the dairy sector.
Tanzania dairy development is in its infancy and requires support to build capacity and strengthen the entire value chain from production to consumption or grass to glass.	1	<ul style="list-style-type: none"> ▪ Facilitate business linkages development within the dairy value chain. ▪ Develop more robust dairy production base and extension services. ▪ Support the development of different farm scales including commercial large scale farms through privatization of some state owned farms. ▪ Promote dairy herd growth through supporting dairy breeding programs, particularly AI. ▪ Support improvement of milk collection logistics and link to processors. ▪ Give land tenure rights for farmers to use as collateral to access loans from banks. Teach farmers business skills, so they can apply for credit based on benefit-cost projections. 	Government, Donors, NGOs and farmer organizations	Dairy sector development starts with building a strong supply chain and eventually preparing the milk cold chain infrastructure in partnership with private sector. Education and mentoring of the entire value chain actors is key so are the mechanisms to collect market data for dynamic management. Financial support through loan provision would help farmers to commercialize their businesses.

Table 2.7				
Key issues, recommendations & potential implementation partners in addressing issues for dairy sector development in Uganda				
Constraint/Issue	Priority	Recommendation(s)	Potential Implementation Partners	Justification/expected impact
Uganda dairy production could be increased through inclusion farmers in Northern and Eastern Uganda; however, these farmers are not well organized. Milk quality is not good, especially for use in value-added products including milk powder.	1	<ul style="list-style-type: none"> ▪ Improve dairy productivity in northern and eastern Uganda through establishment of cooperatives and milk collection centers. ▪ Facilitate production and collection of good quality milk to supply the processing plants, particularly those for milk powder production. 	Government donors, NGOs, and farmer organizations	The Uganda milk demand supply gap remains big so production of milk is justified and makes dairy a potential viable business. Uganda weather has good rains throughout the year which justifies year round milk production.
Uganda has weak public sector institutes and this is negatively impacting dairy development	1	<ul style="list-style-type: none"> ▪ Facilitate the building of capacity of regulatory and enforcement agencies with a view to reduce public expenditure through industry self-regulation. ▪ Regulate the dairy industry to protect milk suppliers from exploitation, and ensure consumer protection and delivery of good quality milk to processors. Introduce milk quality based payment systems ▪ Initiate a public sector driven dairy sub-sector data collection to support, among others, dairy breeding schemes and to facilitate. 	Donors, Government, private sector including dairy stakeholder organizations	Strengthening government institutes will improve regulatory frameworks, create conducive investment and innovation environment, create level playing fields and enhance sustainable dairy development.
Private sector involvement is dairy development remains weak. and requires assistance	1	<ul style="list-style-type: none"> ▪ Improve access to market information and linkages across dairy value chain. ▪ Promote and facilitate formation of strong farmer associations and cooperatives ▪ Promote milk consumption through milk consumption campaigns and product diversification ▪ Promote the development of appropriate loan products for the dairy sector to improve milk production, collection and processing. 	Government, private sector including dairy stakeholder organizations	Operation efficiency will be improved, and hence the dairy sector will be more competitive.

3 Comparative analysis of Ethiopian and East African countries' dairy sectors

This chapter presents the generic and unique country components of the East African country dairy profiles. To this end, the generic and unique components are considered in relation to value chain development; strengths, weaknesses, challenges and opportunities; economic, environmental and social performance; emerging dairy issues that are of regional relevance; prospects for sustainable growth; production, economic, institutional and other models for sustainable regional dairy growth; adequacy and relevance of donor programs and policies for dairy sector development; and opportunities for donor collaboration and linkages with regional dairy sector platforms.

Our conceptual framework is that dairy sector development and growth come from a gender-balanced, youth inclusive restructuring of the sector to adopt a diversified value addition approach, enhance an inclusive marketing structure, engage the private sector in integrated dairy investment and demand driven service provision, and support environmentally friendly commercialization of dairy production systems.

The basis of this framework is that women constitute 70% of the dairy labor force; therefore, gender balance and female contribution cannot be overemphasized. In most East African countries youth below 40 years represent over 50% of the populations and there are increasing concerns about high youth unemployment rate and an aging dairy farmer population. Involvement of youth is therefore a critical component for dairy development sustainability. An inclusive marketing structure encompasses formal and informal marketing strategies for increased dairy consumption and demand for milk. Integrated dairy investments and demand driven service provision are key factors in guaranteeing sustainable development due to shared competencies and equipment investment models. Environmental friendly commercialization in dairy entails milk production and productivity growth models that strictly adhere to environmental custodianship and stewardship, climate smart and natural resource management strategies. The milkshed development model works well to improve production (milk supply) and to develop market linkages among value chain actors located in the same milkshed. Some adjustment may be required to cater for public-private-partnerships at milkshed level. Prospects for sustainable growth will also come from the nascent institutional and policy reforms that are giving more and direct support to the dairy sector.

EAC (2011; p 1) reported that, "The overall goal of animal production at regional level is to produce enough quality animals and animal produce to match the requirements for the rapidly increasing population and create surpluses for export. The East African Community has enormous animal resources that contribute substantially to the economies of the EAC Partner States and livelihoods for livestock keepers, especially pastoralists who form a large proportion of the regional population. The regional livestock resource base is estimated to consist of 50.2 million head of cattle. On average Trade in dairy products is occurring partly because the East African Community (EAC) has set low rates under the common external tariff (CET)" (Draft NDS, 2012). Dairy products manufactured in the EAC are duty free between the members, and higher rates are set for products from other countries outside the region. The EAC set standards on 42 products of which three are dairy which helps to harmonize trade. However, it has to be acknowledged that this trade in the EAC excludes Ethiopia.

In the COMESA and EAC region, milk production was estimated at 12 million metric tons (Mmt) in 2004 with a prediction that regional production would increase to 36 Mmt in 2020 and per capita consumption would increase from 36 l/p/yr. to around 90 l/p/yr. More dairy products will be required to meet rising demand, and the trade will improve food security, generate income and increase employment. However, annual milk consumption per capita for the six countries (Table 3.1) is below the FAO recommended 200 liters per annum with Burundi having the least annual milk consumption per capita. Donors, governments and parents can cost share school milk feeding programs and consumption campaigns to foster a milk drinking culture. Private processors could also work to ensure fortified dairy products similar to target population tastes to enhance consumption. For example, DSM, a milk processor, sought partnership with local cooperatives working to fortify dairy products in Kenya, and the Eastern and Southern African Dairy Association (ESADA) has organized cheese and wine festivals to promote cheese production, and hence promote milk consumption. With the exception of Kenya, milk consumption across the countries is below 60 liters per person/annum and consumer demand is highly skewed towards low price raw milk that is generally boiled before consumption. While boiling milk is expected to reduce microbial load, based on our interviews, it is clear that it does not eliminate toxins (e.g., from *Staphylococcus aureus*) and antibiotic residues. School milk feeding

programs should be supported to improve cognitive and physical effects of milk on child development. In addition, school feeding programs open markets and encourages milk production and national positive effect on health of school going children. It might also stimulate demand and market expansion provided that milk quality does not prejudice human health.

All the countries have the following:

- Bull studs that need technical assistance to produce enough quantity and quality genetics. All have on-site liquid nitrogen generators that are either broken or inefficiently producing liquid nitrogen. Only Kenya and Tanzania have industrial production of liquid nitrogen; however, efficiency of distribution to service providers is poor.
- Large informal sectors with less than 30% of national milk produced being formally marketed. Therefore increasing milk production by smallholders and participation in the formal value chain has to be the next step in the development process.
- Poor milk quality is a perennial problem in all countries. Hygiene starts with good hand milking technique, use of both effective teat dips and food grade metal containers along the value chain. Access to potable water is often limited at farm and collection and cooling centers.
- There is limited quality based milk payment and the dairy industry largely remains focused on the domestic market. Less than 1% of the EAC regions milk output is exported and this is largely due to shortage of milk rather than trade barriers.
- Cattle often are not offered adequate quality feed and water; as such seasonality in milk production is a reality and extreme in all countries, causing milk deficit. This precludes regional trade. Seasonal variation in production is another cause of inefficiency and price variation at consumer level. Price of milk paid to farmers should vary with season encouraging farmers to invest in forage varieties, forage conservation and concentrate purchases. There should be investment in irrigation technologies to increase harvest of fodder. The concentrate feed does not often meet stipulated standards and there is lack of adequate feed testing facilities in addition to farmer ignorance on quality issues. Forage seeds and fertilizers are not affordable or easily accessed. There is opportunity to introduce dairy cattle in mono-cropping areas, to close the nutrient cycle of forage, feed, milk, and manure to soil.
- The total value of exports in the EAC is about USD 55.5 million. Kenya is by far the region's strongest dairy producer and exporter and is responsible for 86% of the total. The ranking after Kenya is Uganda (9%), Tanzania (4%), Rwanda (1%) and Burundi (0.3%) (Jensen and Keyser).
- Only Kenya and Uganda have capacity to value add liquid milk to powder but UHT milk, production now exists in nearly all the countries. High ambient temperatures and poor milk cold chain infrastructure limits dairy products trade to milk powder, UHT, cheese and yoghurt. Brookside Dairies in Kenya is the lead processor and trader in dairy products and their UHT and yoghurt can be seen in supermarkets in Burundi, Uganda, Rwanda and Tanzania. There is cheese trade between Rwanda, Burundi and DRC. "The trade in luxury goods is restricted by the limited size of the middle income class, expatriate societies and the tourism industry."(Jensen and Keyser).
- The formal education systems need to be augmented with adequate learning facilities such as practical training centers or mandatory industry attachment, especially for work experience on different size commercial farms. There must also be facilities for capacity building in extension, organizational skills, dairy technology, financial literacy and business management. Such colleges can be run on regional basis through decentralized regional campuses. SNV in Kenya is assisting remodeling of Dairy Training Institute in Naivasha. Governments (and possibly donors) should assist in establishment of decentralized colleges in other countries. Similarly research has to be responsive to the needs of the private sector partners of the dairy value chain.

Table 3.1	Summary demographic, economic, and dairy statistics for Ethiopia the five East African countries						
	Burundi	Ethiopia	Kenya	Rwanda	Tanzania	Uganda	Average(A) / Total (T)
Country Population Data¹							
Population (000,000) (% increase)	10.9 (3.2%)	89.2 (2.6%)	44.2 (2.7%)	11.1 (2.2%)	49.1 (2.6%)	38 (3.5%)	
Land area (000 km ²)	27,83	1,127	582.6	26.33	945.2	241.04	T = 2392.83
Economics Data²							
Currency(Rate of exchange to USD)	Franc (1,531)	Birr (19.2)	KSh (84.6)	RWF (675)	TZS (1,618)	UgSh (2,470)	
GDP (PPP) \$ Billion, World Bank (WB) (2012)	5.5	105	76	15.5	74	49.1	
GDP Growth (%) WB 2012	4.2	8.5	4.6	8	6.92	3.4	
GDP/capita (US\$) WB (2012/13)	251	454	943	620	609	547	
Agricultural GDP (%)	41	49	30	33	28	23	
Dairy contribution to GDP (%)	<3	-	8	6	1.53	3	
Contribution to EAC Region GDP (%) ³	9	n/a	9	10	8	8	
Poverty & equity WB (%)	86 (1998)	31(2011)	43 (2005)	63.2 (2011)	68 (2007)	38 (2009)	A = 54.9
Dairy Data⁴							
Dairy cattle population (million)	0.01	0.19	3.5	>0.2	0.68	0.65	T = 5.2
National cattle population (million)	0.645	49.2	18	1.5	21	12.8	T = 103.1
Mortality rates (%)	>15%	>14%	8.5	1.8	10	7.4	A = 9.6
Total inseminations/year (% Cattle herd)	10,000 (0.2%)	<300,000 (0.3%)	750,000 (18%)	>30,000 (12%)	>40,000 (5.8%)	>30,000 (4.6%)	T= 1,160,000
Estimated cost of AI/services (US\$)	13	26	12	13	15	12	A =15.2
AI cost farm gate milk equivalent (l/AI service)	35	63	30	57	83	86	A = 59

¹ <http://www.prb.org/Publications/Datasheets/2013/2013-world-population-data-sheet/world-map.aspx>

² Data from http://data.worldbank.org/topic/poverty#tp_wdi and <http://datacatalog.worldbank.org>, currency equivalent by OANDA

³ http://www.eac.int/agriculture/index.php?option=com_content&view=article&id=77&Itemid=108

⁴ Data obtained from country National Dairy Strategy documents (Dairy Development Authority in Uganda, MinAgri in Rwanda, KDB Kenya, TDB in Tanzania and DDA in Ethiopia), East African Dairy Development Reports and country key informant interviews.

Bred heifer price (USD)	1,306	1,895	1,279	1,259	1,298	1,255	A = 1,382
National milk prod./year (million- liters)	73	3,300	4,400	450	1,650	1,190	T = 11,1 Billion
Milk consumption/capita (liters) [5]	6	18.87	98.64	40	23.1	55	A = 40.3
Milk processing capacity (liters/day)	20,000	210,500	2,900,000	160,000	410,500	1,018,000	T = 4,508,500
Actual processed (% Capacity Utilized)	17,000	127,050	1,170,000	32,000	105,000	624,000	T = 2,075,050
% installed capacity utilized	85	60	40	20	27	61	A = 48.8
Data on Milk (Price US\$/liter)⁵							
Farm gate	0.36	0.41	0.39	0.22	0.18	0.14	A = 0.19
Transporter	0.13	0.02	0.02	0.04	0.12	0.02	A = 0.04
MCC	0.42	0.46	0.41	0.47	0.46	0.24	A = 0.26
Milk trader	0.39	0.38	0.35	0.52	0.32	0.16	A = 0.24
Milk trader kiosk	0.59	0.76	0.47	0.74	0.62	0.40	A = 0.37
Processed milk	0.98	0.87	0.59	1.19	0.65	0.38	A = 0.52
Retail	1.31	1.08	1.02	1.41	0.72	0.81	A = 0.76
Concentrate feed cost USD/kg	0.34	0.16	0.30	0.26	0.32	0.71	A = 0.30
No. of Powder plants	0	0	2	0	0	2	

⁵ Data collected during country visits key informant interviews

- A cooperative is a business providing long term service to its members and community, a concept not yet fully grasped and embraced. Also, MCCs, some processors, breed societies all have similar cooperative functions. Common from our country interviews, in particular experience from East African Dairy Development I, leadership and management of cooperatives is weak and requires urgent attention. Investment in the cooperative requires a strategy and a business plan and its members have to be financially literate. This extends to many other issues of the cooperative business and its members. Education and training of members is an indispensable part of a cooperative. Incorporating youth, the future dairy farmers, in the training programs is mandatory.
- Extension and veterinary services are a condition for success yet all countries have weaknesses in these two programs. There should be a public-private-partnership approach to developing sustainable extension and veterinary services that are partly subsidized by government, private sector processors and input suppliers, and farmer cooperative milk levy. Government should regulate the capacity building of extension and veterinary service providers to ensure professionalism and independence are maintained. Private sector should deliver embedded extension to promote efficient use of their products and processors and MCCs should retain extension officers who plan and service the farmer supply chains. Private sector should deliver embedded extension to promote efficient use of their products and processors and MCCs should retain extension officers who plan and service the farmer supply chains.
- There is dearth of valid and reliable dairy sector data, especially for markets, cattle numbers and milk production, farmer categories, input services, disease statistics, and realistic statistical projections for all stakeholders along the value chain. This has a negative effect on investor confidence, and any form of planning and management. Industry or sector data collection, collating, verification and updating is both a public and private good that requires collective action by all parties NGOs/donors projects M & E programs, government, and private sector. Sector platforms should emphasize efficient ways of achieving this. Good examples include Grameen, NAADS and EADD in Uganda and the plan by UBOS and DDA to revise dairy data. In Rwanda USAID has Monitoring Evaluation Management Systems (MEMS) funded by USAID to receive and process all data collected under USAID funded projects. This data can be shared and reposed under an industry body such as the new Rwanda National Dairy Platform.
- The average age of the current dairy farmers is more than 50 years. There is need to relook at programs that would crowd-in youth and women into dairy production and at other value chain levels. This might take involvement and collaboration of all sector players including private sector; for example, MFIs availing credit for investment in equipment for commercial fodder production, milk transportation and micro-processing. Collateral can come from government youth development programs and private sector players such as processors. There will also be a requirement for capacity building and business skills that can be facilitated through donor/NGO program funds. Colleges and schools can play a role in training cooperatives young farmers' boards, calf rearing and breeding clubs and shows, the 4-H type organizations. Because of ergonomic appeal, technological changes such as small milking machines, motorcycles, milk testing gadgets, feed processing and marketing, AI services, and bulk milk transport tankers can make the sector more attractive to young people.
- Most East African countries have land tenure issues that preclude use of land as collateral for accessing loans; with the exception of Tanzania and Uganda, limited farm sizes of less than 2 ha is common. This presents limitations to feed supply and fodder production. Market development for inputs like forage seeds and concentrate feeds, quality control, and inventories of ingredients for concentrate feed production still need improvement and private sector assistance in buying down risk. There is need to develop or interest specialized producers of forages for trading as alternative to mixed farming and grazing systems.
- Across the countries there is low utilization of installed processing capacity which has implications on business profitability and can inflate consumer prices resulting in reduced milk and dairy products consumption. It can also be an indicator of underdeveloped supply chains, inefficient collection including milk spillage and spoilage, side marketing or existence of a large informal sector and probably lack of shared value along the value chain. High prices of processed milk limit market expansion to the upper middle class. An inclusive approach that allows licensed milk traders who receive certified training and finance to invest in appropriate equipment can help to improve the quality of milk and supply more milk for processing.
- Inadequacy of dairy financial services is a characteristic issue across the countries. It has been noted that the financial services sector has not structured appropriate products for the dairy sector. Also, the public sector oriented approach to sector development does not allow the growth of commercial financial services products in the sector. Again, readiness to receive commercial financial services depends on the stage of dairy development of farmers and ultimately the whole country. It can further be argued that the financial services sector does not fully understand the potential business in the dairy sector; alternatively, the dairy sector has not adequately demonstrated a commercial

orientation and the existence of attractive returns. Recent work by RDCP II in Rwanda demonstrated that the financial service providers can offer financial products for the dairy sector; however, they are often not willing to invest in exploring the financial products development opportunities. While collateral has been the prerequisite for lending, it has been proposed cash flows could provide evidence of business performance, and hence it can be a basis for creditworthiness.

- Public infrastructure, particularly road networks, electricity and fuel availability, and efficiency of communication networks influence all the components of the dairy value chain resulting in inefficiencies, higher costs and, ultimately, reduce competitiveness. Broad government support to public investment in infrastructure, electricity grid extension at low prices, affordable fuel and access to dairy training are first priorities to expand the dairy sector.
- Organization of farmers and service providers into groups for lobbying and advocacy has been limited in most countries, and hence this has compromised dairy sector progress. Again, the countries differ depending on the stage of dairy development. In Burundi formation of dairy farmer groups is only emerging despite the existence of such groups in the coffee sector. In a lot of instances formation of these bodies has been externally initiated but the intended beneficiaries neither have a good understanding of the need, nor do they have a vision for growth and sustenance of the bodies.
- Donors have supported different activities in the dairy value chain. The major focus has been on smallholder farmers but not on specific areas such as feeding, disease control, and environmental issues. Donor investment should be based on sustainable dairy value chain development, sharing responsibilities between the private sector, government and donors and ensuring that public funds support public functions and do not create distortions.

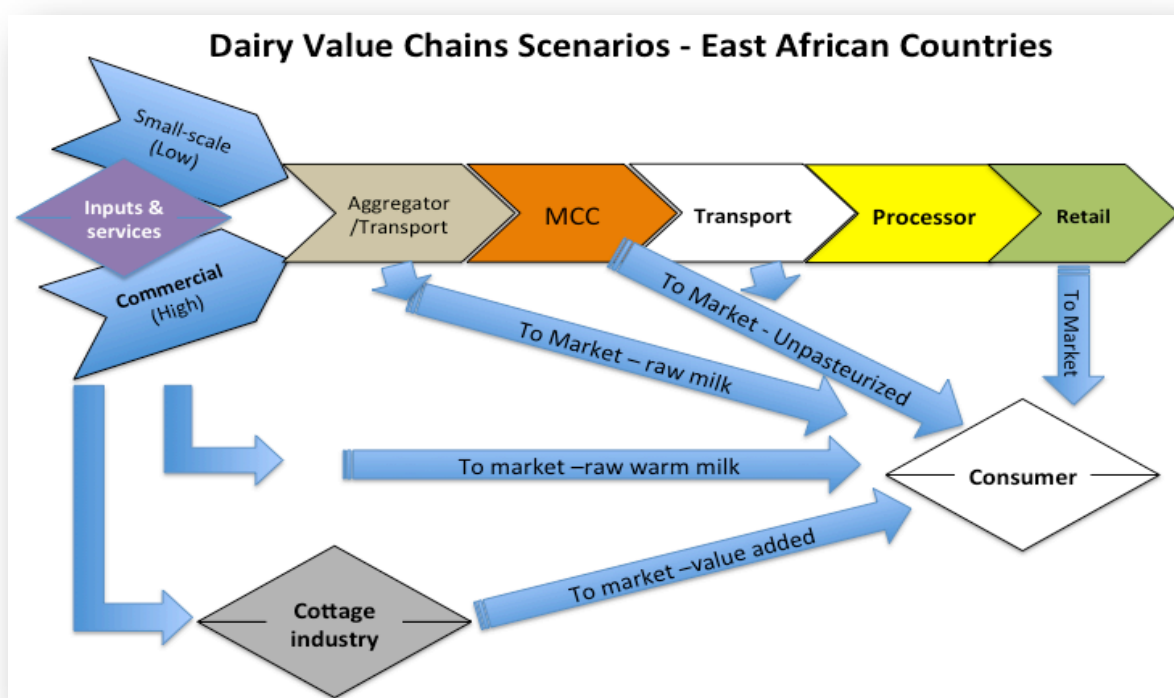


Figure 3.1: Aggregate dairy value chain scenarios for Ethiopia and East African countries.

3.1 Comparative regional dairy structure/value chain and extent of regional dairy development

As stated above, the dairy value chains across the region are largely similar in that the informal sector dominates. The various combinations of value chain players are illustrated in Figure 3.1. The stages of dairy development determine the complexity of the key players and support services available. Clearly, the simplest generic value chain structure has the key players as producers, transporters, milk collectors and sellers, and consumers. This simple chain structure has been characteristic of the Burundi dairy

value chain, but it is emerging with more bulking centers being established. This is a structure in which even support services are not likely to have a market and the producers are largely subsistence with sales arising from surpluses of household requirements.

The stages of development are determined by, among others, type of dominant producers, productivity, degree of farming specialization, land holding, nature of land tenure, proportion of dairy breeds, dairy management knowledge, access to dairy inputs and technology including a milk cold chain, institutional capacity, access to markets and credits, and existence of a middle class with disposable income. While Kenya has not reached the ultimate stage of development that is characterized by commercial efficient production based on large scale farms, it is the most developed dairy sector with regard to the latter determinants.

The Kenya dairy value chain is characterized by many players and support services. It has a range of producers, small, medium and large scale; bulking units (MCCs), a wide range of transporters including processor-transporters; processors of a wide range of processing capacities, and even with regional expansion ambitions; milk distributors at wholesale and retail levels; and informal milk buyers and sellers; and finally consumers. The support services including feed supply, AI, veterinary services and dairy product diversity are stronger than in all the other countries. Ethiopia, Tanzania, Rwanda and Uganda dairy structures lie on the dairy services diversity trajectory between those of Burundi and Kenya. A key issue is the poor collaboration between farmers to jointly organise bulking of milk for processing and to jointly receive inputs & services like extension; this is offset by individual behaviour ignoring contracts for a little more money per liter of milk. This affects long term market stability and security.

3.2 Challenges and opportunities in regional dairy sector and shared challenges across the region

The key overarching challenge across the region is transforming the informal sector to a formal commercialized sector that has traceability safeguards. This can be even more justifiable if there is consumer demand for good quality products that pose less health risks. Credible sources of data are a challenge across most of the countries making it difficult to make accurate projections. The official sources are often not run by a cross section of staff with appropriate competencies and experience. In a country such as Burundi the risk of sporadic civil unrest has made the country unattractive to donors and foreign investors.

In efforts to transform the informal to the formal sector as demanded by the governments across the countries, development agents should ensure that what farmers are producing is safe and the farmers they are assisting will later become part of the chain. However, it has been argued that cost benefit analysis should be done to justify wholesale transformation from the informal to a formal sector. Where it is justifiable to transform to the formal sector, development agents should adhere to standards and quality issues when dealing with the poor farmers given cattle. They should train them before cows are given to avoid poor management, animal welfare and human health issues, and then understand that these farmers will transit to be bigger dairy farmers and at all times milk from their animals should be of good quality for their health and public health. The framework for intervention/engagement should be innovative, use of communication platforms, emphasize building capacity of locals and minimize importation of expatriates.

Hawkers and traders should be trained and encouraged to work at a higher hygiene level so that they can afford to purchase the right kinds of equipment e.g. testing, milk cans and saddled bulk transport tanks. They should be able to challenge farmers offering below standard milk.

In order to support the transformation from the informal to the formal sector, challenges that need to be addressed are largely similar across the countries but the severity of each generic challenge depends on the stage of dairy development. While Kenya is ahead of all the other countries in per capita milk consumption and supply, milk supply is still lower than expected across the countries. Invariably the low supply is, among others, a consequence of inadequate feed supply, inappropriate cattle for dairy production, low productivity of the cows, high cost of inputs (e.g., feed and fodder) leading to seasonal production, inadequate in-country and transboundary disease control, lack of incentives to stimulate production, low adoption of dairy industry technologies and low capacity utilization among processors, inadequate capacity of farmers and extension providers, poor market access, inadequate financial services, inadequate organization of farmers and coordinating bodies, and weak uncoordinated donor support. Burundi, Ethiopia, Rwanda, Tanzania and Uganda have per capita milk consumption of 60 liters per annum or less. Across these countries the latter challenges are evident but the gravity differs by

country. Donors and governments can fund economic studies on various milk production models, to understand profitability and compare it with alternative crops. The price the formal market offers is often not very attractive for farmers, but the formal market should offer long term price guarantees assisting farmer in planning capacity development.

Countries such as Burundi, Ethiopia, and Tanzania are still trying to build up their dairy herds through increased use of AI whereas Kenya embarked on this program long ago; hence, Kenya has comparatively less need to increase the dairy breed herd. The challenge for Kenya and all the other countries is to tap the full genetic potential of the dairy breeds through productivity improvements.

Related to productivity improvement is the limited conservation of fodder and feeds for dry season feeding across the region. For some reason, messages and demonstration on the need for fodder and feed budgeting have not been widely adopted leading to limited feed availability during the dry season. In turn inadequate feeding during the dry season reduces milk production during this period. Invariably farmers across the region should recognize that costs of feeding are reduced through maximum use of home derived feeds including conserved fodders. It is not clear why this message has been hard to sell. Possibly because farmers value daily income and sale of calves and old cows, but do not account for daily input costs. Also studies of smallholder dairy farmers show this pattern ignoring costs of feed, health, AI, labor and often women's labor does not count.

Lack of bulking and processor capacity utilization has been a challenge across the countries. This is probably an indication of either incorrect assumptions or inadequate data and information for planning. In some cases the bulking facilities have been funded by donors and government with little regard to sustainability and operational viability. Kenya is different in that there are a few large processors that are now dominating and can acquire the quantities of milk they require to utilize their capacity. EAC has no internal barriers, so Brookside can easily compete with small processors in neighboring countries. The case of formal processors in Tanzania that are closing down is retrogressive towards the formalization and competitiveness of the regional dairy sector. The lack of formal processors can compromise milk and dairy products standards implementation and enforcement.

Most of the countries aim to or have privatized extension services (as a result of the SAP in the 80-90 era), but this is not likely to be appropriate for some countries (e.g., Burundi, Ethiopia, Rwanda and Tanzania) that are at the early or middle dairy development stages and for the large majority of farmers at the smallholder level in Kenya, Tanzania, Uganda. For example, in Ethiopia at the onset of sector liberalization, the government withdrew from extension services but private extension services are few and expensive; as a result, dairy extension services are inadequate and have compromised the dairy sector productivity. Public sector and donor supported extension services should have been maintained to take the sector to a competitive stage where private investors are attracted because of economies of scale and compete. In general, to upscale the dairy sector, stakeholders, including government, will have to address extension delivery through appropriate policies that support dairy sector growth. It has to be acknowledged that a predominantly smallholder sector is unlikely to access, let alone afford, private extension services, relevant technologies and investment resources needed for improved productivity and competitiveness.

Disease control in relation to notifiable diseases has always been a government responsibility and weak services expose farmers buying a Euro 2,000 in calf heifer to risk when FMD or East Coast Fever is rampant. Transboundary disease control should be handled at government level and at regional level. If the regional dairy sector is to be competitive then there has to be joint effort to control diseases of international concern including foot and mouth disease. Tanzania is an example of a country that has a government veterinary service that is buttressed by the NGOs and private service providers but there is high calf mortality. While the government has to assist in controlling notifiable diseases and zoonoses and food safety, ultimately the control of key dairy diseases at farm level is the responsibility of the farmer and private veterinary services augmented by CAHW integrated to the hubs or MCCs and also operating private veterinary service and input supply shops. For example, control of important dairy diseases mastitis, foot and leg problems, reproduction, feed associated- disorders, particularly brucellosis, should be a public private-partnership for public health reasons and mostly farmer responsibility since these can be prevented by best management practices e.g. maintaining vaccination schedules eliminates incidences of brucellosis.

All the countries lack professional support services including veterinary and extension services. Notifiable and tick-borne diseases are common leading to high mortality and production losses especially from foot and mouth, East Coast fever, lumpy skin, anthrax and contagious bovine pleuro pneumonia. A regional approach to animal movement, identification and disease control is essential particularly for investment in dairy cattle by farmers, heifer and dairy cattle trade. Private sector donors and governments should collaborate to address this constraint especially vaccine production and quality control, regional

vaccination campaigns, veterinary drugs distribution and quality controls. Interviews in Kenya, Uganda and Burundi revealed that tick resistance to acaricides was increasing and this would require governments to address the constraint and donors can fund capacity building and awareness programs to save farmers investments. The Bill & Melinda Gates Foundation has been funding GALVMED for ECF tick control by the Infection and Treatment Method vaccination programs. In Kenya and Uganda the East African Dairy Development Program-I (EADDP I) collaborated with GALVMED to vaccinate dairy cattle. FAO also funded purchase of liquid nitrogen tanks and facilitated private veterinarians to adopt this technology for Tanzania and Kenya. Ethiopia, Rwanda and Burundi should be encouraged to adopt the technology as it reduces both cost of prevention and drug resistance by ticks.

The countries can pool resources and jointly fund institutes for vaccine production (in Kenya and Ethiopia). Advantages would be in implementation of agreed vaccination schedules, preventive measures and treatments facilitate crossborder trade. They should also develop regional mitigation strategies such as traceability and animal movement.

While crossbreeding domestic breeds with sexed semen offers tremendous return on investment (ROI) for the East African producer and is a sustainable solution to increase the productivity of underutilized lands, sexed in vitro fertilized (IVF) embryos can be an important component for producers hoping to maximize returns per acre of grass but do so in a manner that preserves the environment. The sexed IVF technology can be promoted at regional level and by utilizing elite genetics crossed to indigenous breeds appropriate genetics for dairy can be produced similar to (Gyr x Holstein) Girolando females in Brazil or Holstein x Sahiwal in India that will have the genetic capacity to produce over 24 liters per day on improved pasture/grass, which is lacking in East Africa countries. Furthermore, through AI the offspring from a domestic breed and a global elite sire may have the capacity to produce about 20 liters per day. These technologies cannot be ignored and should be facilitated through conducive government policy, governments and donors funding facilitation of programs training artificial breeding technicians (ET and AI) and funding establishment of liquid nitrogen production and distribution infrastructure. Given the increasing demand for improved dairy breeds, in the region, donors should also collaborate with international breeding companies to buy down risk and encourage bull stud business partnerships that can produce affordable tropical genetics and training of artificial breeding technicians.

Attention should be paid to planning of crossbreeding and its level resulting in crossbred cattle fitting the environmental conditions. Conservation: Breeding plans for the indigenous breed rests with public responsibility.

Donor support and implementers have often been uncoordinated, except in Rwanda where all donor and NGO interventions have to be congruent to individual district annual plans and performance contracts. While this creates bottlenecks for donors, it allows their programs to be complementary and the districts can invite input on their specific needs.

The largest opportunity in the region is a huge potential to produce large milk quantities through simple improvements, for example, improved cow productivity. There is a potential large market provided milk consumption is promoted. This could be done through milk consumption campaigns including for luxury dairy products by processors and retailers that can pull supply and contribute to improved human nutrition. The milk consumption increase may also come naturally with the growth in the urban population and a middle class with disposable income that is evident in cities across the region. Across the countries per capita milk consumption has been projected to grow with targets set in national dairy strategies including that for Rwanda; hence, this will create a larger demand for milk. There is also potential to increase the diversity of dairy products across most of the countries. In this regard Kenya leads with at least 11 types of dairy products compared to the rest of the countries that have less than seven. The region has great potential to produce dairy products such as milk powder which have a potential for export.

Ethiopia has introduced incentives that have encouraged investment in which smallholder livestock farmers are eligible for tax holidays and duty-free imported capital goods for agro-processing such as milk collection and bulking centers, dairy processing plants, feed processing. This has increased dairy development and milk production.

The climate of the East African region is suitable for dairy production. Because of two seasons of rainfall, and hence two seasons for crop production, in some areas, opportunities to conserve feeds are large. Among the six countries, Uganda is a good example that has the advantage of a fertile land resource, a favorable climate (good rainfall and low temperature variability) and abundant pastures for low cost milk production.

3.3 Comparative economic, environmental, gender and social performance programs of country dairy sectors

Most of the dairy sectors of the countries are growing but there has been limited attention to gender balance in dairy development. Economically there is rapid growth of the dairy sectors in Ethiopia, Rwanda, Kenya and Uganda and they are likely to continue contributing substantially to GDP growth. Increased commercialization of activities is contributing to this economic growth.

Good examples of dairy sector development that is anchored on benefiting the poor are in Ethiopia and Rwanda. Ethiopia has the GTP program that is transforming the agricultural sector and dairy in particular and is anchored on pro-poor policies to support such development. While the Government of Rwanda (GOR) has developed the Vision 2020 in which dairy supports the vision's pillars, and key strategic documents that are addressing poverty reduction, agricultural growth and, specifically, dairy sub-sector growth. The Rwanda NDS seeks to increase per capita milk consumption from 40 liters/year to 80 liters/year through promotion of consumption by current milk consumers and the one third of the Rwanda population that does not consume milk. Rwanda has dairy-related socio-economic programs including the "One Cow per Poor Family" (Gir'inka) program that has distributed more 133,000 cows to poor households and aims for gender balance in cattle distribution. This is a model for increasing the supply base for dairy and for increasing availability of milk for human nutrition. However, such programs should facilitate herd expansion and growth of these smallholder herds into commercial entities for example through customized dairy cattle financing and insurance programs.

Clearly, Kenya, Rwanda and Uganda have focused on dairy by developing national strategies that give emphasis to the dairy sector and its potential for GDP growth. Across the countries a strategy focusing on the dairy and promulgation a dairy act can enhance not only growth but competitiveness of the dairy sector. Unfortunately, there are no dairy acts in Rwanda and Uganda.

There is increasing attention to environmental issues and across sectors. For example, Tanzania, has appropriate policies and strategies for environmental and water resource management are in place. However, the relationship between the environment, natural resource management and dairy farming activities has not been established. This is an agenda for action across the countries, including planning of dairy enterprise locations, protecting water resources, and simultaneously making water resources available for dairy cows and cleaning of utensils. Increased milk production per dairy cow is simultaneously economically efficient and reducing the carbon footprint, opening opportunities for payment. Investing in manure management can save expensive fertilizers and has positive effects on soil fertility. Dairy farming can have a positive role in crop rotation halting the degeneration of soil fertility on land solely used for maize production.

There is intra-regional milk trade with Kenya dominating the export market. However, Rwanda and Uganda also supply, largely informally, the Burundi and DRC markets. Ugandan milk and dairy products are also marketed in Rwanda and Kenya. However, opportunities for export of value added products, particularly cheese, to all East African countries exists because of lower product prices. Challenges that have precluded formal exports include the poor quality of raw milk and weak enforcement of milk standards. However, this challenge is being tackled through the introduction of milk and dairy products certification programs and milk quality regulations. The cold chain is being extended and improved to assist in maintaining milk quality along the whole dairy value chain.

Gender equity

It is acknowledged that participation of women in dairy is still low and moving towards gender balance will take long because traditionally women do not own cattle across the countries and in some countries women (e.g. widows) cannot inherit land and cattle. However, women substantially participate in dairy activities. Also, when the operations become large women are increasingly excluded. There is mention of gender mainstreaming in the dairy sector but practically this has been implemented at a slow pace. However, positive attempts have been made by the Ethiopian government in its GTP that stipulates gender mainstreaming and women participation in dairy technology usage. Also, the Rwanda "One Cow One Poor Family" program has affirmatively distributed cows to women. Unfortunately, the dominance of men in the households leads to the cow ownership de facto reverting to the men.

Both men and women engage in dairy sector activities but face different challenges. In Rwanda and Uganda interviews there were fears that dairy intensification would increase the burden of women as they are often left to manage dairy cattle activities including feeding, watering and milking animals. Such roles revolve around the homestead, yet milk sales and marketing occurs a distance from the homestead. Thus, the latter becomes a men's role and increases risk of unequal share of milk revenue.

In India daily payments for milk at the collecting centers resulted in more payments (in small amounts) made direct to women who bring the milk. Monthly or weekly payments made it worthwhile for men to go and collect. Low education and literacy skills, access to property titles that can serve as collateral, inadequate access to training and market information and gender-blind policy and regulatory environments are among the constraints that block women from fully tapping available economic opportunities (SNV, 2013). Thorough diagnosis of existing gender inequities at community and household level is critical. Only 7 per cent of women in Uganda own land, and only 30 per cent have access to and have control over resources (UN, 2008). Anecdotal evidence shows that it is often difficult for women to express their concerns in public, therefore strategies to conduct women-only sessions helps to ensure that women voices are heard before formal stakeholders discussions.

In Uganda, SNV facilitated the capacity strengthening of 13 dairy producer groups (with a majority female membership) in improved dairy and food production techniques, leadership and milk marketing skills. As a result, women producers have become much more proactive in identifying and investing in other critical areas of improvement, such as biogas for domestic energy (SNV, 2013). Dairy development progress and sustainability can be measured and enhanced when there is increased women and youth active involvement through access to and active control of productive assets including land and cattle and are able to actively sell and market their dairy produce, gaining control of their dairy income. Projects should therefore prioritize gender equity beginning with their implementing staff to field activities. Women participation can measurably increase project impact and this can be increased through management capacity building, affirmative action, planning for meetings at appropriate times and women friendly venues where they can have child care services during meetings and trainings, availability of separate toilet services and water in the meeting places. The selected venues should be either closer to their homes or facilitate transport. It is also important for facilitators to ensure that women organizations are well represented so that women's concerns are taken into account when designing dairy development strategies. Technical and business training, access to information, networking, cooperatives development, diversification, and many other activities will expand women's skills and opportunities (USAID/AGP-LMDP, 2013). Development of women friendly technologies and affirmed women extension in dairy will also increase participation. By ensuring such dialogue processes, facilitators can help to ensure that. The role of women should be along the whole value chain and not just farm production. Roles should extend to processing, inputs and service provision to increase their economic empowerment.

Country interviews revealed that gender issues have often been confused with sex balance disaggregation at reporting and social construction that has to do with male– female differences and not with issues related to roles, responsibilities and access to productive resources. Also, tribe, cultural backgrounds, predominance of traditions, customs and beliefs that men are considered to be superior to and more intelligent than women are responsible for the gender inequalities. Therefore, at onset of dairy development interventions, it is important to understand prevailing gender equalities and constraints at household and country levels, *inter alia*, how to increase women access to technologies, inputs, financial services, high value markets and multiple enterprises.

Despite efforts to increase women participation in dairy, throughout the 6 East African countries studied, there are few women in dairy cooperatives, unions and associations leadership positions. All East African country governments are committed to achieving gender equity, and give this objective specific attention in their constitutions and policy initiatives. However the Government of Rwanda has developed policy and legal reforms in areas critical to advancing women's economic status and wellbeing. Legislation and policies to promote gender equality and empower women is included in 5 laws and policies. A key challenge for all governments, development partners and private sector is identifying the ideal gender specialists who can unlock gender quality and increase the role of women in dairy.

3.4 Emerging regional dairy issues

The emerging regional dairy issues are primarily the recent interest in investment in the dairy sector by regional (e.g., Brookside of Kenya) and international (e.g., FrieslandCampina) processors. This interest is a reflection of the confidence the processors are having in adequacy or potential for increased milk supply. This is likely to change the nature of dairy business in that it is likely to promote a commercial orientation along the whole dairy value chain.

For example, lead milk processors in Kenya, Rwanda and Uganda are now exploring quality based milk payment systems. Also, the entry of international dairy companies is a game changer as it forces East Africa operators to develop supply chains as opposed to random milk buying. Also it will lead to milk quality improvements and stability in milk supply chains. This is also likely to shift focus to production

economies of scale, and hence offers opportunities for smallholders to grow to medium sized specialized dairy farms which can be supported through farmer education on best management practices and access to dairy cattle insurance and financing schemes.

There is increasing investment in milk powder production with big processors in Uganda coming on board. This is a welcome development because it could even out the fluctuations in demand for milk from milk buyers. Because milk production is seasonal characterized by over supply during the rainy season and under supply during the dry season, differential and quality based milk payment schemes, conversion of milk into milk powder and UHT allows mopping up the oversupply during the rainy season.

The EAC continues improving its trade policies that has led to reduction of trade barriers, and hence allowing free flow of dairy products, ex/imports of dairy cattle, bull semen, feed components, and veterinary medicines across borders within EA. This will and has resulted in surpluses from one country crossing borders. While this is desirable to the established dairy countries, it may inhibit dairy development in emerging dairy countries. For example, in Rwanda and Burundi Ugandan milk and dairy products, as a result of low prices, out-compete the local products.

The link between dairy farming and environmental conservation which, hitherto, was not seriously considered has become topical in the face of the climate change challenge and decreasing soil fertility. The disconnect between policy and programs in environment and natural resource management, including water resources and the dairy farming, should be a focus of sector development strategies in the region.

Repeatedly, UHT milk from regional processing plants was said to have a shorter shelf life than indicated on the product and the shelf life was shorter than that of milk from Europe. This is probably a consequence of the poor quality of milk used.

3.5 Prospects for sustainable growth of regional dairy sector

There are prospects for sustainable growth across the region provided inclusive models such as gender mainstreaming activities, training and financing of milk hawkers to become milk traders, that promote dairy development across the levels of production (i.e., small, medium & large scale) are adopted. The need to create economies of scale in milk collection and processing and a promotion of farmer growth and transition from subsistence to commercial and smallholder to medium & large scales critical to drive sustainable regional dairy sector growth. As long as the population of the countries in the region continues growing and allied to this the population of a middle class with disposable income grows, demand for milk will increase, and hence sustain growth of the industry. It is likely that growth of the dairy sector will lead to economies of scale for provision of services leading to business expansion. The signs of sustained growth are evident across the countries although the pace of growth varies for individual countries.

Of importance is the acceptance by the countries of a market led economy that transforms subsistence farmers to commercial production to promote growth of the dairy sector. This is important in countries such as Ethiopia and Tanzania that had socialist agendas which slowed down dairy development progress.

Governments have an important leading role in public investments for road infrastructure, electricity grid, lower costs of electricity and fuel, secure low inflation rates, provide security, education and training, extension and veterinary services for animal and human health. Private investors will initiate dairy investment when public conditions are secure and banks and donors add to an attractive environment for investment.

3.6 Production, economic and other models for sustainable regional dairy sector growth

Invariably any models of dairy production should have a commercial objective that is driven by adequate financial services and a business approach. However, across all countries large scale dairying has remained below 3% of the dairy sector production and is still not growing. Dairy knowledge and entrepreneurship are missing. Githunguri Dairy in Kenya is a showcase of smallholder dairy growth and its success is attributed to qualified and experienced management and good farmer leadership. The Land

O'Lakes Cooperative development projects in Kenya and Uganda are studying the attributes that are essential for such successful cooperatives.

Unfortunately, the model anchored on business development is not appropriate for some of the countries' dairy sectors and building social capital is also important. However, all the countries recognize that a model for sustainable dairy sector growth takes into account the supply and demand side that have to grow in synchrony. Clearly, for growth in milk supply the public sector needs to invest substantial donor, public and private funds in, among others, breed improvement, disease control and extension services (for business management, milk quality and forage and feed production). When this supply base is established an increase in demand can be satisfied because the base to increase milk supply exists. The other commercial activities including value addition and product diversification can now further increase demand that can be met from the elastic production base. It is clear that while market demand can stimulate production it can also be met through imports. This implies that the local dairy sector has to be competitive through, among other strategies, improved productivity, shared value across the value chain, efficient performance of the value chain, and good quality products across the value chain.

Farm production models do not all need to be zero grazing dairy farms. Specialized forage producers may become part of the dairy value chain as well as specialized heifer rearing farms. Depending on land availability and soil fertility and religious/cultural beliefs other models can be developed, like the seasonal grass based systems and specialized butter and cheese production to address fasting periods. The latter production systems require fitting value chain structures to link to markets.

3.7 Adequacy and relevance of donor policies and programs for dairy sector development

Donor programs have been based on internal donor policies and the plans of governments on dairy development. In some countries there has been focus on the dairy value chain as a key contributor and a key driver of economic growth, particularly in the rural areas. The national dairy strategies of the East African countries emphasize the importance of public-private-partnership in the achievement of the national dairy strategy objectives.

Across the countries, several NGOs and donors have contributed directly, through projects, to dairy development (Appendix 2). Most are in line with the plans of the governments and in some cases such as in Rwanda the plans have to be scaled down to the district of implementation. Most donors consult governments before deciding on the value chains or areas to support. However, much as the donors consult the relevant government authorities but there have been allegations that some donors come with blueprints that they "persuade" countries to adopt. A case in point is the National Agricultural Advisory Services in Uganda (NAADS) that was established through substantial donor support to lead privatization of extension services but it has not been as successful. Veterinary services suffered as they were reduced budget resulting in, lack of quality control of veterinary medicines and vaccines, non-availability of vets, no expertise, no building up of alternatives like para-veterinary clinics. Veterinary extension service is now offered by Agronomists, and the organization has become a procurement agency. There are now concerns that the model adopted is inappropriate for the stage of agricultural development in Uganda.

In general, it is perceived that there is room for donors to embed their projects in the framework of government dairy sector programs without losing sight of their objectives. It is also clear that across the countries the key donors supporting dairy are few and they could easily create a platform to share responsibilities and areas of focus along the value chain or in disparate geographical locations.

3.8 Opportunities for donor collaboration and linkages with dairy sector platforms across region

Opportunities for donors to collaborate within a -country or across the region to address transboundary agendas and issues affecting the dairy sub-sectors and trade. Platforms should be created for donors to share information on developments across the region and apportion areas of intervention. A lot of donor efforts in the region have been on activities along the whole dairy value chain but this has not given adequate focus on some components of the dairy value chains or to the efficient performance of the whole value chain nor the need for shared value across the chain. For example, few donors are supporting increase in milk consumption that can increase demand for milk. In addition there has been little focus on increasing productivity of cows through developing robust feed conservation programs. Further, data collection and data set maintenance have not been adequately supported by donors and

yet all planning and projections are based on data that in many instances is not verifiable, and hence may not be valid. BMGF has decided to focus on diseases, breeding and the functioning of the dairy value chain. Many donors have created special investment funds to encourage private sector participation at SME level in both donor and recipient countries. An integrated approach regarding the identified need for subject matter/expertise and funding appear to be necessary without forgetting what the private sector, the backbone of the dairy value chain, can achieve by itself to prevent distortions and discontinuity.

4 Country dairy value chain summaries

The dairy value chain summaries of the six countries (Burundi, Ethiopia, Kenya, Rwanda, Tanzania & Uganda) in the study are presented below. They capture, among others, background country resources for dairy; the key strengths, weaknesses, opportunities and threats, government policies that affect the dairy sector; donor programs, policies and collaboration among themselves and their implementers; and the socio-economic impact of the dairy sector including gender sensitivity of the dairy sector programs. These summaries (Table 3.1) bring to the fore the issues that are discussed in the following chapters on the regional dairy profile and comparative analysis.

4.1 Burundi

Burundi has been going through post-war rehabilitation since 2005. While the livestock sector contributes just 5% to agricultural GDP, in order to meet the strong demand for livestock products, rebuilding of the livestock herds including the dairy herd have been a priority. Burundi has a suitable climate for dairy farming, particularly in areas close to the capital city, Bujumbura, where there is no challenge from tsetse flies that transmit trypanosomiasis. With a population of 10.9 million, Burundi has a per capita milk consumption of 6liters per annum, which is below those of other East African countries. It has been projected that the per capita milk consumption will increase to 35 liters per annum in 2020. In-country milk production steadily increased from about 20.5 million liters in 2005 to about 73 million liters per year currently. Consistent with this increase has been the growth of the cattle herd size from 355,000 in 2003 to 645,000 in 2013 with about 10,000 being improved breeds.

The current Burundi National Agricultural Strategy is generically designed to: (i) sustain growth of production and agricultural productivity; (ii) promote industry and agribusiness; (iii) support the professionalization of producers and the development of private initiatives; and (iv) strengthen management capabilities and develop the agricultural sector.

These objectives also apply to the dairy sub-sector in which there are government and donor supported programs that not only aim to rebuild the dairy herd through importation and improved natural herd growth, but also to improve the cattle dairy quality through AI. Annual inseminations have increased from 3 to 4 thousand in the year 2000 to the current 10,000 with an annual target of 30,000 in the next two years. Dairy breeds that have been introduced and bred to the local Ankole cattle include the Sahiwal, Friesian, Montbéliarde, Brown Swiss, Ayrshire and Jersey.

Consistent with the objective to promote industry and agribusiness, there is a thrust to formalize the dairy value chain through introducing milk collection centers (14 so far established largely through donor support, government and partners' plan is to establish 84 in the country), developing a cold chain for milk throughout the value chain and promoting investment in milk processing and distribution of milk and dairy products. Two companies are processing milk (~5,000 liters/day) for the Bujumbura market. The challenge is unreliable electricity supply that increases the risk of milk spoilage; as a result, the processors have reduced the volume of milk processed. One of the two processors, Natura products, has purchased equipment to process 10,000 liters of UHT milk/day. Artisanal cheese producers exist in areas that are far from Bujumbura but cheese processing has been a way to mop up the milk produced in the locality that, because of low local demand, cannot be sold as fresh milk. The Government of Burundi and its partners have recognized the need to improve milk transportation from distant rural areas to the urban areas, particularly Bujumbura, where there is a strong demand for milk and dairy products.

Again, consistent with the third objective of the National Dairy Strategy, there are donor and public sector efforts to train and build the capacity extension workers and farmers. Extension and veterinary services were devolved from the public to the private sector without allowing a phase out period. As a consequence, extension delivery is weak. NGOs are now delivering extension services and some are using the farmer field school approach. Private veterinary services are weak and there are few veterinarians in the country. In addition, farmers are being encouraged to form gender mainstreamed associations that are expected transition into strong organizations to lobby for their sub-sectors. Regarding gender mainstreaming, while women are engaged at the agricultural primary level of production, their role in the dairy value chain is not clear. However, at the professional level there is low women participation; for example, women hold about 15% of positions in agricultural research institutions. Apart from the lack of gender balance and inadequate producer organizations, the absence of a dairy coordinating body and public sector focus on the dairy sector has been recognized. Fortunately, the need for such dairy sub-sector advocacy bodies is now regarded by the government and its partners because the dairy sector has grown.

4.2 Ethiopia

Ethiopia dairy development has passed through three notable political phases. Modern dairy in Ethiopia started during the imperial era that was a progressing phase followed by socialist era which was known for its declining phase and the market led economy phase that was started after the current government came to power 1993. The market led economy encourages private sector investment in livestock/dairy farming and industrial sectors that are eligible for tax holidays and duty-free imported capital goods. However, the policies that favor private sector engagement are less practiced at ground level, making it difficult for the private sector to progress. More policy and trade issues might be required to improve the engagement of the private sector in dairy sector however; there is no institutional framework that allows the private sector to participate in policy development and implementations.

Ethiopia has a global share of 2.86% in terms of livestock population, ranked 8th in the world that is almost equivalent to the livestock population in the entire USA that has a global share of 2.83% ranked 9th next to Ethiopia. However production and productivity is very low and Ethiopia is not self-sufficient in milk. There is unmet demand for dairy products in urban and village town markets that lead the country to spend foreign currency every year to import dairy products; for instance in 2012, the country spent USD14.4 million. The country has also export market potential for dairy products. In 2011 for instance, the country exported dairy products value USD 3.3 million, while imported dairy products value USD10.6 million for the same year. So far no work has been done by the public or by donor supported projects to export dairy products. The plan has been to satisfy the domestic market to be self-sufficient in dairy products and still need long distance to travel to achieve this.

Per capita milk consumption in Ethiopia decreased from 26 liters in mid-1980s to 16 liters in 2001 and rose to 19 and 20 liters in 2009 and 2010, respectively, now estimated to be 18.87 liters, which is extremely low in comparison to Africa and world average. Milk is also a cash crop for smallholder farmers. There are three milk production systems in Ethiopia, urban, peri-urban and rural production systems. Considering all three, cow milk production was estimated at 869 million liters in 1992 and consistently increased to 1,100 million liters in 2000 and 3,300 million liters in 2011. These increases come largely from increased number of cows not increase in productivity. Milk production enhancement inputs and services are limited in Ethiopia.

At present Ethiopia is implementing the GTP (Growth and Transformation Plan) that is being executed from 2010/11-2014/15 to facilitate the AGP (Agricultural Growth Program), with long term vision to be middle income country by 2020. The GTP aims at restructuring the agriculture sector from subsistence to commercial production system. The CAADP-PIF promotes a strategic framework to eradicate poverty and hunger with market oriented approach and the participation of the private sector. The major dairy activities are breed improvement, pasture development, and animal health services. AI is largely to be used to improve cattle breeds, also local cattle breeds will be selected for milk production. Forage production, zero grazing practices, access to feed supplements and conserved feeds will be addressed to improve feed supply. The three years of the GTP period is almost completed and it is unlikely that the targeted plan for milk will be achieved by the end of the GTP period.

The AGP is supported by multilateral funded projects with good focus in dairy sector development. The on-going livestock projects that are focusing on dairy are LMD and EDGET that CNFA and SNV are implementing respectively. USAID and DGIS (Ministry of International Cooperation of the Netherlands) funded LMD and EDGET projects for five years respective. It is essential that the public sector also donors interact with the private sector to facilitate the achievements of the planned projects of the AGP and GTP but so far was limited.

Women play a predominant role in performing almost all dairy farm activities with the exception of breeding (e.g., AI) which is usually the domain of men. The GTP and AGP stipulate gender mainstreaming and women participation in dairy technology usage. So far, dairy development projects have given limited support to women.

Building capacity of dairy value chain actors and supporters through tailored trainings and knowledge management are also key issues in technology scaling up process of dairy growth program. Moreover training and preparing young animal science graduates in enterprise skills in specific career in the value chain would be key issue in Ethiopia.

4.3 Kenya

The dairy sub-sector contributes an estimated 8 per cent to GDP. It provides employment to 700,000 households, mainly in the rural areas. The dairy value chain in Kenya comprises smallholder, medium and large scale farmers; bulking, logistics and transport providers; processors; and retailers. Support

services include financial services, feeds and fodder supply and extension services. The high cost transport due to poor road infrastructure, the high costs of electricity, communication, loan interest and inputs (feeds and fodder), low adoption of dairy industry technologies and low capacity utilization among processors, point to a high cost industry. This has negative implications on the growth and competitiveness of the sector. While Kenya has 27 registered processors, the major players, New KCC, Brookside and Githunguri, control over 90 percent of this segment. The processors are, therefore, in a position to determine the price of raw milk and the consumer price of the processed milk. This oligopolistic status of the processor has potential to constrain sector development. It is estimated that there are over 100 commercial feeds manufacturers in Kenya. Most are members of AKEFEMA. Notwithstanding KEBS standards on animal feeds, there is agreement that the quality of feeds is low and erratic. The cost of feeds is also high. This high cost, low quality status of animal feeds has a negative impact on sector productivity.

Animal health is regulated under the Veterinary and Surgeons Act, Cap 366. The Act establishes a Board to control and manage animal related diseases and vectors; however, the implementation of control measures is limited. Animal production is promoted by KAGRC, the public agency responsible for breeding services. Deficit in local semen production is supplemented through private sector imports. Financial support to smallholder dairy farmers is mainly inputs credit through embedded services in the co-operative societies and chilling hubs. Investment in animals and equipment is a recurring challenge.

Extension and knowledge transfer depends, primarily, on the public sector. This extends to technology transfer from research institutions. At the onset of sector liberalization, government withdrew from extension services. Private producers of these services are few and expensive. In the event, the weak and erratic extension service is a factor in low sector productivity. The link between dairy farming and environmental conservation has not been appreciated. The disconnect between policy and programs in environment and natural resource management, including water resource, and the dairy farming, should be a focus of sector development strategy.

The private sector associations in the dairy sector need capacity building to play effective advocacy role. Similarly, public sector institutions should reform to be in tandem with the needs of a growth oriented sector. Related to this is the need to reform the policy and legal framework to facilitate the transformation of the sector. The dairy industry has grown by an average of 4 per cent per annum in the last decade. Production is currently estimated at 5.0 billion liters per annum (2012).

To upscale the dairy sector, stakeholders, including government, will have to address critical challenges of adequate policy incentives and weak extension service and weak veterinary services. As a consequence of limited capital to demand for services and advocacy skills, it has to be acknowledged that a predominantly smallholder sector is unlikely to access the technologies and investment resources needed for improve productivity and competitiveness. A move towards a more commercially oriented sector in line with the ASDS is called for. Government will have to provide leadership in this process of transformation. Emerging issues in the dairy sector growth are, therefore, a dominant smallholder segment which has limits on growth and competitiveness; a weak extension service; inadequate policy, legal and institutional framework; and weak and uncoordinated donor support in the sector with sub-optimal impact. Sustainable growth of the dairy sector will therefore address a common vision which will anchor collaboration between the public, private and development sectors and which will mobilize resources from strategic investors.

The dairy sector has not taken advantage of regional integration, notwithstanding the existence of the Protocol of for the establishment of EAC common market, and a common external tariff that re-enforces regional integration. To take advantage of regional integration, the dairy sector will need robust policies and strategies of growth and competitiveness. It should be noted; however, that Kenya is the center of excellence in dairy development under the World Bank funded EAAPP. This could be the building block of technical collaboration between the four regional countries (Kenya, Tanzania, Uganda and Ethiopia), supported by this program.

4.4 Rwanda

Since Rwanda emerged from the devastating Genocide in 1994 in which economic and social infrastructure were destroyed, it has recovered. The Government of Rwanda (GOR) has developed the Vision 2020 in which dairy supports the vision's pillars, and key strategic documents that are addressing poverty reduction, agricultural growth and, specifically, dairy sub-sector growth. The key documents developed include Economic Development and Poverty Reduction Strategy II (EDPRS II), the Strategic Plan for Transformation of Agriculture III (PSTA III), and the National Dairy Strategy (NDS). Prior to the NDS, a dairy master plan was in place although it is now regarded as obsolete, and hence it has been overtaken by the more recent NDS.

The dairy sector contributes about 33% to agricultural GDP and 6% to the national GDP. With a population of 11.1 million people, Rwanda has a per capita milk consumption of 40 liters per annum which is below those some East African countries such as Kenya but aims to reach an annual per capita consumption of 80 liters by the year 2017. In-country milk production steadily increased from about 112.5 million liters in 2003 to about 445 million liters per year in 2012 now estimated to be 503 million liters. Consistent with this increase has been the growth of the cattle herd size which is now close to 1.5 million (2013). The proportion of improved dairy breeds has also increased and 82% of milk marketed is from improved breeds that make up 28% of the total cattle herd. The national herd increase has been from cattle imports and a massive state subsidized artificial insemination campaign in which hundreds of thousands of cows have been bred.

The Rwanda NDS seeks to increase per capita milk consumption from 40 liters/year to 80 liters/year through promotion of consumption by current milk consumers and the one third of the Rwanda population that does not consume milk. In addition, it seeks to formalize the dairy value chain and, considering the health benefits, orient consumers to consume processed milk instead of the raw milk currently being consumed. The NDS further envisions, improved value addition (e.g., through product diversification) that is expected to use the anticipated milk surplus.

With regard to milk supply, the NDS anticipates an increase in milk supply from 445 million liters/year (2012) to 650 million liters/year by 2017. To this end, it aims to increase the number of improved breed cows and improve their productivity, for example, through improved feeding across seasons. The latter is important in ensuring consistent milk supply, particularly maintaining milk supply during the dry season when milk supply has always been below demand. It further seeks to expand, largely through government and donor funded programs, milk collection infrastructure including establishment of more milk collection centers, and commercializing their operations. The improved productivity and efficiency along the dairy value chain is expected to reduce costs, and hence make Rwanda dairy products cheaper and more competitive in regional markets.

The NDS emphasizes the importance of public-private-partnership in the achievement of the NDS objectives. Several NGOs including the USAID-funded Rwanda Dairy Competitiveness Program II (RDCP II), SNV Rwanda, Heifer International, Send a Cow and the just-ended East African Dairy Development Project have contributed directly, through projects, to dairy development in Rwanda. The projects are being implemented in prescribed districts with RDCP II working in 17 districts across the five milksheds in Rwanda. Since the NDS was developed after wide consultation of stakeholders, most of the projects being supported by the donors fit into the NDS framework.

Because Rwanda is a small country, there are some sentiments that there is a risk of overlaps in donor programs in the dairy sector. However, there is room for donors to work in different districts or different parts of the dairy value chain. Consistent with this is the need for dairy development support in districts in the Southern and Western provinces. In addition, there is need for support to enhance milk consumption and value addition components of the dairy value chain. There are few formal forums where dairy funders meet except the dairy sector and agricultural sector working groups that are facilitated by the Ministry of Agriculture and Animal Resources. Apart from the latter, platforms for implementers funded by different donors to meet are not in place.

Rwanda has dairy-related socio-economic programs including the "One Cow per Poor Family" (Gir'inka) program that has distributed more 133,000 cows to poor households and aims for gender balance in cattle distribution. Traditionally women do not own cattle; as a result, dairy cattle ownership by women is low. The government cattle distribution is reversing this skewed cattle ownership pattern. This is also supported by the Rwanda Constitution which prescribes a 30% women quota in decision making positions.

The Rwanda dairy sub-sector contributes to regional milk supply largely through informal exports to Burundi and the Democratic Republic of Congo. The informal milk exports can be as much as one million liters of fresh and fermented milk per month. Because the price of milk from Rwanda is high, Rwandan milk cannot compete in milk markets in Uganda and Kenya. However, opportunities for export of value added products, particularly cheese, to all East African countries exists because of lower product prices. Challenges that have precluded formal exports include the poor quality of raw milk and weak enforcement of milk standards. However, this challenge is being tackled through the introduction of milk and dairy products certification programs and milk quality regulations for the whole dairy value chain. The cold chain is being extended and improved to assist in maintaining milk quality along the whole dairy value chain.

4.5 Tanzania

With a total land area of 884,000km², and a human population of 49.1 million, Tanzania is mainly an agricultural country. Agriculture contributes 28 per cent to GDP and provides livelihood to 75 per cent of the population. The livestock sector accounts for 13 per cent of the agricultural GDP and approximately 5.9 per cent of the national GDP. The dairy sector contributes approximately 1.53 per cent of GDP.

The dairy industry relies on a mixture of the traditional zebu cattle and cross-breeds between exotic and zebu cattle. The former accounts for 70 per cent of the total milk production. Total milk produced in 2012 was 1.65 billion liters. The main production areas are the Lake Region and northern parts of the country. It is estimated that most milk produced is consumed on-farm and neighborhoods. The informal raw milk channel accounts for 15 to 25 per cent of the marketed milk. The processed milk segment accounts for 3 per cent of the marketed output. Milk consumption per capita is 23.1 liters per annum, and compares to WHO recommended consumption of 200 liters per capita.

The dairy value chain players include livelihood oriented smallholder farmers practicing agro-pastoralism and sedentary dairy farming, and medium and large scale farmers owning in excess of 50 animals. The latter constitutes 6 per cent of the national herd. Bulking and transportation to processors is through informal systems (bicycles, hand carts) and hired vehicles. In most cases, the co-operative societies arrange transportation to the processing plants.

There are over 50 processing plants with a combined intake capacity of 410,500 liters per day. The limited quantity of milk sold through the formal channel has led to closure of 13 processing plants and below capacity utilization in the operating plants (estimated at 30 per cent). Animal feed and fodder supply services are constrained by an under-developed dairy sector and high cost of inputs. The traditional production systems are not supportive of a modern feed and fodder supply sub-sector.

Government is responsible for veterinary services outreach and breed improvement services. Prevalent diseases are East Coast Fever and other trans-boundary diseases. It is estimated that 30 to 40 per cent of calves die each year from preventable diseases. Low genetic base constrains dairy industry productivity. Interventions to improve livestock productivity include strengthening of the Livestock Multiplication Units (LMUs; e.g., for breeding heifers production) combined with improvements including feeding and disease control.

The financial services sector has not structured appropriate products for the dairy sector. The public sector oriented approach to sector development does not allow the growth of commercial financial services products in the sector. The nascent Tanzania Agricultural Development bank offers possibilities of developing appropriate financial products for the dairy industry.

Research and extension services are mainly government responsibility with supplementary support from NGOs and international organizations (ILRI). An elaborate system of devolved governance system provides an effective base for grassroots level extension services. The linkage between research and formal technologies transfer is, however, weak due to inadequate capacity of local level institutions.

Appropriate policies and strategies for environmental and water resource management are in place (NAP, NAPA and water policy). The relationship between the environment, natural resource management and dairy farming activities has not been established. This is an agenda for action.

Dairy industry associations include TAMPRODA and TAMPAA. The co-operative societies play a role in the sector. These institutions require strengthening through capacity building to be effective advocates of sector development. Public institutions include Ministry of Livestock and Fisheries Development; Ministry of Agriculture, Food Security and Co-operatives, and the Tanzania Dairy Board. A common characteristic of public institutions is their weak technical and financial capacities. This challenge needs to be addressed if the dairy sector is to develop into a growth oriented sector.

Notwithstanding the weak capacity of private sector associations, there are indications that private sector advocacy is taking root. The participatory development of the PPP Act, 2010; and the ongoing consultations around the Private Sector Development Policy (in draft form) would indicate that private sector advocacy is now accepted as integral to policy dialogue. The emerging role of the Tanzania Dairy Board as an active facilitator of sector development through the framework of Maziwa Zaidi creates a potentially viable mechanism for private sector driven dairy sector.

Emerging issues in the dairy sector include inability to take advantage of the large domestic and regional market, mainly due to low productivity of the dairy herd, limited participation of the private sector due to uncertain and low profit opportunities, limited dairy product diversification, lack of processed products marketing strategies, and challenges of environmental degradation and climate change. Addressing these challenges and improving knowledge generation and extension services will unlock the potential in the sector. Collaboration between the development partners, public and private sectors is key to sector

transformation. This should be based on a clearly defined development path and vision. The Government has to exercise leadership in this respect. The TDB is emerging as an important facilitator of sector development, but more support is required at both national and local levels.

While regional integration offers opportunities of a large market, realization of this potential will require a clear strategy of sector development. The challenge is in strategy implementation. Resources, both technical and financial, will be required for this purpose. The development partners could supplement government efforts in this respect. In the meantime, Tanzania will continue to import dairy products from the region and the global sources, at least in the medium term.

4.6 Uganda

Rehabilitation of the dairy industry occurred in the period 1987 to 1992 under the Ugandan Government National Rehabilitation and Development Plan. The plan had a clear goal to self-sufficiency in milk by re-establishing dairy farm production capacity, improving milk collection, processing and marketing, and strengthening dairy extension services. A key lesson learnt was the collaborative effort made by donors in the rehabilitation of the dairy sector that allowed harmonized and synchronized implementation of programs. The result of this was evident as in the period 1999 to 2004 when Uganda dairy sector growth was 5% per annum. The sector continues to grow at 10% per annum.

Growing in excess of 3.6% per annum, the Uganda population is 38 million with 60% as youth. The GDP of Uganda is USD 21 billion of which 23% is from agriculture and 3% from dairy. About 80% of the population, the majority of who are women, is engaged in agriculture. Uganda has a viable growing pasture-based dairy. Though increasing, annual milk consumption remains low at 50 liters/capita compared to the FAO recommended annual quantity of 200 liters/capita. In the East African region, Uganda has an advantage of a fertile land resource, a favorable climate (good rainfall and low temperature variability) for milk production and dairy farmers willingness to adopt productivity enhancing technologies continue to increase. Because it is largely pasture based, Uganda dairy sector has one of the lowest costs of production (Hemme et al., 2007).

The major challenges facing the industry are inappropriate dairy breeds, high input cost (e.g., concentrates & veterinary drugs), poor extension and milk quality, pronounced seasonality of milk production and an under-developed milk supply chain, particularly the milk cold chain and transport infrastructure. Despite these constraints, current increases in milk production are stimulated by increased investments in processing capacity, particularly drying of milk into powder products that are used nationally and exported regionally. In the East African region, Uganda now has the highest utilized capacity for drying milk into powder.

Uganda has three milk production systems identified as pastoral farms with greater than 50 indigenous cattle grazing on coarse pasture throughout the year. The cows are milked twice a day and don not get supplementary feeding. The second milk production system is the peri-urban small-scale mixed crop and livestock farms using less than ten mixed dairy cow breeds while the third system consists of commercial dairy farms that keep 20 to 100 pure and crossbred dairy cows largely on planted pastures supplemented with grain by-products and oilseed cake. Constraints to increased milk production are poor management resulting in a poor dairy genetic base, unimproved pasture grasses and legumes, hence insufficient and poor quality feeds and drinking-water, especially during the dry season; poor breeding, veterinary and extension services; high cost of dairy inputs and inadequate credit for small-scale dairy farm enterprises.

There are five distinct milksheds along the cattle corridor extending from Mable in the east to Kabarole in the west and stretching down to Kabale in the south west. According to the National Livestock Census (2008), cattle population stands at 12.8 million of which 11.98 million (93.6%) are indigenous cattle and 1.52 million milked cows producing an average 1.2 liters of milk per cow per day, approximately 1.85 million liters of milk per day. With an estimated growth of 4% per annum, Uganda's national annual milk production is estimated at 0.8 billion liters. Western Region had the highest number of milked cows estimated to be 0.41 million milked cows; while Northern Region had the least number of milked cows estimated to be 0.16 million milked cows. Currently Uganda national annual milk production is estimated to be over one billion liters.

Total milk processing capacity is estimated at 1,018,000 liters that is handled by 14 registered processors (DDA, 2013). It is estimated that about 80 percent of all milk produced is marketed through informal and formal channels (Agriterria, 2013). Key processors are Sameer Agriculture Livestock limited (SALL) that processes more than 550,000 liters per day into pasteurized milk, milk powder, butter and yoghurt and Pearl Dairies that processes 200,000 liters per day into butter oil and powder. Medium to small processors include SBJ Dairies and Jesa Dairies each processing in excess of 50,000 liters per day

into mainly pasteurized milk and yoghurt. Of all the fresh milk marketed, the Dairy Corporation handles over 10 percent and the balance is sold through informal channels.

Following the launch of both the Government of Uganda five year National Development Plan (NDP, 2010/2011-2014/2015) and the Ministry of Agriculture, Animal Industry and Fisheries' development Strategy and Investment Plan (DSIP) for the period 2010/11-2014/15, which ranked dairy as first among livestock and fourth on list of the ten prioritized enterprises, the Uganda dairy strategy was revised by the DDA in 2011. The vision of the NDS is that of a dynamic, profitable well regulated dairy sector. This National Dairy Strategy (2011 - 2015) has four strategic objectives namely: (i) increase milk production and productivity; (ii) enhance dairy market access and value addition; (iii) create an enabling dairy environment; and (iv) strengthen dairy institution capacity. In line with the DSIP investment programs, the NDS five year investment program has an investment budget of USD150 million that prioritizes private sector in the dairy sector. Sector contributions to this budget are public sector 47%, private sector 29%, and development partners 24%. Contrary to DSIP investment share allocation of 25% to market access and value addition and 69% primary production, NDS investment emphasis is 40% to market access and value addition and 25% to production.

Consistent with objective "i," to increase milk production and productivity, the Uganda government through Ministry of Agriculture Animal Industry and Fisheries (MAAIF) has privatized extension and created the National Agriculture Advisory Services (NAADS) a secretariat for privatized extension. Also, the National Animal Genetic Centre and Data Base (NAGRC & DB) was mandated to assist and privatize dairy breeding activities and the World Bank, through the ASARECA East Africa Agricultural Productivity Program (EAAPP), continues to fund its artificial breeding activities. Though requiring further restructuring for effectiveness, donors including World Bank have responded by funding NAADS for improved dairy production. In addition, donor programs funded by USAID through Land O'Lakes and development partners, the Bill & Melinda Gates Foundation East African Dairy Development Program, SNV and Agriterro continue to assist dairy production efficiency through artificial breeding programs, extension, and milk collection and chilling infrastructure to increase formal marketing through improved market access and support an increased role of women in production. It is now estimated that at 70% contribution, the role of women in Uganda dairy is increasingly significant.

Part II: Country profiles

In this second part of the report, in order to provide more background information to that covered in the country summaries, dairy profiles of Ethiopia and the five East African countries (Burundi, Ethiopia, Kenya, Rwanda, Tanzania & Uganda) are presented in individual chapters.

5 Burundi dairy profile

5.1 Country background

Burundi is a small country covering an area of 27,834 km² (Berahino, undated) (Appendices 2 & 3). It has three agro-ecological zones that are defined by altitude and rainfall (Table 5.1) and, in general, it has a temperate tropical climate with two rain seasons (Berahino undated; IFAD, 2011). Overall, an undulating plateau with an altitude of between 1600 m and 2,000 m covers 80 percent of the country.

With a population of 8.5 million and an annual growth rate of 3%, the average plot size per household is currently 0.5 ha with most households having 0.25 ha (IRIN, 2012). Burundi is the second most densely populated country in Africa with a population density of 257 people Km². It is one of the poorest countries in the world with 67% of the population living below the poverty line (IFAD, 2011). IRIN (2012, p 1) reported that, "Some 58 per cent of the children are chronically malnourished, which means their physical and intellectual development is seriously threatened."

Ninety per cent of the population of Burundi resides in the rural areas and is engaged in subsistence agriculture and produces crops including cassava, sweet potatoes, maize, beans, sorghum, rice and bananas (IRIN, 2012). Banana is the major staple crop that takes up 30% of the land and coffee is the most important export crop that accounts for 60% of export revenue.

Burundi went through a civil war from 1993 to 2005 in which economic and social infrastructure were destroyed (IRIN, 2012). As a consequence, it has been going through a post war rehabilitation program across sectors. Of note are agricultural, justice, rule of law and security restorative programs that are intended to improve the environment in order to attract investment and improve food security.

The IMF (2010) reported fluctuating but satisfactory real GDP growth rate that ranged from 4.42% to 2.17% from 2001 to 2005. A more recent report (MINAGRI, 2012) indicated that GDP per capita and GDP growth rate were USD 160 and 3.5%, respectively.

The dairy sector was not spared from the vagaries of the civil war which decimated cattle from 800,000 to about 300,000 largely through indiscriminate slaughters (Ndikumana, 2013). There have been efforts to increase the size of the cattle herd through cattle importation and herd growth. To this end, 25,000 were distributed by the government, NGOs and other organization up to 2013 that has contributed to the increase in herd size to about 600,000 (ibid.) However, demand for cattle and other livestock products has still not been met and manure from livestock is regarded as a key input for soil fertility amelioration.

Unfortunately, only 5.2% of farmers are engaged in livestock activities, particularly small animals (IMF, 2010). However, almost without exception, farms also include livestock, mainly small animals (IFAD, 2011). However, 10 to 20% of the households own cattle. According to the Burundi Goat Development Project (2004) due to ease of care, size, fast reproduction, and decreasing availability of fodder, goats have become the most important livestock species on small farms in Burundi.

Specifically, the net effect on the dairy sector has been an inadequate milk supply that cannot be met by the existing cattle. As a result, cattle restocking (IMF, 2010) and improvement of the local breeds from artificial insemination (AI) programs have been central to the dairy rehabilitation process. From interviews with IFAD staff, it was estimated that annual milk supply has to grow at 8.2% to match the demand and, in 2008, 5.6 million liters of liquid milk was imported and accounted for 5% of dairy imports. However, powder imports largely from Kenya (34%) and Europe (59%) accounted 84% of dairy imports. The value of these dairy imports was about USD 2 million.

Zone	Altitude (m)	Area (km ²)	Temperature °C	Rainfall	
				Mm	Season (months)
Low altitude	880	1,875	21-23	900	5
Middle altitude	900-1500	8,511	18-25	1,100	8
High altitude	1500-2600	15,511	16-20	1,500	9

As a result of these herd rebuilding programs, milk production in Burundi has steadily increased from 20,574 metric tons in 2004 to 71,300 metric tons in 2011 (Ndikumana, 2013). Despite the above increases in milk production, even at a peak milk production of 58,650 liters/year before the civil war, the country had a milk deficit that was met through milk powder and butter oil imports for reconstitution

into milk. While the civil war destroyed the dairy sector, it is acknowledged that even during the pre-war period the dairy sector was not modern; for example, there were no formal milk collection centers and cold chains for milk transportation and storage as seen in other East African countries.

The per capita milk consumption of 6 liters per year often cited in reports and was mentioned during interviews negates the substantial whole milk, milk powder and dairy imports. According to MINAGRI (2012), Burundi has a per capita milk consumption of 30 liters per annum, which is still below those of other East African countries. It further projected that the per capita milk consumption would increase to 35 liters per annum in 2020.

5.2 Dairy value chain

The dairy value chain of Burundi will be presented in relation to the players in the chain, production, transport and milk collection systems; processing, distribution, animal production (including AI), veterinary and financial services; extension, training and knowledge transfer systems and services; environmental issues, and potable water resources; industry associations, producer groups and farmers' organizations; and dairy sector institutions, governance and policies. The information presented here was obtained from desk studies and interviews of organizations and individuals listed in Appendix 5.

5.2.1 Key dairy value chain players and partners (projects, donors etc.)

The dairy value chain in Burundi is made up of smallholder farmers that produce milk and trade among themselves or supply milk to informal milk kiosks and artisanal cheese makers, particularly in areas where markets for fresh milk are limited. There has been little transportation of milk from smallholder farmers to the Bujumbura market that is largely informal. The latter market is largely supplied by peri-urban dairy farmers that reside near Bujumbura. However, the emergence of MCCs has resulted in organized milk transport to processors particularly Natura and Laiterie Ntazimba which is also vertically integrated as it has a large scale farm. Thus most of the milk trade and transportation is informal and there is no well-established cold chain for milk.

Key players in the Burundi dairy value chain include:

- **Farmers:** Key value chain actors in the formal market are rural and peri-urban smallholder, medium and large scale commercial dairy farmers (e.g., Bukkeye farm, Burundi Institute of Agronomic Sciences (ISABU) Farm at Mawa)
- **Private sector:** Dairy cooperatives, milk collectors (cooperatives and private), milk chilling centers (MCC) (Appendix 5), banks, and Association des Industrielle du Burundi
- **Breeding Services:** National Artificial Insemination Centre (CNIA) (Government)
- **Processors:** Laiterie Ntazimba and Natura Products (Industry Agroalimentaire de Buterere)
- **International NGOs and funding agencies:** ASARECA, Belgian Technical Cooperation (BTC), FAO, IFAD, Send a Cow, and World Bank
- **Public Sector Institutions:** Burundi Institute of Agronomic Sciences (ISABU), Ministry of Agriculture, and University of Burundi Faculty of Agriculture Gitega Campus

5.2.2 Production systems

According to MINAGRI (2012), milk production is not concentrated in a particular milkshed but rather is spread over a large area among small farms. The development of MCCs is therefore limited in scope. It is primarily based on traditional livestock farming systems which involve extensive grazing systems on communal lands. However, Burundi is making efforts to modernize the dairy industry and some improved (exotic) dairy cattle breeds had been introduced in the country, primarily in the large state farms at Kiryama in Bututsiland and at Gifurwe in Imboland, which have Friesian dairy cattle. Some small traditional farms also keep some exotic cattle dairy breeds, primarily the Jersey dairy breed. The Sahiwal x Ankole was popular, particularly in Bututsiland. Cattle distribution programs are now widespread with PRODEMA, a World Bank funded NGO, having distributed more than 7,000 pure and largely crossbred dairy heifers since 2011 to smallholder farmers across several provinces. These heifers have largely been imported from Uganda.

Large dairy farms also exist. These include the government owned ISABO station at Mawa and the private Bukkeye Farm (Box 5.1) that even have milk cooling tanks.

Since 2007, the growth in cattle population stagnated and the IMF (2010) attributed this to a reduction in general investment in small-scale animal farming and to an increase in cattle and other livestock slaughters to satisfy an increase in demand for meat for consumption (Table 5.2). In addition, poor AI

success rate in breeding programs contributed to the herd size stagnation. However, thereafter the number of cattle increased in 2010. The number has continued to increase and, as mentioned above, in 2013 the cattle herd size was estimated to be 600,000 (Ndikumana, 2013). Resurgence in herd growth has been the result of expanded AI and cattle distribution programs presented above.

Box 5.1: Bukkeye farm alone supplies 1,500 liters per day to its processing plant, Laiterie Ntazimba, from 200 Friesian cow herd reared on 40 acres of land. The farm uses a 6-cow unit milking machine and produces fodder. However, security of land tenure is not guaranteed; as a result, the farm has invested in 40 ha commercial farm near Bujumbura where security of tenure is guaranteed. He employs a Veterinarian who conducts AI on the farm but offers commercial veterinary and AI services to farmers from adjacent farms. AI costs 20,000 Burundi Francs/insemination (US\$13).

Year	Number
2003	355,222
2004	374,475
2005	396,741
2006	433,800
2007	479,106
2008	471,614
2010	586,282

Source: Annual Report Ministry of Agriculture and Livestock, Year 2008 cited by IMF (2010)

Promotion of local milk production and the improvement of cattle (through AI) are seen as major dairy development programs, which are to be supported through activities to improve the collection and marketing of milk, particularly in the rural areas.

5.2.3 Aggregation and marketing of raw milk

There is no formal milk transportation system that also maintains a cold chain. However, the two processing plants in Bujumbura have insulated tankers (1,000 liter capacity) for milk transportation. Private transportation is largely by foot, bicycle and vehicles particularly for those producers near Bujumbura. Rural inter-house marketing systems are predominant in Burundi; as a result, milk transportation is individually arranged. Private traders and hawkers transport milk into urban areas, particularly Bujumbura.

Private vendors including those on bicycles and kiosks (milk bars) collect milk from farmers and distribute it to consumers. The milk processing plants have distribution networks that reach consumers through retail outlets such as supermarkets and vendors located in peripheral areas of Bujumbura. For example, Laiterie Ntazimba has a network of 40 distributors of its products that were given refrigerators on usufruct contracts. The processing plant had to invest in this cold chain to extend the shelf life of their products.

Through assistance from NGOs and other partners, Burundi has introduced a formal milk marketing system by establishing privately run milk collection centers (MCCs) and processing plants that can form a cold chain. In this regard, IFAD, BTC and other organizations have supported the establishment of 14 milk collection centers across six of the 17 Burundi provinces (Bubanza, Bururi, Gitega, Karusi, Muramvya, and Ngozi) that are supplying milk to processors including Natura Products. These 14 MCCs have a capacity to collect 14,000 liters per day (Appendix 5). The plan largely being facilitated by IFAD is to establish 84 milk collection centers across the country. At some of the existing MCCs, the IFAD Projet d'Appui à la Reconstruction du Secteur l'Élevage (PARSE) has been largely responsible for facilitating the installation of cooling tanks of 500, or 1,000-litre capacity in the MCCs.

Unfortunately, the processors are still unable to collect and buy all the milk from the MCCs. In general, markets for bulk milk from MCCs that are best served by large buyers including processors (Lentz, 2009) are limited. Lentz (2009) suggested that presence of large buyers was perceived by participants at a workshop as a precondition for investments in milk collection technology and that the viability of MCCs without linkage to a large centralized buyer was questionable. On the contrary, based on his personal

experience after building a milk processing plant that was destroyed during the civil war, the president of the Association of Industries in Burundi was adamant that milk supply had to be abundant for a large buyer to justify investing in a processing plant. He further pointed out that an investor who has to pay back a loan cannot afford for the supply to grow or invest in growing the supply.

This implies that the MCCs should be functional and collecting large quantities of milk to guarantee supply to the processing plants. Lentz (2009) further pointed out that there was no clear MCC management model for Burundi that had been tested and farmers associations needed to be consulted in developing such a model. Other than dairy cooperatives at MCC or local level, we did not identify active national dairy farmer associations in Burundi.

A key cause of the inability of processors to buy more milk from MCCs is the risk of spoilage that is a consequence of the unstable electricity supply. In this regard, there are frequent power outages that break the cold chain. For milk processors, this is a big risk that can lead to financial losses.

Farmers also sell milk to kiosks in Bujumbura and in other towns. In Bujumbura alone there are more than 100 milk kiosks. A visit to one kiosk, Kiosque de la Gloire, revealed that farmers that supply milk to kiosk receive 800 BFrw/liter (USD 0.52) and the kiosk sells raw milk (boiled) and fermented milk, Iktivuguto, at 1,200 BFrw /liter (USD 0.78). When asked to reveal the volume of milk sold daily the kiosk representative was reticent.

Table 5.3 Prices of milk and dairy products along the value chain and different locations for distributors				
Item	Transaction	Value Chain Beneficiary	Price or payment/liter (USD)	Payment as % of milk consumer price
1. MCC Model				
Raw milk	Farm to MCC	Producer (farmer)	0.36	27.5
Raw milk	MCC to processor	MCC	0.42	4.6
Pasteurized milk	Processor to distributor (retail)	Processor	0.98	42.7
Pasteurized milk	Distributor to consumer	Distributor	1.31	25.2
2. Farmer to Processor				
Raw milk	Farm to transporter	Farmer	0.39	50
Raw milk	Transporter/farmer to processor	Transporter/Farmer	0.13/0.52	16.7/66.7
Pasteurized milk	Processor to distributor	Processor	0.65	16.7
Pasteurized milk	Distributor to consumer	Distributor	0.78	16.7
Iktivuguto (fermented milk)	Processor to distributor	Processor	0.65	
Iktivuguto	Distributor to consumer	Distributor	0.78	
Yoghurt	Processor to distributor	Processor	1.44	
3. Kiosk Model				
Raw milk	Farm to kiosk	Producer (farmer)	0.52	66.7
Raw milk	Kiosk to consumer	Kiosk	0.78	33.3
Iktivuguto	Kiosk to consumer	Kiosk	0.78	

5.2.4 Milk processing and distribution

In December 2013, the two processors in Bujumbura, Laiterie Ntazimba and Natura Products, were collecting and processing 5000 to 5500 liters/day but had capacity to process 14,000 liters. Producer prices per liter of milk were not similar for the processors but ranged from BuFr 550 to 600 (USD 0.36 to

0.39) for the producer at farm or MCC, and 800 BuFr (USD 0.78) at a kiosk (Table 5.2). The processors produce pasteurized milk, Ikiviguto, and yoghurt.

Clearly, the distribution model that involves MCCs and one of the processors resulted in lower farmer share of the consumer price than direct farmer sales to processors and kiosks (Table 5.3). The best returns to farmers (suppliers) and price advantage to consumers was when milk was distributed through kiosks. In the MCC model, the consumer price share of the processor was disproportionately large at 42.7% compared to that of processors in other East African countries.

Not surprising, it was reported by the processors that consumers preferred to purchase milk from kiosks rather than purchase pasteurized milk from supermarkets. However, one of the processors put a cap on pasteurized milk price at a level that is comparable to milk kiosk prices.

The two processors see potential in production of UHT milk which is selling at BuFr 2,600/liter (USD 1.70) in Bujumbura. They expect the price of locally produced UHT milk to be lower than the imported UHT milk. In order to increase milk sales through a long shelf-life product, Natura Products has purchased equipment for UHT milk production and expects to process 10,000 liters per day. It expects to commission the new UHT plant this year. While UHT milk production is seen as the best option, UHT milk sellers complained about the East African produced UHT milk failure to reach the 'expiry' date before spoilage while UHT from Europe had a longer shelf-life. The cause of this relatively short shelf life is not clear but could be a result of poor milk quality and/or inefficient UHT processing across the East African region. However, based on platform milk quality tests including the alcohol test, one processor reported that 90% of the milk received from MCCs was of good quality.

The two processors conduct the alcohol test for acidity, and the lactometer test for milk density, and hence indirectly test for adulteration with added water. One processor also conducts a mastitis screening test but none of the processors conducts phosphatase test to determine pasteurization efficacy. The two processors neither conduct faecal coliform tests nor somatic cell count tests to check for mastitis which was reported by one of the processors to be prevalent (15%). Considering that mastitis prevention and control programs are virtually absent, this prevalence rate is likely to be an under estimation and not based on somatic cell counts.

Distribution of milk and cheese has largely been through retail outlets largely milk bars, food shops and supermarkets. In Bujumbura, there are four major milk bars and an additional 50 food shops that also sell milk (MINAGRI, 2012). However, there is limited dairy products variety. Some shops sell imported UHT and milk powder, largely from Kenya. Because of the informal nature of milk marketing, it is difficult to get an official raw milk price but, as reported above the producer price at a kiosk in Bujumbura was USD 0.52/liter while the consumer price was USD 0.78/liter. The price range is similar to the estimate of USD 0.56/liter reported by MINAGRI (2012).

Apart from the unreliable electricity supply, most dairy product distributors that obtain products from the processors do not have refrigerators. This is worsened by long distances between the processing plants and some distributors. In order to partly address this limitation, Laiterie Ntazimba distributed 40 electricity powered refrigerators to its distributors under a usufruct arrangement.

There is little cheese processing in Burundi. It is largely artisanal and it is done in places far from Bujumbura where there is a limited market for fresh milk. Historically, artisanal cheese production has been largely in the western region of Burundi that is adjacent to the eastern Congo cheese making belt. Cheese from these two regions is highly regarded in Burundi. While the DRC cheese is preferred; as a consequence of instability in the DRC, supply can be erratic. Reasons given for limited cheese processing include the high cost of milk that makes locally produced cheese uncompetitive against cheaper imports. Cheese imports are mostly from Rwanda and the DRC.

Despite the absence of industrial cheese production, in traditional cattle production systems most milk was converted to sour milk and butter. For more than two decades, GTZ worked with Burundian small farmers in schemes in which they sold goat and cow milk at prescribed prices for processing into several types of cheese (Goat Development Project, 2004). These schemes virtually collapsed during the civil war. However, some missionary groups such as The Little Apostles of Jesus have continued producing cheese at their artisanal cheese production center at Mutoi, in central Burundi, and in Karuzi Province. While there has been a focus on cheese production, Lentz (2009) noted that the demand for fresh milk exceeded that of cheese but cheese production would still be an option in areas where there is limited fresh milk demand.

5.2.5 Commercial animal feed and fodder supply services

According to IRIN (2012) there is an urgent need to boost access to forage and feeds to those with farm animals. Cattle whose milk is sold for cheese production, for example in Ngozi area, are often zero-grazed and fed on cut-and-carry fodder grasses (Goat Development Project, 2004). Lentz (2009) suggested that, apart from fodder crop cultivation and improving tropical grasses and legumes, maize and soybean should also be produced. Insufficient fodder is a key dairy production constraint.

Consistent with this fodder need, building of appropriate shelters, and provision of fodder, concentrate and minerals have been some of the conditions set for farmers to receive livestock from the livestock distribution programs. To this end, in 2009, 41,886 farmers planted 9,392 hectares of forages, they made 2,984 tons of concentrates, and 16,189 kg of dietary mineral (IMF, 2010). Napier grass (*Pennisetum purpureum*) is a major source of feed for dairy cattle. However, the grass is under threat for smut and stunt diseases.

In order to control these diseases, ASARECA is working with ISABU to conduct research on these diseases that seriously reduce quantities of plant biomass. As a consequence of the plant biomass reduction, ASARECA (2013) reported that price of a bundle of Napier grass has increased by 100% compared to the pre-disease period.

The Projet et de Développement des Marchés Agricoles (PRODEMA), a World Bank funded project, has been distributing heifers to groups of 20 to 35 smallholder farmers. The farmer groups are given 12 heifers and 1 bull and continue the donations as a pass on the gift program. The farmer groups are trained on fodder production and conservation before receiving the animals. They are also given packages of animal feed concentrate and veterinary drug package for the first 6 months. Heifers given are pregnant and expected to calve down within six months to enable the milk produced to finance upkeep of the heifer. Concentrate feed is accessible from markets but is largely from byproducts of processed grains; as a result, the quality of the concentrate is poor. Farmers can still access AI services from IFAD programs in the provinces.

In peri-urban areas zero grazing is predominant. There is a thriving fodder selling business that is dominated by boys and young men; for example, in Gihanga village near Bujumbura on the road to Cibitoke (Box 5.2; Plate 1).

Box 5.2. In Gihanga Village there are young men engaged in fodder selling. They buy the fodder grass from a government research station at BuFr 100 (USD 0.07) per bunch (~120 kg, ~15% dry matter), transport it on bicycles, and sell it in peri-urban villages at BuFr 4,000 (USD 1.58) per bunch. They often make two trips per day and have regular customers. The cost of a bunch would be equivalent to return from 5 to 7 liters of milk depending on the milk price. The fodder business appears to be vibrant but the fodder sellers are not organized into associations or formal groups. Also, this seemed to be a major source of employment for youth in the village.

In general, feed shortage and low quality of feeds limit dairy production. Concentrates are expensive costing about USD 0.36 per kg but their quality is poor. Farmers neither use crop residues nor do they conserve fodder. They have limited knowledge on best feeding practices including crop residue utilization.

5.2.6 Veterinary and animal production services

Veterinary services

There is a public veterinary service in place that has vaccinated cattle against infectious diseases including nodular scleritis, blackleg, and rabies. In 2008 the veterinary laboratory in Bujumbura diagnosed a total 1,500 cases of blackleg, 110 cases of infectious nodular scleritis, and 255 cases of rabies (IMF, 2010). A total of 1,865 disease cases were recorded. The affected provinces were Cibitoke, Rutana, Muramvya, Muyinga, Kayanza, Ruyigi, Bururi, Mwaro, and Bujumbura. Also, foot and mouth disease and lumpy skin disease outbreak occur almost every year. However, veterinary services that used to be provided by government are now being provided privately. The private services are inefficient partly because there was no phase out program from the public to the private service delivery. The IMF (2010) recommended that programs to combat animal diseases must be carried out on a large scale in order to reduce losses associated with failure to properly care for animals. In addition, it reported that there had been veterinary legislation and regulatory frameworks that resulted in the formulation of three draft instruments, intended to improve and coordinate veterinary activities, on the following:

- The practice of veterinary medicine
- Creation of an order for veterinarians
- Veterinary pharmacy practice.

The threat of diseases spreading from cattle importation is real. In 2008, 2,522 cattle were imported into Burundi from neighboring countries and this number has increased since then. As a result, cross-border control of cattle movement and disease surveillance should be highly considered in collaboration with neighboring countries. There is interaction of livestock and wildlife and foot and mouth disease is a big challenge that needs action. Also, there are no private veterinarians in Burundi that could be a result of limited real demand for veterinary services.

Artificial insemination services

In the cattle rebuilding programs, live animals and semen of the following breeds has been distributed through NGOs, projects and government: Sahiwal, Friesian, Brown Swiss, Montbéliarde and Ayrshire breeds. The crosses of these breeds and the local Ankole breed have been produced previously but a popular cross, particularly in Bututsiland, has been the Ankole x Sahiwal. There is a major government program to improve AI throughout the country. According to the National Centre for AI, in the year 2000, 3,000 to 4,000 inseminations were conducted per year across the country but in 2011/2012 10,000 inseminations were achieved for the year. During the next two years the target will be 30,000 inseminations per year. Major activities of CNIA include training AI technicians in localized areas to have at least one technician per commune/district (total = 116 technicians). All semen used before was imported, but CNIA now has initiated local semen collection. The CNIA requires further capacity building in this activity. The semen collection station now has 20 bulls of Holstein and Jersey breeds that were imported from the Netherlands and are expected to produce 50,000 semen doses per year. The center also has two liquid N production plants with 5 and 25 liters/hour capacity. The liquid N is for use by CNIA affiliated programs only.

There is collaboration where government of Burundi funded liquid nitrogen plants and laboratory equipment while IFAD is funding training of AI technicians. AI is currently subsidized and offered free due to the cattle herd rehabilitation process. The Ministry of Agriculture is currently developing the cattle breeding policy. Further assistance is required in training more AI technicians and equipping them.

5.2.7 Financial services

According to IMF (2010) interest rates are high in Burundi partly as a result of a high inflation that reached 25.65% in 2008. Compared to the 2003 level, the consumer price index doubled in 2008. In addition, in general, the supply of microcredit is limited. In 2008, the Network of Microfinance Institutions (RIM), which brings together 16 of the 21 institutions authorized by the Burundi Reserve Bank, reached 5 percent of the population (400,000), and awarded loans to only about 100,000 borrowers. As at the end of December the total debt was just 2.2 percent of GDP.

Overall, it has been noted that there is no supportive national policy on microfinance. In general, use of savings deposits is the major means for microfinance institutions (MFIs) to fund credit lines. As a result, they are exposed to high risks and thus lend at prohibitive rates against sizeable guarantees, to populations that are traditionally solvent such as civil servants and salaried employees in the formal sector in rural areas rather than farmers.

The absence of appropriate bank loan products for dairy and other activities was confirmed by the President of the Association des Industriels du Burundi. In addition, he lamented on the lack of finance for long term investments. He further noted exchange rate risk where the Burundi Franc has been unstable and perennially losing value posing a repayment failure risk on equipment purchase from countries with stable currencies. Because of unpredictable future milk supply, he also noted that investing in milk processing carries the risk of underutilizing processing capacity in the face of loan repayments.

The managing director Laiterie Ntazimba was concerned about the high interest rates of 17 to 18% per year. While some of the processors benefited from donor funded projects including 3,000 liter tank donation of a cooling tank to Laiterie Ntazimba from the DAI project, the processors called for partial financial support from donors for some investments that benefit the dairy sector.



Figure 5.1: Fodder selling in Gihanga village near Bujumbura

5.2.8 Extension, training and knowledge transfer systems and services

Extension services have been limited by inadequate capacity, lack of adequately trained manpower and low salaries in the public sector. While public extension services are limited by inadequate capacity, the Government of Burundi has changed its policy and has opted for private extension services as the model. This model has short comings, particularly where farmers do not have sufficient income and capacity to demand and pay for services.

Dairy research and extension support is weak. With just 10% of agricultural researchers having PhD degrees, researcher capacity should be strengthened. Of major concern is the shortage of veterinarians and animal breeding specialists that has even affected ISABU, the research organization. However, collaboration with ASARECA has assisted in strengthening research and staff capacity building.

Some international organizations and projects have trained and offered extension services to farmers as part their programs; for example, after distributing heifer donations. Of note is the IFAD extension approach that has been anchored in farmer field schools. The PRODEMA World Bank funded project has donated heifers and embedded extension services in the donations.

According to IMF (2010) recognized need for agricultural extension workers. Clearly, public and private extension services in Burundi are weak, and hence require development and support.

5.2.9 Environmental issues, including potable water resources

Based on a 2005 survey (MICS survey), IMF (2010) reported that 79.7 percent of the urban population and 63.4 percent of the rural population had access to an improved (potable) source of water. In general, there had been an improvement in access to potable water across the population, except in Mwaro Province.

According to IMF (2010; p 79), "Actions taken to protect and improve the environment seek to achieve three objectives: (i) strengthening of the institutional and technical capabilities of the environmental services; (ii) promotion of the national policy on natural resources management, and (iii) promotion of the use of natural resources and environmental sanitation." However, there is little direct reference to the dairy sector.

Burundi is promoting zero-grazing based dairy production which is evident in the peri-urban areas. However, in the rural areas where cows are grazed the threat of overgrazing prevails. Effluent and manure are in great demand as fertilizer for crops in the lowland areas where soil fertility has been depleted. Effluent from dairy processors has not been of concern because of the small volumes handled, but with the prospects to process more milk into UHT safe handling of effluent has to be considered.

5.2.10 Industry associations, producer groups and farmers' organizations

Lentz (2009) suggested that producer organizations will be critical partners in the development of dairy in the country including decisions on the MCC model to be adopted. However, in general, the livestock sector, in particular the dairy sub-sector, lacks producer organizations. This is a reflection of the absence of organization at the grassroots level despite the example of coffee where such low level organizations exist (e.g., GOB & OCIBU) (Lentz, 2009).

In response to absence of these key groups, IFAD (2010) reported a value chain development program that is intended to professionalize and organize farmers including those in the dairy value chain. This organization is evolving after the setting up of the 14 MCCs that originate from cooperatives.

5.2.11 5.2.12 Dairy sector institutions, governance and policies

According to IFAD (2012; p 3), "In November 2011, the government launched the National Agricultural Investment Program to streamline its National Agricultural Strategy into programs that address the root causes of rural poverty through investments financed by the country's own resources, as well as external sources." The programs include the dairy value chain.

ISABU has two stations one in the lowland, Imbo and the other is in middle altitude, Mawa. They have 6 researchers at MSC level nutrition and health and 7 technicians. ISABU collaborates with University of Burundi Faculty of Agriculture Gitega Campus. The ISABU program of research is linked with the private sector (i.e. the actors in the dairy value chain).

Lentz (2009) noted that the public sector had an important role to play largely in two dairy areas:

- Development and enforcement of milk quality standards; however, even if some of the standards are available they had not been enforced.
- Supporting the dairy sector through provision of appropriate services including ensuring use or supply of good quality dairy cows.
- Making liquid nitrogen available to private AI service providers.
- Clarifying the role of actors involved in providing veterinary services.

Clearly, the public sector should design policies that support growth of the dairy sector. Related to this, taking from the views of participants at a BAP workshop, Lentz (2009) observed an absence of a dairy coordinating body that would be responsible for lobbying in the public sector and for financial support and investments in the sector. To date there is no visible national dairy coordinating body that links the whole dairy value chain.

5.3 Strengths, weaknesses, challenges and opportunities in dairy sector

The major areas of strength relevant to dairy that Burundi has included a history of commercial milk production and processing, and public sector support for the cattle herd rebuilding program (Table 5.3). Prevalent weaknesses include the high population density that leads to small household land holding and, consequently, limited land to support dairy production, particularly for the very poor; inadequate extension services; disorganized milk marketing system; the inconsistent electricity supply that has

compromised investment in milk processing; and limited capacity to manage dairy cattle and offer dairy support services.

Opportunities for the dairy sector are largely the buoyant milk market arising from unmet demand for milk and dairy products and opportunities for export to neighboring countries including the Democratic Republic of Congo. Challenges facing the industry are largely competition from cheaper milk and dairy imports from other East African countries such as Uganda and Rwanda and the intensification of milk production when land size per household is limited

5.4 Emerging dairy sector issues

IMF (2010) identified key dairy sector emerging issues including the following:

- Rebuilding of cattle herd is imperative for sustainable dairying and meeting milk demand.
- Establishing modern dairies and dairy product processing plants and adoption of measures attractive to private investors are required. This has been realized through establishment of 14 MCCs by IFAD and a target of 84 on the cards.
- Continuation and strengthening of existing livestock programs are essential to sustainably replenish livestock in Burundi including development of livestock, breeding centers rehabilitation, pan-African control of epizootics, rehabilitation and equipping of veterinary laboratories and setting up veterinary pharmacies.
- The imminent production of UHT in Bujumbura is likely to be a game changer in the Burundi milk market and may affect demand for regional UHT products.
- The emergence of MCCs and plans to establish more has created bulk supplies that should be matched by the existence of large scale buyers, particularly milk processors.
- Organization of dairy farmers around MCCs has created a preamble for national farmer organizations and dairy value chain coordinating organizations.

5.5 Prospects for sustainable growth

5.5.1 Economic, environmental and social performance of sector

The issue of social equity and poverty impact of a dairy improvement program should be considered (Lentz, 2009). In many rural areas of Burundi the lead adopters of intensive dairy production practices are relatively wealthy civil servants who have large farms that can grow fodder crops for improved breed dairy cattle under zero-grazing conditions. In general, such farms are at least 4 ha in size. As a result of the relatively large size, these farms can be an important commercial source of breeding heifers and have the potential to serve as dairy best practice models. Lentz (2009) further suggested that the target households should be those with land resources adequate to raise one or two improved breed cows under intensive management. In fact, 0.3 ha is required to produce enough fodder for a lactating crossbred heifer for a year. Apart from this, a household should also have sufficient land to plant staple crops. In this regard, a household should have at least 0.8 ha (0.5 ha for crops & 0.3 ha for fodder) in order to have extra land to support an improved dairy program.

Participation of women in agriculture is high at the production level but their role in the dairy sector is not apparent. However, at the technical level, in 2008 only 15% of agricultural researchers in Burundi were female and this proportion had been consistent since the beginning of the millennium (Stads and Ndimuriwo, 2011). The proportion of women in extension and training is unclear; perhaps this is a consequence of the weak extension service. However, the Government of Burundi gender policy is to have 30% women and 70% men in decision making positions. The involvement of women in dairy has to be affirmatively promoted through allocation of gender quotas to ensure that women who are more involved in dairy operations are effectively rewarded.

5.5.2 Production, economic and other models for sustainable dairy sector growth

According to IRIN (2010), growth of the agricultural sector will occur when production is commercialized and not just maintained at subsistence level. In addition, processing of commodities including milk is key to the growth of the agricultural sector in Burundi. This is necessary because most products leave the country with no value addition. The overarching constraint mentioned by all persons interviewed in Burundi is the electricity shortage that leads to power outages. However, there are several electricity generation projects including Rusizi III that are expected to be commissioned over the next few years. These are expected to meet the electricity demand at low cost of the country. The availability of electricity is expected to foster industrial growth and attract investment.

IMF (2010) suggested that Burundi's membership in regional groups such as the EAC could improve economic growth opportunities through better trade prospects.

Specific to commercialization of milk supply, Lentz (2009) reported that, despite MCCs being the fulcrum of a commercialized milk supply, Burundi is the only member of the EAC in which MCCs are not present. MCCs have now been developed but limited markets for milk from MCCs remains a constraint for reasons discussed above. However, the processing of milk into UHT milk and increased availability of electricity will increase the markets for local milk.

The massive increases in cow inseminations planned by the National Centre for AI bode well for a substantial increase in the crossbred cattle that have higher potential for milk production. The milk production increase trend that has been obtained since the end of the civil war is likely to increase from the massive increase in inseminations.

5.6 Collaboration prospects

5.6.1 Donor programs, policies of, and collaboration status among, dairy funders and/or funded projects

According to Stabs and Ndimuriwo (2011), overall, the institutional structure of the national agricultural research systems in Burundi has not changed since the turn of the millennium. The civil war led to departure of donors and foreign aid, but since the end of the war there have been some foreign assistance flows including support from the BTC for a new five year agricultural research plan. In addition, there has been support from other donors including USAID (e.g., through BAP & DAI), ASARECA, The World Bank and IFAD and its partners.

Table 5.3 Strengths, weaknesses, challenges and opportunities in the dairy sub-sector	
<p>Strengths:</p> <ul style="list-style-type: none"> ▪ Large & growing cattle population ▪ Favorable government & other programs promoting cattle restocking & livestock products value addition ▪ Past experience in milk production & processing ▪ Though decrepit, presence of some dairy infrastructure ▪ Favorable climate for dairy ▪ Appropriate forages and crops for dairy are available 	<p>Weaknesses:</p> <ul style="list-style-type: none"> ▪ Limited land sizes for supporting dairy production, particularly for the very poor ▪ Land fragmentation leading to uneconomic units for dairy ▪ Inadequate electricity that leads to frequent power outages & breaking the milk cold chain ▪ Inadequate water resources management ▪ Poor soil fertility, except on plateaus ▪ Inadequate suitable dairy breeds ▪ Limited capacity to rear dairy cattle & offer support services ▪ Lack of technical training, market information, marketing channels, dairy equipment & transport ▪ Weak dairy extension and research ▪ Disease control systems are limited ▪ Landlocked & too distant to ports (e.g., Dar-es-Salaam is 1500 km away) that increases landing costs of dairy inputs & increases costs of transport ▪ Lack of a dairy coordinating body ▪ Inadequate dairy producer organizations & platforms to lobby for the sector ▪ Milk marketing regulatory framework is very weak ▪ Limited valid data on distribution of land sizes, cow numbers/breed distribution and more ▪ Underdeveloped infrastructure ▪ Disorganized milk marketing is constrains farm milk production.
<p>Opportunities:</p> <ul style="list-style-type: none"> ▪ Buoyant market for milk and dairy products, human population doubling every 30 years ▪ Potential export markets, particularly DRC ▪ Membership of Burundi in regional organizations including East African community can improve trade prospects 	<p>Challenges:</p> <ul style="list-style-type: none"> ▪ Competition from cheaper milk & dairy imports ▪ Low investment in training, extension, research & development ▪ Limited milk processing facilities ▪ Disease control; cross-border disease transmission ▪ Restricted flow of imported goods as a result of trans-boundary trade protocols & barriers ▪ Inadequate investment in the dairy sector, a consequence of previous instability of the country

<p>Opportunities:</p> <ul style="list-style-type: none"> ▪ Growing GDP implies growing purchasing power & middle class that demands dairy products ▪ Manure for soil fertility and crop production ▪ Dairy for farms of larger size of 0.8 ha 	<p>Challenges:</p> <ul style="list-style-type: none"> ▪ Limited credit for farmers ▪ Unsustainable land use (e.g., little opportunity for crop rotations) ▪ Lack of electricity hampers progress of processors
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IMF (2010) reported that the National Agricultural Strategy (SAN) developed in 2008 covers the period 2008 to 2015 and revolves around four priority strategic axes. In this regard, it stated (p 68) that, "In order to meet the challenges posed by the need to improve the productivity of food crops and ensure the population's food security, the government has adopted a National Agricultural strategy based on four objectives seeking (i) sustainable growth of productivity and agricultural productivity; (ii) to promote industry and agribusiness; (iii) to support the professionalization of producers and the development of private initiatives; and (iv) to strengthen management capabilities and develop the agricultural sector."

The stated axes form the framework for donors and other partners to contribute to the development of the dairy sub-sector. These axes, while generic, are applicable to the dairy sub-sector and capture the key issues to be addressed to set the Burundi dairy sub-sector on a recovery, modernization and, ultimately, a development trajectory. IMF (2010) further stated the effort at coordination of technical ministries through the establishment of the national food security program (PNSA), approved in 2008, that seeks to establish a framework for consistency and integration of actions to fully realize the four pillars of food security, i.e., availability, stability of agricultural production, economic and geographic accessibility, and optimal utilization of foods.

Several donors have provided support that has been determined by the dictates of the SAN. These donors include IFAD and its partners, BTC, the EU, World Bank, and World Food Program. Of relevance to the dairy sub-sector is the IFAD Livestock Sector Rehabilitation Support Project (USD 17 million) and the PRODEMA project (USD 12 million for livestock development).

The former project has been running since 2008 and will end in 2014 and is directly benefiting 100,000 households. The project was instituted because it considers livestock to be important for rural development. It further recognizes the existence of a buoyant demand for livestock products but an inadequate supply of livestock. It seeks to address the constraints to livestock production including inadequate feed, animal production support services, and farmer production capacity, and support livestock products, including milk, value addition. While the focus of the project is not only cattle production, as of March 2012, the project had distributed 682 cattle; in addition, 308 cattle have been passed on to other community members.

The PRODEMA started in 2011 and will end in 2015. As briefly reported above; it has been distributing heifers to smallholder farmers in 10 provinces. The heifers are bought largely from Uganda and land in Burundi at a cost ranging from USD800 to 1,000. Since the beginning of the project it has distributed 7,826 (7,224 heifers and 602 bulls).

5.6.2 Public-private and within private sector collaboration and some insights into donor policies on dairy

The collaboration of public and private sectors is unclear. There is little indication of a strong dairy private sector apart from individual farms and emerging processors. The major focus of dairy activities has been on rebuilding of the cattle herd. Formal structures including milk collection centers are just emerging although even prior to the civil war these structures were non-existent. There are few farmer and private sector organizations to lead and facilitate collaboration with the public sector. The donors have supported projects that are targeting the priority areas of attention in a country that is going through post war rehabilitation. Despite livestock contributing just 5% to the GDP, dairy is one of the key value chains that is receiving support from donors and the government because of the potential to generate income for farmers, alleviate malnutrition and generate manure for crop production. Some key donors, PRODEMA, BAP and IFAD embarked on dairy projects that sought to increase cattle supply, improve milk production and collection, and commercialize and formalize milk trading.

The IFAD project targeted vulnerable groups, including women, returnees and landless people and other people with few assets (IFAD, 2011). Consistent with the SAN four axes, specifically, the project aims to help improve private sector delivery of inputs and processing facilities, and empower community

committees to manage local development and contribute to national government-led policy development on animal health and management.

The Government of Burundi and IFAD have collaborated in the national AI program with the former supplying liquid nitrogen and semen and the latter funding AI technicians training. As a result of such collaboration, AI is currently subsidized, and hence offered free of charge to the farmers for cattle herd rehabilitation. However, more assistance is required to train more AI technicians and equipping them.

5.6.3 Opportunities for collaboration between dairy funders, and between dairy funders and dairy programs

There is a platform to discuss collaboration of stakeholders in the agricultural sector that is called the Groupe Sectoriel Agriculture et Développement constituted by the Minister of Agriculture. This group includes donors, NGOs, Government of Burundi staff, and meets every first Tuesday of the month and has sub-committees for research, NGOs and dairy.

Examples of collaboration include those between ISABU, and IFAD, EU and ASARECA. ISABU is carrying out dairy cattle nutrition, database and formulation research in partnership with IFAD. It is also working with ASARECA on three projects in integration of crop and livestock research, fodder variety screening and production, and tick borne diseases control. The EU is also funding work on livestock diseases.

ISABU has had a successful donor/implementer eight- year relationship with both IFAD and ASARECA. It supports the ASARECA model of collaboration in that it is largely participatory. In this model, key constraints and funding areas are identified jointly. In addition, the model embeds dynamic project evaluation and problem solving.

There has been collaboration between projects and some private companies. For example, Laiterie Ntazimba collaborated with Development Alternative Initiative (DAI) in dairy market development. Through this collaboration, it received a 3,000 liter milk cooling tank and technical assistance in the form of training from Kenyan dairy technology.

Given this need for credit, there seems to have been limited effort for donors and funders to facilitate acquisition of credit to support agricultural activities, particularly dairy.

Areas of collaboration with funders identified by players in the Burundi dairy value chain include the following:

- Development of markets for milk and assisting milk producers to access markets.
- Development and training milk traders professional in milk/product quality testing, equipment and logistics
- Increasing and stabilizing electricity supply which is necessary for investment in dairy value addition.
- Assisting with loan guarantees and in development of appropriate loan products for the dairy sector.
- Strengthening the national milk school feeding program.
- Assisting processors with milk consumption campaigns to increase demand for milk and dairy products.
- While most donors have a pro-poor approach, they should also support the private sector to ensure sustainability of their interventions; for example, there have been substantial donor funds to purchase cows, build MCCs etc. but limited funds have been assigned to entrepreneurs.
- Developing a bank or microfinance system for agricultural credit.
- Milk processing capacity improvement to include UHT needs to be supported and enhanced through provision of low cost electricity.
- Technical assistance in dairy product diversification through exchange and training in the east African region.
- Development of livestock insurance products by the private insurance companies.

5.6.4 Potential for regional integration

The per capita milk consumption for Burundi is lower than in other EAC countries. Historically, Burundi imported milk products including milk powder and butter oil for milk reconstitution, cheese and butter largely from the EU and Kenya. Given the rate of increase in milk supply, Burundi is likely to continue

meeting its needs for milk and dairy products from imports. These imports, depending on price advantages are likely to come from the East African region.

IMF (2010) reported that Burundi has benefited from membership in the EAC, particularly through favorable trade concessions including customs reforms and unhindered goods and personnel movements across borders. The GOB is committed to implementing further agreed reforms in order to benefit from its EAC membership.

Burundi also belongs to other regional organizations including the Nile Basin Initiative, the Economic Community of the Great Lakes Countries, the Common Market for Eastern and Southern Africa, the Economic Community of Central African States, and the International Conference on the Great Lakes Countries. The objectives of these organizations are complementary and at times overlap. Limited funding has resulted in low activity of some of the organizations, and hence a review on the mandates of the organizations would help streamline their focus and participation of the member countries.

While these regional organizations exist and their generic mandates are presented, there appears to be no specific mention of, or agreements on, milk and dairy products trade. However, milk and dairy products from other EAC countries including Rwanda pass through the Burundi borders daily.

6 Ethiopia dairy profile

6.1 Country background

Ethiopia has a total area of 1.1 million km². Located in the Horn of Africa, six countries border the country (3.3). The topography of Ethiopia ranges from the highest altitude at Ras Dashen that is 4550 meters above sea level to 110 meters above sea level at the Afar depression. Climate varies likewise with the topography from a mean annual temperature as high as 47 °C temperature in the Afar depression to as low as 10 °C in most of the highlands. Rainfall ranges from less than 100 mm to as high as 3200 mm per annum.

The livestock sector, dairy included, contributes about 14% to the total GDP and 40% to the total agriculture GDP and has huge production and market potential for improvement. The cattle population is estimated at 52 million and is owned by 80% of the peasant households residing all over the country except in the non-sedentary areas of Afar and areas bordering Somalia. Cattle are used for meat, milk and hide production and for traction. The households own cattle herd sizes ranging from 0 to 200.

Ethiopia produces 3.3 billion liters of milk from 11 million cows owned by peasant, smallholder, medium level and commercial dairy farmers. Peasant farmers are classified as farmers who own local cows and are subsistence oriented in their farming practices. They produce about 95% of the milk produced in the country.

Smallholder farmers are classified as farmers that own 5 or less improved dairy cows. Medium level farmers own 6-39 and commercial farmers own 40 and above improved dairy cows. These classifications were developed by the EDDP of LOL to avoid confusion in extension service provisions. The smallholder, medium level and commercial dairy farmers have business orientation and are classified under the private sector. Smallholders' extension is delivered through local lead farmers, community leaders and agents while consultation with commercial farmers is on a one on one basis and the quality of services also differs. Income from sales of milk obtained from two improved dairy cows is estimated at 24,000 Birr (USD1,300) per year, which is three times larger than the USD 454 current GDP per capita. In addition to government staff and retired military, individual business people, share companies, Ethiopians in the diaspora, international companies, smallholders and commercial dairy farmers are investing in improved dairy cattle. Of interest is the classification of smallholder dairy farmers under the private sector.

Average milk production per day per local cow is 1.54 liters while improved cows produce on average 12 liters per day. The improved dairy cattle population in Ethiopia is less than 1%. The major feed resources in the highlands, which are characterized by high population density, are poor grazing fields with limited land size, limited crop residues quantity and poor quality hay while in the lowlands and pastoralist areas there are good pastures, rangelands, and standing hay but limited access to water. IN general, feeds obtained from these sources are deficient in basic nutrients; also, palatability and digestibility are low.

6.2 Dairy value chain

Despite the efforts made so far, the dairy value chain in Ethiopia is underdeveloped. Most agricultural sector investments and business development services were handled by Government until the advent of the market led economy and liberalization policies in 1993 when a new government came into power. After the introduction of these policies, private sector investments and services started to emerge in the dairy sector; however, they are still inadequate. The dairy value chain actors and support service providers are working in an uncoordinated manner leading to an ineffective value chain. However, there are indications that the number of private sector input suppliers such as feed/forage and equipment suppliers, AI and service providers has begun to increase to fill the gap.

In Ethiopia, there are two dairy value chain marketing channels, the formal and informal markets and the latter dominates. About 90% of milk is marketed informally in Addis Ababa. The informal market is characterized by a shorter value chain, production and market operation inefficiencies, poor quality products, unstable income to milk producers, and low investment and job creation opportunities. It is essential to start engaging the informal dairy product marketers, especially in urban and peri-urban areas to increase supply of raw milk to the formal market. The shift from informal to formal can be facilitated by educating the informal actors to shift from traditional to formal marketing of milk and milk products. A legal framework and the livestock master plan being developed will likely address this supply chain issue by introducing profit incentives to encourage change. National milk production is estimated to

be 3.3 billion liters of milk (LLC, 2011). Of the 3.3 billion liters less than 5% is channeled through the formal market operations. According to price information gathered from AGP-LMD dairy value chain analysis in 2013, indicative price transactions in Greater Addis Milk are as follows.

At production level of 3,600 liter of milk per year, average production cost per liter of milk is estimated at ETB 6.52 (USD 0.34) including family farm labor cost. Ten per cent of the total variable cost is included as additional cost. Selling price of milk by farmers at collection centers is ETB 7.6 (USD 0.41) giving a margin of USD 0.07/liter. This includes transportation cost, to deliver milk to a collection centre which is estimated at ETB 0.15 (USD 0.01) per liter of milk. This allows smallholders to earn about ETB 0.93 (USD 0.05) per liter of milk. This gives the producer about 14% gross profit. A smallholder farmer supplying 12 liters of milk will earn about ETB 91.2 (USD 4.75) per day. This margin can be improved by reducing feed and other management related costs from current 72% to below 60% The gross margin calculation is estimated at ETB 11, 897 (USD 620) per cow per year, which is very high (297% increase) in comparison to ETB 4000 (USD 208) in 1998 for the same area and same production level (AGP/LMD 2013, SDDP Project Report, 2002).

6.2.1 Key dairy value chain players and partners (projects, donors etc.)

Land O'Lakes produced the Ethiopia Dairy Business Directory that holds a list of 1013 dairy value chain actors and supporters that are grouped under 33 categories (Appendix 6; online www.etchedairydirectory.com). Key players in the Ethiopian dairy value chain and development partners in the formal marketing system include the following.

Farmers: Key value chain actors in the formal market are urban and peri-urban smallholder, medium scale and commercial dairy farmers

Input Suppliers:

Animal feed processors: These are Alema Koudijs, Akakai, Ashraf, Kality, Ethio feeds, Addisalem and HBA.

Hay marketers: These include Selale youth hay marketers.

Forage seed suppliers: These include Eden Agri-seed enterprise, Biftuberga union and research organizations, and feed ingredient suppliers.

Genetics: AI services providers include ALPPIS and NAIC, Cattle ranches, dairy cattle brokers, dairy cattle importation by commercial farmers and government.

Health: Animal drug suppliers include Neway plc, East Africa Pharmaceutical plc., Gasco Trading, Agricultural Inputs Supply Enterprise, DAT International, and Tropical PHARMA Trading

Agro chemicals dairy equipment suppliers: Agro PHARM Limited, Gasco Trading, IDC Denmark International, ENCON Engineers, Al-impex, NAPCO group, PACKO, and HAGBES

Milk collection and chilling centers: About 300 in urban and peri-urban areas that are owned by cooperatives, youth groups and about 10 private chilling centers.

Cooperatives and unions: Dairy unions and cooperatives are not less than 200. The dairy unions are Selale, Asella, Hiwet, Zemen and Humera. Some of dairy cooperatives are Adaa, Asella Town, Lemuaray, Biftuberga, Bekoji, Hibret, Hiwet, Chancho Town, Fitch Town, Anokere, and Agolala.

Processors: Sebeta Agro Industry, Lame Dairy, Diredawa Dairy, Holland Dairy, MB PLC, Adaa Liben Dairy Coop, Genesis, Lema Dairy, Bora Milk, Timret, Loni, Nardeli, Enat, Zemen Milk, Fasil Milk, Berta and Family, Ruth and Hirut, Almiwetet, ELEMENTU and Velocity Dairy; however, the latter two have not begun processing.

International NGOs and funding agencies: Finland Development Cooperation, USAID, CIDA, Ministry of International Cooperation, the Netherlands Government (DGIS), Land O'Lakes (LOL), Citizens Network for Foreign Affairs (CNFA), SNV-EDGET, LIVES (ILRI and IWMI), ILRI, Bill & Melinda Gates Foundation (BMGF), Ethiopia Agriculture Transformation Agency (EATA), and MTT Agro Food Research (Finland).

6.2.2 Production systems

The Ethiopian milk production system is based on a milkshed development pattern/approach that relates to the market and distance from urban centers. This is more practical than agro-ecologically based classification which is more appropriate for crop production than for livestock. Accordingly, the milk production system in Ethiopia is classified as urban, peri-urban and rural. All the other systems such as subsistence, smallholder, commercial, intensive, extensive, highland and pastoral are subsets of this general classification.

Urban milk production system

The urban milk production system includes intra-urban semi-intensive dairy farming in the capital Addis Ababa and emerging national regional towns including Hawassa, Bahir Dar, Mekele, Gondar, Diredawa, Jimma, and Desse. The production system is mainly zero-grazing in which purchased hay from the peri-urban and rural areas is fed. According to SDDP (2008), 74% of the milk supplied to Addis Ababa comes from the urban milk production system. However, the Livestock Marketing Agency of the Ministry of Agriculture year 2000 study revealed that this contribution had declined to 53%. The GoE is discouraging urban dairy farming, thus the contribution has further declined to about 51%, but it still exists and will continue to exist for some time in the future. In total, about 90% (51% and 39% from urban and peri-urban, respectively) of milk is marketed informally in Addis Ababa and less than 10% enters the formal market.

Peri-urban milk production system

The peri-urban milk production system practices both intensive and semi-intensive dairy farming. The system encompasses dairy farming areas that are within 180 km Addis Ababa radius and 60 to 80 km of other national regional towns. This production system is expanding because of high demand for milk in urban centers. Most improved dairy cattle breeds are in this production system. All dairy processors, except LAME Dairy and FAMILY, and most MCCs are located in this system. Milk producers are commercially oriented and respond to improved best practices, technology, input supply and marketing services, if available, especially when a milk market is secured.

Rural milk production system

This system entirely derives milk from local cows that produce surplus milk when grass is abundant. The small surplus milk is usually consumed at home and some is processed into butter and *ayib* (a cottage type of cheese). The processed products are sold in local/village markets and also taken to urban centers including the capital city, Addis Ababa. Butter traders move their products from primary to secondary markets and consumer centers. Butter trading is a legally registered business in Ethiopia. This system occurs in two areas, rural areas in the highlands and mid-altitude areas that are recognized as the butter processing areas, and in the pastoral community. In fact, butter and cheese are important products in Ethiopia, because fresh dairy products cannot be sold and consumed during the long fasting periods. Orthodox Christian believers do not consume livestock products including dairy and poultry products during fasting periods. Based on the population religion classification data and anecdotal evidence, milk sales can decline by 20 to 25% during the Orthodox Christian fasting season.

6.2.3 Milk transportation from farm to market

Transportation of milk from smallholder farms to MCCs or any market outlet is mainly done by family members, mostly children on foot, although animals, bicycles and motorcycles are also used. Some individuals rent or own trucks to transport milk from farms to milk shops, cafes, restaurants and milk processing centers. Commercial dairy farmers and dairy cooperatives also use trucks with capacity to carry 10 to 50-litre milk cans to transport milk from their farms to markets. Private milk marketers also collect milk from smallholder farm gates to milk to processors or retailers, cafes and restaurants in urban areas. Processors also collect and transport milk directly from commercial farms, non-cooling milk collection centers and MCCs using insulated tankers. Given the mix of transportation means for formal and informal markets, there is no standard milk transportation system. In most cases, due to poor road infrastructure, unreliable timing and delayed payments for milk delivered, milk transportation is inefficient resulting in significant losses from spilling and spoilage.

6.2.4 Aggregation and marketing of raw milk

Out of the 3.3 billion liters produced nationally (LLC, 2010/11), 4.5% was marketed as fluid milk, 46.61% consumed in households, 0.35% in-kind wage payment, and 48.36% for butter and *ayib* production (AGP/LMD, 2013). In addition, dairy products valued at USD 10.6 million were imported in 2012, mostly in milk powder form. Milk sales in Addis Ababa were estimated to be 83,500 liters per day (SDDP Report, 2002). When milk powder imports were included, the city's total liquid milk market was estimated to be 112,000 liters per day. In addition, about 15 metric tons of butter was sold daily for cooking and cosmetics purpose in Addis Ababa. This gives an estimated total market for milk and dairy products of 300,000 liters per day. Considering population growth, urbanization and increased income, the raw milk market in Addis Ababa is estimated to grow three fold by 2020 from the year 2000 base. The same trend is expected for emerging national, regional towns.

In the formal milk marketing system, morning raw milk comes from peri-urban dairy farmers and is channeled through cooperatives, cooperative unions and private MCCs. There is potential to increase supply from uncollected afternoon milk if smallholders can have access to cooling facilities closer to their farms. This will be possible given the on-going rural electrification programs in Ethiopia. Attempted use of water-cooled charcoal or sand-boxes to cool milk on farms was not adopted mainly because of increased labor demand. There is need to introduce other innovative cooling means such as solar ice-cooling facilities to help farmers preserve their morning and afternoon milk immediately after milking and be able to sell good quality milk to market. Demography and health surveys indicated that 0.6% rural households own refrigerators yet 33.7%, 1.1% and 12.8% own radio, television and mobile phones, respectively (CSA, 2011). In areas where electric power is available, the use of small size refrigerators needs to be enhanced to reduce milk spoilage. Due to poor milking hygiene and handling practices and long distance to milk cooling facilities, 25 to 30% of milk of wasted. If half of the milk that is being wasted can be recovered, revenue collected can be invested in farm inputs and technologies including milk cooling tanks and refrigerators. Also, introducing milk quality testing platforms/protocols and quality-based payments systems will improve product quality and food safety.

Despite volumes of milk and poor milk collection and cooling facilities, the Ethiopian milksheds lack access to formal milk markets (Land O'Lakes Field Report, 2010).

Ethiopia's challenge is in improving dairy value chain efficiency through a participatory and inclusive approach that address sustainable regulation of milk trading, improvements in the cold chain infrastructure to reduce wastage, improve quality and increase volume of marketed milk. Dairy value chain stakeholders need platforms to discuss strategies to sensitize players on food safety and on the benefits from a regulated and efficient milk production, collection and marketing system.

Milk prices along the dairy value chain (Figure 7.1) are ETB 7.6 (USD 0.4), 7.9 (USD 0.42), 8.5 (USD 0.45), 14.2 (USD 0.74), 18.4 (USD 0.97) and 18.4 for farm gate, MCC, bulking centers, processors and distribution/retailers, respectively (AGP/LMD, 2013). Factors affecting price of raw milk are cost of production, seasonality, milk transportation and distribution system and fasting/non-fasting by the Orthodox Christian Church followers, quality, access to markets and government tax.

6.2.5 Milk processing and distribution

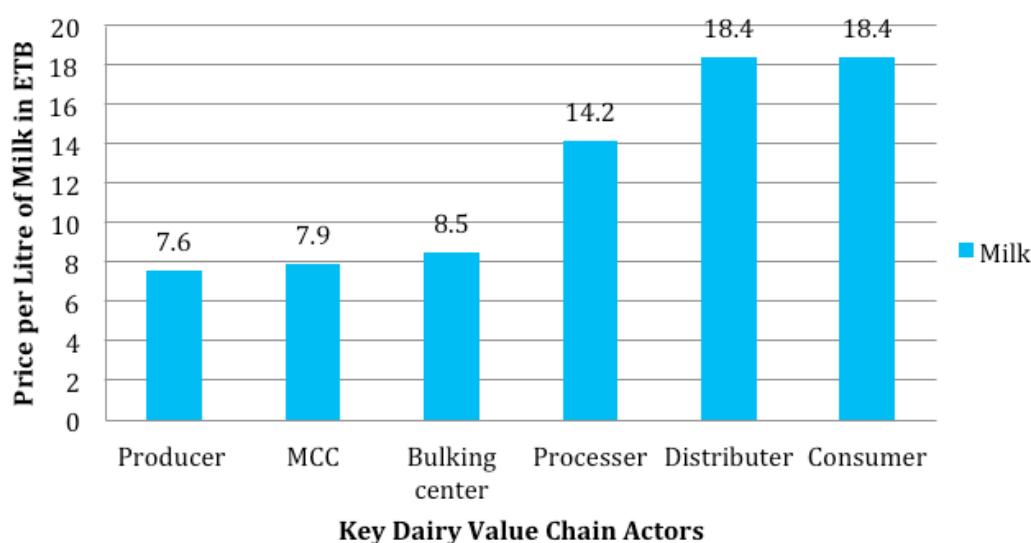
Over 15 branded dairy products that are available in the market place from both sources, local and imported, are pasteurized milk, yoghurt of various kinds, pasteurized skimmed milk of various fat levels, table and cooking butter, ghee, soft and hard varieties of cheeses and powder milk for babies and adults. The prices of imported products are usually double those of the locally produced dairy products. Key factors to enhance consumption are identification of new market channels and efficient distribution to reduce cost. Milk revenue (consumer price) share is 41, 2, 3, 31 and 23% for farmers, MCC, bulking centers, processors and retailers/supermarkets, respectively. Supermarkets still suffer effects of seasonality in supply.

With increasing urbanization and a fast population growth, the demand for processed dairy products will continue to be high. As a result, the value of imported dairy products rose from USD 6.9 million in 2008 to USD 15 million in 2010 (Ethiopia Revenue and Customs Authority, 2011). Nowadays imported dairy products have market access in both urban centers and villages countrywide.

Milk processing plants number has been increasing and but the milk processing plants have under-utilized processing capacity ranging from 5,000 to 30,000 liters per day. There is need to understand how the processing plants remain profitable despite low capacity utilization. It is estimated over 125,000 liters of milk per day is processed by all processors. Before 1998, it was only the DDE plant with the brand name SHOLA that was supplying processed dairy products to the Addis Ababa market. After 1998, over 20 small, medium and large milk processing plants were established.

The new processors include Sebeta Agro Industry, the first privately owned dairy plant in Ethiopia that supplies dairy products with the brand name MAMA. ELEMENTU a share company which signed a MOU to partner with Brookside of Kenya will have a processing capacity of 35,000 liters of milk per day when commissioned shortly. Also, Velocity Dairy, under construction, will have a capacity to process more than 150,000 liters of milk per day. Understanding Ethiopian consumers and cultural issues that influence dairy usage is critical. Consumer preferences are complicated and selling dairy products in Ethiopia is not an easy task. Consumer preference, fasting for 180 days and demand for quality dairy products are issues to be considered when marketing.

Figure 7.1: Price transactions across DVC actors in Greater Addis Milk Shed



6.2.6 Commercial animal feed and fodder supply services

There are few concentrate feed producing plants in Ethiopia that are largely found in and around Addis Ababa. There are also two new feed processing plants in the North. The production capacity of the feed plants range from 0.5 to 12.5 tons per hour. All the feed plants are not utilizing the installed capacity mainly because of poor availability and high cost of feed ingredients, technical limitations, poor product distribution systems and inadequate storage facilities. The feed plants primarily produce poultry feed. For instance, in 2010/11 out of the 264,390 quintals of compound feed produced by eight feed processors, 62%, 22% and 16% was for poultry, fattening animals and dairy cattle, respectively. The prices for dairy cattle compound feed for cows, bulls, heifers and calves rose from 2005 to 2011 by 228%, 241%, 204% and 355%, respectively. Cost of production for a liter of milk is estimated at ETB 6.52 (USD 0.34) and 72% of production cost is feed cost.

Pastures and crop residues are major animal feed sources. Hay, silage, green forages, forage seeds, seedlings and cuttings are produced in rural villages and marketed mostly among households. The Land O'Lakes approach in forage seed and seedling production contributed to sustaining forage production and initiated commercial fodder production. Hay and forage seeds are becoming a marketable commodity in Ethiopia. Silage is marketed on specialized farms in Debre Zeit.

The price of hay (bale) that weighs 17 kg is ETB 55 (ETB 3.24/USD 0.16). The average price of quality concentrate feed is ETB 3.34/kg (USD 0.17). Although the prices of both feeds are increasing, the price increase is more for roughages (hay) which is the basic feed that should be available at a reasonable price. Under the existing production system, consumers will continue to pay high prices for milk, which reduces sales. The price of hay is increasing from time to time but availability is still limited. Hay is expensive because few entrepreneurs are doing baled hay business and marketing is still restricted to few locations. Also, some of the entrepreneurs used to export hay leading to shortage. There are still potential areas that can be used for hay production and marketing but this requires government facilitation to lease the lands.

6.2.7 Veterinary and animal production services

Ethiopia started its livestock development activities by providing public animal health services. The veterinarians used to assist in animal production and farm management extension services as there was no trained manpower in animal production.

The GoE plays a major role in providing veterinary services that are supported by the National Animal Health Research Centre which diagnoses diseases, and runs fourteen national regional veterinary

investigation laboratories and one National Veterinary Institute that manufactures vaccines. The field health services are provided through veterinary clinics and health posts located at zonal and district levels. Farmers in the vicinity of these health centers bring their animals to get the service. Health services are limited to these locations and thus are inadequate. Economically important diseases in Ethiopia are foot and mouth, CBPP, anaplasmosis, enterotoxaemia, TB, brucellosis, lumpy skin, haemorrhagic septicaemia, and black leg and anthrax that occur sporadically. Mastitis and milk fever are regarded as management issues. There is no difference in animal health services provision despite beef and pastoral cattle being local breeds that are relatively more resistant to diseases while dairy cattle are imported breeds, and hence more susceptible to diseases. The latter therefore require better animal health services than the former.

Most households keep dairy cattle close to their homes but some allow them to graze and herd them together with local cattle risking disease transfer. The engagement of the private sector in veterinary drug production (e.g., East Africa Pharmaceuticals) and importation, vet equipment and supplies distribution, and running vet clinics and health posts in urban and rural areas helped to expand animal health field services in Ethiopia. Privatized veterinary services suffer market distortion because of government vets providing service at no cost (labor) and/or selling vaccines and medicine at subsidized prices.

Improved breed dairy heifers and cows are not available locally, particularly for those intending to establish new farms or expanding dairy farms. There is a high demand for good quality bred heifers in Ethiopia. In 2011 some farmers imported bred heifers from the Netherlands and they landed at a cost of Euro 3,055 (CIF, Addis Ababa). Imported dairy cattle are performing better on private commercial farms than government farms. Smallholder farmers successfully managed crossbred in-calf heifers imported from Kenya. There are seven government owned cattle breeding ranches aimed at producing in-calf dairy heifers. However, the ranches are not producing enough because of inefficiency and administrative structure changes. Breeding services are constrained by limited availability and access to liquid nitrogen. Privatizing the government ranches and liquid nitrogen supply could improve the AI service, and hence increase availability of improved dairy cattle.

Poor milk quality is of concern in the country. There is high mastitis prevalence, particularly in the greater Addis Ababa milkshed, where its prevalence ranges from 84 to 94%. Milk samples collected from dairy farms and collection centers showed also SCCs that ranged from 100,000 to 1,000,000 per ml (EDDP, 2007).

Access to AI services is limited. Cattle breeding is predominantly through natural service. In the highlands and mid-altitude areas, farmers practice mixed farming. In this system, unlike in the pastoral areas, good performing steers are selected and castrated for ploughing instead of using them as breeding bulls to improve the performance of the herd. As a result, cattle in these areas are usually small in size, weak and produce low milk quantity. Although the GoE provides most of the AI services through the National Artificial Insemination Centre (NAIC), it supports AI service privatization and adoption of a cost recovery system. There is only one private AI service provider called ALPPIS. ALPPIS uses imported semen from World Wide Sires and it has so far distributed 14,000 doses of semen. The cost of AI using imported semen is estimated at USD 26 per insemination.

One critical constraint that restricts the expansion of modern dairy farms in Ethiopia is shortage of improved dairy breed cattle. Many farmers started importing dairy heifers and female calves to open new farms or to have replacement stock. The government-owned cattle breeding ranches that produce heifers are being privatized. Two out of the seven ranches have already been privatized but they are not working for the intended objective. Moreover, in an attempt to improve AI services and delivery of good quality semen, the GoE established 11 liquid nitrogen plants in different places in Ethiopia. Though accessible to both private and public AI service providers, the liquid nitrogen plants are often out of order. Binding after sale service contracts and technical assistance in maintenance and repair of these onsite generators is required. This also offers employment opportunities for young graduate engineers to service and repair these plants.

6.2.8 Financial services

The GoE operates three banks and there are 16 private banks. Microfinance institutions are increasing in number. However, the value of loans allocated to agricultural sector development is relatively small. Dairy is a long-term, capital intensive activity; hence, creating links with financial services and innovative credit facilities is essential. The critical issue related to dairy lending is that government-owned and private banks do not recognize that the dairy business pays; hence, they are reluctant to offer loans to, in particular, dairy value chain actors operating at the lower end of the dairy value chain. Further in this

regard, the required loan collateral precludes a large proportion of smallholder farmers from accessing loans. As a consequence, most smallholder dairy farmers may never get credit from banks but will most likely depend on support from development partners. Opportunities for women to access loans are even less than for men because they have less productive assets to use for collateral.

Some private banks in Ethiopia are able to provide loans to livestock farmers through a USAID/DCA guarantee fund. Rabobank of the Netherlands has started financing rural farmers through cooperatives in the coffee and flower sectors. With some adjustments, the same model can be used also for dairy. There is a need to build social capital and organized dairy farmers groups for collective milk marketing that can facilitate access to finance.

6.2.9 Extension, training and knowledge transfer systems and services

Dairy extension services are more effective and successful if farmers can take a lead, or have a bigger share in the provision of the extension services (Redda, 2007). As a result, many extension services are provided through contact, lead, champion and model farmers, and the ratio to their follower farmers often used is one to 25. Recently Ministry of Agriculture is using one model farmer for five follower farmers to ensure adoption of best practices and technology transfer.

Dairy projects usually organize classroom sessions with field supported practical trainings for contact farmers, dairy value chain actors and also TOTs. Training materials including manuals, posters, factsheet and flyers are used to conduct the trainings. Organizing village conferences, field days, and meetings are some of the other methods used to transfer knowledge to end users. Farmers training and knowledge Centers are available to use them as venue in trainings organized in villages. The farmer training centers (FTCs) have space that can be used to demonstrate new technologies and computer services and business planning.

Processors, dairy cooperatives and private sector extension services are not yet involved in organizing village level training. As a result, the responsibility of dairy training and extension services are in the hands of government and dairy projects. Innovative extension services that also facilitate input output market functions can be developed if private sector can have the opportunity to work on knowledge transfer/extension services.

Apparently, there is an oversupply of veterinary graduates from the vet school in Debre Zeit. Development programs can absorb some of these graduates who could be employed by the cooperatives, processors and private AI service providers.

6.2.10 Environmental issues and potable water resources

Crop farming is extending to pasture areas and, as a result, grazing area in mixed farming system is diminishing with time. This accelerates overstocking and overgrazing that contribute to environment degradation. Having a high unproductive livestock population exacerbates the situation. Ammonia release from cattle farms is another concern that contributes to environmental pollution. Actors across the value chain need to apply environmentally friendly practices and there must be a regulation/an incentive that enforces its application.

All dairy projects promote environmentally sound dairy management practices at farm production, collection, bulking and dairy processing levels. However, public and private investors in other agricultural sectors should submit environment impact assessments before they lease land for use. The assessment should include mitigation measures to reduce environment degradation.

Availability and access to potable water resource in rural areas for human use is improving but the water might not be used for livestock consumption and MCC cleaning. Use of non-potable water on farm and in village MCCs for cleaning milking equipment and facilities compromises milk quality.

6.2.11 Industry associations, producer groups and farmers organizations

There are five industrial and professional livestock associations, namely the Ethiopia Animal Feed Industry Association (EAFIA), Ethiopia Producers and Processors Association (EPPA), Ethiopia Breeders Association (EBA), Ethiopia Society of Animal Production (ESAP), and Ethiopia Veterinary Association (EVA). Some are engaged in livestock studies and organize events to discuss challenges affecting the growth of the sector and proffer solutions. The industrial associations are weak, and hence they have not brought large changes in the sector. Joint discussion platforms of all value chain actors that are in an

area or specific milksheds are required to develop a bottom up dairy development institutional framework.

Over 300 milk marketer groups, dairy cooperatives and unions exist in the dairy sector at various management levels. These are community based institutions that facilitate collective milk marketing. Most do not have milk cooling facilities and also lack business orientation. Most of the centers were initiated by donor supported dairy projects.

6.2.12 Dairy sector institutions, governance and policies

The development frameworks for the dairy sector in Ethiopia include the ADLIP, RDPAS, GTP, AGP, CAADP/PIF, USAID strategy document, REDFS and DSF. There is no functional dairy sector policy and private sector focus dairy institution in Ethiopia. The dairy sector development lacks an institutional arrangement that coordinates dairy investments and services. The Ethiopia Dairy Board was on its way to its formation, however during the country visit it was noted that the concept paper developed and submitted to the Ministry of Agriculture is still under consideration.

A livestock breeding policy including dairy breeding has been developed by the ministry of agriculture in collaboration with key sector partners but still requires endorsement and adoption for use. A livestock master plan is under preparation. The master plan is a road map that is expected to show new direction, priority areas and investment opportunities in the implementation of national livestock development programs, including dairy.

A REDFS platform was created under the Ministry of Agriculture and is chaired and co-chaired by the Minister of Agriculture and USAID. The REDFS is a crop dominated platform with no representative from the private sector. There are also four technical committees including one for the livestock sector chaired

<p style="text-align: center;"><u>Strengths</u></p> <ul style="list-style-type: none"> ▪ Population and economic growth ▪ Commercial interest by investors to engage in dairy sector development. ▪ Addis Ababa has large market due to regional AU & other international meetings, business conferences and exhibitions. ▪ More improvements than before in access to water, electricity, health centers, schools and roads in rural areas 	<p style="text-align: center;"><u>Weaknesses</u></p> <ul style="list-style-type: none"> ▪ Limited private sector participation ▪ Limited availability of farm inputs and services. ▪ Poor financial and business management skills of dairy cooperatives/groups ▪ Weak veterinary services ▪ Weak extension services including AI & feeding extension services ▪ High input and distribution costs & government taxes ▪ Poor udder health, hygiene and milk quality standards, ▪ Lack of cooling facilities at some MCCs ▪ Frequent electricity power cuts that lead to milk spoilage ▪ No responsible body to coordinate dairy at government level
<p style="text-align: center;"><u>Challenges</u></p> <ul style="list-style-type: none"> ▪ Shortage of raw milk supply as a result of low cow productivity ▪ Shortage of good quality feeds ▪ Limited access to financial and credit services ▪ Lack milk of quality assurance mechanism ▪ No institutional frame work to sustain dairy efforts ▪ Poor market linkages across dairy value chain actors. ▪ Poor infrastructure such as rural roads, access to clean water and other basic household needs 	<p style="text-align: center;"><u>Opportunities</u></p> <ul style="list-style-type: none"> ▪ Demand for dairy products is increasing ▪ High demand for dairy business development services ▪ Huge potential to initiate new distribution channel such as school milk program ▪ Good opportunities to export camel dairy products. ▪ The highlands have a good environment to expand dairy farming

by the State Minister of Livestock. Dairy is under the highland/mid altitude area taskforce. However, it remains unclear how these development platforms support the dairy sector.

There is no official inspection for food safety of milk and milk products in Ethiopia. The public and private sectors, and actors across the value chain should be aware of the need and the different methods available such as HACCP to improve quality assurance of the products. More infrastructure support is required in rural roads, financial and communications services.

6.3 Strengths, weaknesses, challenges and opportunities in dairy sector

The strengths, weaknesses, challenges and opportunities are presented in Table 6.2.

6.4 Emerging dairy sector issues

The dairy sector is expanding. Many individuals, Ethiopians in the diaspora, and international companies have started investing in the sector. They are investing in dairy farms and processing plants, such as Velocity from the Netherlands and Brookside from Kenya.

Ethiopia recently restructured the Ministry of Agriculture. Livestock sector development activities are now managed at the State Ministers level, which is one step forward in promoting the sector. The Extension State Minister and Regulatory Directorate used to manage the livestock sector together with other agriculture departments.

The government is mobilizing funds and has engaged in harmonization of the dairy value chain and improvement of the national artificial insemination service delivery. However, the role of private sector in these new developments remains weak.

Some local authorities including Addis Ababa and Dire Dawa City are taking more responsibilities in dairy sector development, which is unusual, but favorable for dairy sector growth. Some Ethiopian states have started transferring public owned properties to the private sector. An example is the Mekele Town abattoir that has been transferred to private ownership.

A private company, Precise Consult International, has initiated a support program to the dairy sector that is using a business innovation and incubation approach to enhance private sector engagement.

6.5 Prospects for sustainable growth

6.5.1 Economic, environmental and social performance of the sector

The agriculture sector in Ethiopia accounts for 49% of GDP, 85% of employment and 90% of exports. The livestock sector contributes 19.6% to the agriculture GDP but the specific contribution of dairy to GDP could not be ascertained. These estimates exclude many of the other social and economic benefits that livestock contribute to agricultural as well as national GDP. The overall economic and social values of dairy to the gross value of livestock is not known, but ILRI study in 1989 showed that sales of dairy products, especially butter provide 20% of the rural household income in central highlands of Ethiopia. Smallholder farmers earn USD 831 to USD 3,279 per year per household from milk sales depending on herd size, location and access to market. This is only income collected from milk sales excluding other benefits. In comparison to the national per capita GDP which is about USD 454, smallholder farmers therefore earn two to seven-fold more from dairy farming.

In rural areas, wealth is also determined by the number of animals owned. Smallholder farmers usually use revenues collected from sales of animals and dairy products to purchase improved seed, fertilizer and other farm inputs to improve food crop production. In the Ethiopian context improving livestock is improving the whole agriculture sector.

6.5.2 Production, economic and other models for sustainable dairy sector growth

The Ethiopia dairy sector has bright prospects. Its prospects come from restructuring the sector to adopt a value addition approach, enhance a formal marketing structure, engage the private sector in dairy investment and service provisions, support commercialization of smallholder production systems, and link smallholders to farm input suppliers and lead companies in the sector. The milkshed development model works well to improve production (milk supply) and to develop market linkages among value chain actors located in the same milkshed. Some adjustment may be required to cater for public-private-partnerships at milkshed level. Prospects for sustainable growth will also come from the nascent institutional and policy reforms that are giving more and direct support to the dairy sector.

Prospect for dairy development is hinged on sustaining milk supply and consumption bases. Targeting consumers such as age group below 15 that represent 47% of Ethiopian population through good quality school milk program will sustain the consumption base.

Savings and production margins can be improved through reducing peri-urban oxen kept all year round but used for a few months in a year. Given the scarcity of feeds, feeding and handling oxen competes with dairy cows. There should be a system that promotes oxen renting service to peri-urban areas by rural farmers.

6.6 Collaboration prospects

6.6.1 Donor programs, policies of, and collaboration status among, dairy funders and/or implementers

The Government of Ethiopia (GoE) is supported by international NGOs and funding agencies to improve the dairy sector. Market oriented dairy projects supported by donors are presented below.

Finland Development Cooperation funds the Smallholder Dairy Development Project (SDDP) for 25 million Fin mark. The SDDP initiated collective milk marketing approach in Ethiopia that processors are linked with smallholders through their milk marketing groups/cooperatives. Following the SDDP is the National Livestock Development Project (NLDP) which is financed by a USD10 million loan from African Development Bank, and the Integrated Livestock Development Project (ILDP) funded by the Austria Development Cooperation. All were managed on bilateral cooperation basis.

SNV Ethiopia had a project entitled Business Organizations and their Access to Markets (SNV-BOAM). The project made value chain analysis in a number of milksheds in Ethiopia, assisted in dairy business development, performed milk quality testing operations on a pilot basis, and initiated milk quality based payments. It also provided training to milk suppliers and dairy processors. The SNV-BOAM project ended but has been followed by SNV-EDGET, which is on-going.

Land O'Lakes implemented two projects in Ethiopia: the Milk Marketing and Processing Project in Tigray implemented in collaboration with Irish Aid, and the USAID funded Ethiopian Dairy Development Project (EDDP). Land O'Lakes introduced milkshed and value chain development approaches that led to large improvements in the dairy industry. Actors along the value chain were assisted in technical innovation and business operations, particularly in the lower and upper end of the value chain. Average milk yield per day per local and improved cow increased from 1.2 to 1.98 liters and 6 to 12 liters, respectively, in project assisted areas. The generic consumption promotion conducted by Land O'Lakes increased dairy sales by 20%.

On-going donor funded dairy projects include:

- USAID funded CNFA-AGP/LMD that is focusing on livestock sector development including dairy. It builds on the efforts made by Land O'Lakes in strengthening dairy value chain commercialization.
- The SNV-EDGET is funded by DGIS (Ministry of International Cooperation) of the Netherlands. The project expects to improve milk production and cow productivity, and enhance market access through establishment of MCCs and small-scale processing plants. The project plans to improve child nutrition through increased milk consumption.
- LIVES – the LIVES project is a collaborative project of two institutions, International Livestock Research Institute (ILRI) and International Water Management Institute (IWMI) It aims to enhance the success of the CIDA (Canadian International Development Agency) funded project of IPMS (Improving Productivity and Market Success for Ethiopia farmers).
- The Bill & Melinda Gates Foundation (BMGF) is assisting the GoE to implement the GTP, in both crops and livestock sectors, through the Ethiopia Agriculture Transformation Agency (EATA).The ATA is just starting to develop its livestock program; all activities to date have been focused on crops. The BMGF is also funding the development of Livestock Master Plan.
- Finland government restarted supporting National Artificial Insemination Centre (NAIC), in collaboration with MTT Agro Food Research in Finland, to undertake a milk-recording scheme in Ethiopia.

In general, there is poor coordination among donor supported dairy projects. The implementers plan dairy projects together with the public, sign memorandums of understanding or some kind of collaboration methods, but not among themselves. Among dairy funders, adopting "Client Based Approach" along the dairy value chain might help to properly utilize donor programs. Donor support can be based on value chain studies, constraint analysis, followed by an integrated approach and support of private sector development in line with public responsibilities like extension, infrastructure, training and education. To avoid duplication of efforts and improve resource utilization, dairy funders could focus on one or two parts of the value chain. For example, if one dairy donor focuses on the lower end of the value chain other funders could deal with processing and distribution. Among dairy funders and implementers, regular meetings with implementers and more field visits might help to understand the implementation process of donor supported projects.

6.6.2 Public-private and within private sector collaboration and some insights into donor policies on dairy

Building public private partnerships in achieving dairy sector plans, incorporating innovations and technologies, trade and investment policy development to attain an enabling environment are some of the issues for collaboration. When the Ethiopia Dairy Board begins its functions, it is likely facilitate the public-private-partnership building process.

Although the GoE supports private sector development, the situation now is that it is up to the private sector to lobby for GoE support for dairy sector development collaboration. This can be done in a coordinated manner through the nascent Ethiopian Dairy Board or industrial associations. However, the associations are still weak to address and influence government or lobby for change. Enhancing collective action of farmers groups and platforms representing value chain actors might also influence government support for change.

6.6.3 Opportunities for collaboration between dairy funders, and between dairy funders and implementers

The opportunities for collaboration are as follows:

- More technical support, technology and knowledge transfer are required to support private sector dairy development. There is high demand for private sector investment and business development services.
- Regardless of the efforts made so far, poverty and hunger are still big challenges in Ethiopia. Feeding Ethiopia and the world poor is the responsibility of government and well-wishers.
- Supporting a nutrition program for children through dairy products consumption is a good approach to collaborate to improve human resources development and create demand for dairy products.

6.6.4 Potential for regional integration

Considering the proximity of Ethiopia to Kenya that has a more developed dairy sector, Ethiopia can benefit from collaboration with Kenya. Potential areas of collaboration are in dairy farm productivity enhancement activities such as genetics, feeds and health services, market linkages, processing equipment and supplies, and private sector engagement modalities. In addition, collaboration with Uganda and Tanzania in dairy sector institution formation and private public collaboration is also important for Ethiopia to learn and benchmark.

Implementers such as SNV, LOL, and CNFA are available in most East African countries. Sharing ideas among the same implementer in countries involved might help to identify potential area of collaboration for regional integration.

7 Kenya dairy profile

7.1 Country background

Kenya land area is 580,367 km² of which 25 per cent is arable (Appendix 3.4). The rest is arid and semi-arid (ASAL). The human population is estimated at 41.0 million, over 70 per cent of which lives in the rural areas. The development blueprint for Kenya is Vision 2030. The country aspires to be a middle-income country enjoying a high quality life by the year 2030. This transformation is anchored on three pillars: economic, social and political transformation. Agriculture is among the priority economic sectors that will drive growth and development. Other sectors are manufacturing, trade, business process outsourcing and mining.

Agriculture is the main economic activity that accounts for 25 per cent of GDP. Livestock accounts for 40 and 10 per cent of the agricultural and national GDP, respectively. The dairy sub-sector accounts for 40 per cent of the livestock GDP and 3.5 per cent of the national GDP. Over 60 per cent of livestock is found in the ASAL regions (Appendix 3.4). The livestock sub-sector employs over 90 per cent of the local population in the region. The dairy sub-sector contributes to the income of over 700,000 smallholder farmers mostly women and youth. This has positive implications on food security and nutrition and has the potential to reduce poverty, particularly in the rural areas. Estimated to have grown by an average of 4 to 5 per cent per annum in the last eight years, the sub-sector produced approximately 5.0 billion liters of milk in 2012.

7.2 Key dairy value chain players and partners (projects, donors etc.)

Value chain players active in the dairy industry are smallholder farmers, medium and large scale dairy farmers, logistics and service providers. The key dairy sector value chain players and development work partners given below are grouped under the following headings: private sector, dairy traders, input suppliers, public sector, parastatal institutes, civil society, donor-funded projects and non-governmental organizations.

Civil society: Civil-society organizations supporting rural development in the agricultural sector include the Kenya Small-scale Milk Traders Association

Dairy industry traders lobby group:

Kenya National Dairy Producers Organization (KENDAPO), Kenya Livestock Breeding Organization (KLBO), Kenya Livestock Producers Association (KLPA), Livestock Genetics Society of East Africa, and Association of Kenya Feed Manufacturers (AKEFEMA)

Dairy input suppliers:

- Imported genetics, artificial breeding equipment and supplies of frozen bull semen and embryos - ABS TCM Ltd, Bimeda/Alta Genetics, Dairy Enterprise Trust Fund, Highchem/CRI, Coopers/CRV, Twiga Ltd/SEMEX, Best Farm Genetics, Fleckvieh, and World Wide Sires
- Liquid nitrogen: British Oxygen Company (BOC), Welrods, Kenya Animal Genetic Resource Centre (KAGRC), and ABS TCM Ltd
- Bred heifers: Gogar Farm, Baraton University, Deneside Farm, Moiben Dairies, private enterprise
- Dairy equipment -milk cooling and processing, milk cans and bulk transport tanks: AITEC, Desley Holdings Kenya Limited, and DSS/Alfa Laval.
- Milk packaging suppliers: TetraPak
- Veterinary inputs and vaccines: Coopers, Norbrook, Ultravetis, Higchem, Twiga Limited, and Nairobi Veterinary Centre
- Commercial feed and ingredients: Unga (K) Ltd, Sigma Feeds Ltd, Pembe, Belfast Millers, Novus, and Nutrimix Feeds (There are more than 100 feed millers in Kenya).

Parastatal institutions:

- KAGRC, Kenya Dairy Board (KDB), Agricultural Development Cooperation (ADC), Agricultural Finance Corporation (AFC), New KCC, Bukura Agricultural College, Kenya Agricultural Research Institute (KARI), Agricultural Information Resource Centre, and Kenya Veterinary Vaccines Production Institute (KEVEVAPI)

Private sector milk buyers and processors:

- Milk buyers and processors include Brookside Dairy, New Kenya Creameries Cooperative (New KCC), Sameer/Daima Dairies, Githunguri Dairy, Kabianga Dairy, Ilara Dairy, and Uplands Dairy.

Public sector:

- Ministry of Agriculture Livestock and Fisheries (MALF),
- Dairy Training Institute (DTI), Animal Health and Industry Training Institute (AHITI)
- Production and extension colleges include Egerton University, Nairobi University Departments of Animal Production and Veterinary Science, and Moi University.

Services:

- Feed laboratories: ABS TCM Ltd and Egerton University
- Milk quality and Veterinary services: ANALABS
- Veterinary laboratories: Nairobi University, KEVEVAPI for vaccine production, and Vetlabs
- Dairy ICT providers: Grameen Foundation and AgriTrace

7.2.1 Production systems

The dairy industry in Kenya is fragmented, with different production systems and an un-coordinated value chain. The dairy production systems in Kenya can be classified under three systems, zero grazing, semi-zero grazing, and extensive grazing systems. The predominant systems for dairy production are the zero and semi-zero grazing systems which are practiced in the important milksheds of the Rift Valley and central Kenya. To a smaller extent, these systems are characteristic of the western areas, Nyanza, and the coastal lowlands.

In general, smallholder farmers (owning 1-3 dairy cows) account for 80 per cent of milk produced in Kenya. These are mostly subsistence farmers. In effect, therefore, medium and large scale farmers account for 20 per cent of milk production. This structure has implications on the growth of the industry, particularly considering that the smallholder farmer has technical and financial resources constraints. This limits dairy sector productivity up-scaling.

The cows of livelihood (subsistence) dairy farmers produce 5 to 10 liters of milk per day while individual medium and large scale farmers own in excess of 10 cows that produce more than 10 liters per cow/day. The last two categories of farmers are business oriented, and form the basis of a growth oriented industry, the livelihood dairy farmers are mainly concerned with nutrition and food security. This category of farmers could benefit from the traditional poverty oriented programs implemented by development partners. However, this support should be consistent with the market oriented policies for the growth and competitiveness of the sector.

Milk production has increased by approximately 4 per cent per annum over the last eight years. Productivity has also increased due to improved breeds, improved animal husbandry practices and availability of animal health services; however, productivity varies according to the agro-regional zone, with the highest productivity recorded in central highlands and the lowest in western lowlands (Table 7.1).

Table 7.1 Milk productivity growth by agro-regional zone

Agro-regional zone	Milk productivity (litres/cow/year)			
	2000	2004	2007	2010
Coastal Lowlands	418.4	206.7	700.5	606.7
Eastern Lowlands	864.3	785.1	889.9	852.9
Western Lowlands	371.8	359.4	365.0	498.5
Western Transitional	661.9	811.6	1019.5	940.2
High Potential Maize Zone	968.6	1291.6	1679.9	1602.6
Western Highlands	1005.5	1070.9	836.1	898.3
Central Highlands	1973.9	2233.7	1985.2	2035.7
Marginal Rain Shadow	617.9	1480.4	1433.6	1482.3
Average	1085.8	1287.5	1362.2	1344.0

Source: *Productivity Trends and Performance of Dairy farming in Kenya – Tegemeo Institute*

Per capita milk consumption in Kenya is estimated at 91.0 liters per annum and is expected to increase to 220 liters by 2030. The increase in consumption is correlated with increased population, increased urbanization and improved incomes. In the event, and given the current production trends, there will be a "gap" in demand and supply of milk, unless productivity can be dramatically scaled-up to cater for the increased domestic demand and an expanding regional market.

7.2.2 Milk bulking and transportation to processors

Cooperative societies and cooperative unions provide milk collection, cooling and bulking services. Processors collect from the bulking units of these cooperative societies and unions. In this regard, milk chilling hubs have been promoted in partnerships between cooperative societies and development partners including the EADDP I. These chilling hubs are the interface between farmers and processors.

Smallholder dairy farmers transport raw milk either to the local cooling centers or the milk chilling centers/hubs (MCCs). Local cooling centers are normally satellites of the MCCs or are owned by specific processors. Processors collect milk from the processor supplied cooling center, MCCs or from roadside collection points.

The MCCs are an innovation initiated by a USAID-funded project in 1996, which was later supported by the Melinda and Bill Gates Foundation through the EADDP I that assisted in equipment procurement and setting-up MCCs in different milksheds. Under EADDP I, farmers borrowed funds from an investment fund managed by the project. The sustainability of this donor driven model requires an objective assessment. However, the cooperative societies have traditionally been a major support mechanism for the smallholder dairy farmer.

It is estimated that transport costs to bulking centers vary from KShs. 1.50 per liter to KShs. 3.0 per liter and could account for up to 8 per cent of milk revenues. A major contributor to the high cost of transport is poor rural roads and inappropriate means of transport and containers (bicycles, plastic jerry cans), leading to spoilage and wastage.

7.2.3 Milk processing and distribution

Kenya has 27 registered milk processors with an installed capacity of 3.0 million liters per day. Average milk intake is 1.5 million liters per day. Capacity utilization is therefore about or less than 50 per cent. Major processors are New KCC, Brookside, Githunguri and Buzeki. These processors account for 85 per cent of processed milk. With the recent acquisition of Buzeki by Brookside, more than 90 per cent of processed milk is now in the hands of the three major processors. This concentration of processor power has adverse implications for producer price setting and consumer price negotiations. In this regard, processor concentration lowers the bargaining power of producers and could constrain sector development. This partly accounts for the high price of processed milk.

New KCC operates long life UHT and powder plants. This stabilizes supply and demand of milk during the dry season when milk production is at a low level. Brookside has invested in a milk powder plant which is expected to be commissioned soon.

There is limited value addition at processor level. Yoghurts, pasteurized milk, UHT, sour milk/*mala*, ghee, cream, cheese and bio-products, and butter are the main value added items. Increasing value addition in the processor segment is likely to expand dairy products distribution in regional markets.

Distribution of processed liquid milk is through retailers and supermarkets. The processors normally contract out the distribution process to commercial transporters. Some processors, for example Githunguri, have distribution depots from where retailers and milk wholesalers collect their supplies. A recent development is liquid milk supply to supermarkets in bulk (keg). Consumers are able to purchase quantities of this milk they want from a dispenser. This system allows low income earners access processed milk in affordably priced quantities.

In general, most milk (60-70 per cent of the marketed production) is sold in raw form in the informal market channels. Formal milk market channels account for about 32 per cent of milk sold. The dominant nature of the informal market constrains the development of the sector in that it creates unfair competition and negates safety and hygiene standards. Consumer milk prices are 86 KSh per liter of pasteurized milk, approximately. Milk price at farm gate is KSh 35 per liter. There is limited value addition. Common dairy products are processed liquid milk, yoghurt, cheese, ice cream and butter. Product development to diversify product range could be an area of innovation.

7.2.4 Commercial animal feeds and fodder supply

It is estimated that there are over 100 commercial animal feed manufacturers in Kenya. Most are members of the Association of Kenya Animal Feed Manufacturers (AKEFEMA). Registered under the Societies Act, AKEFEMA seeks to promote self-regulation in feeds quality and advocates for an enabling environment for the sector.

Notwithstanding existing quality standards from the Kenya Bureau of Standards, the feed industry is characterized by high cost feeds, low and variable feed quality, and over-dependence on high cost and inconsistent quality imported feed ingredients, particularly feed processing by-products. Feed concentrates are a major item of the dairy farm expenditure and their availability is crucial for productivity improvement, especially under the zero-grazing system of production. Commercial fodder production in the dairy sector is at its infancy. Cases of large scale farmers abandoning dairy farming in favor of fodder production have been noted. This would imply that commercial fodder production could be more profitable than dairy farming. There is a realization that availability of commercial fodder, particularly maize, sorghum and Lucerne, is key to unlocking the production potential in the dairy sector. Cases of the dairy co-operative societies (e.g., Ndumberi) leasing large scale farms in distant locations for the purpose of commercial fodder production have been noted. Adequate fodder availability maintains milk production across seasons and sustains profits from dairy farming.

The importance of the fodder in the dairy value chain indicates the need to influence policy to mobilize both technical and financial resources in support of this sub-sector. This is an approach that the dairy sector stakeholders could champion with the support of development partners.

7.2.5 Veterinary and animal production services

Veterinary services are regulated under the Veterinary Surgeons Act, Cap 366. The Kenya Veterinary Board is mandated to control and manage animal related diseases and vectors. The Board also controls and regulates the professional conduct of veterinary practitioners. To control the spread of animal diseases, particularly from the pastoral ASAL regions to the high potential areas where dairy animals are reared, a system of animal movement permits in place should be enforced through allocation of more human and financial resources to the Veterinary department.

Animal diseases negatively impact animal health and productivity. Important notifiable diseases include foot and mouth disease, contagious bovine pleuropneumonia (CBPP), lumpy skin, leucosis, anthrax and Rift Valley fever, East Coast fever. Emerging noticeable diseases include avian influenza. The Animal Disease Act, Cap 364, provides the framework for animal disease control. Technical capacity and budget limitations constrain the role of the veterinary department in outreach. Dairy farmers normally rely on AHITI diploma level veterinary technicians for disease management services. The legal framework to facilitate regulation of the para-veterinary staff does not exist and this is an area of concern for policy makers. Vaccines and drugs are available through veterinary retail outlets. The quality of these products is, however, not always assured due to weak statutory veterinary drugs quality monitoring. Vaccine availability can be limited and not affordable to some farmers. Management of farm diseases including mastitis, zoonoses such as brucellosis and leptospirosis, and food safety (bacterial, antibiotics and aflatoxins contamination) need urgent attention. Less than 4% of the dairy farmers use teat dip for mastitis prevention and control.

Most smallholder farmers rely on crossbreeds between local and imported dairy cattle breeds to produce milk. The medium and large scale farmers maintain these exotic breeds, mainly Holstein- Friesians, Ayrshire and Jersey. Artificial insemination services are readily available. Smallholder dairy farmers in major milksheds use AI for breeding purposes. The cost and failure rate of the service is a matter of concern. In the marginal and low production areas (Western Kenya and Nyanza), the use of bulls for breeding is more prevalent.

The demand for AI doses is estimated to be about 1.0 million straws per year. KAGRC, the public agency responsible for breeding services, produces about 500,000 straws per year. The private sector imports 250,000 straws per year, mainly from Australia, New Zealand, Europe, Israel, South Africa and the USA. There is an apparent shortfall of 250,000 straws per year for dairy cattle breeding resulting in a shortage of improved replacement breeding stock.

7.2.6 Financial services

Financial services, particularly working capital, are needed at all stages of the dairy value chain. At producer level, breed improvement, AI, feeds/forages supply and disease control call for constant financial services support. While commercial banks lend to commercial medium and large scale dairy

farmers, the same is not the case with smallholder farmers. However, the cooperatives have endeavored to provide embedded services to their cross-section of members including smallholder dairy farmers. For example, Githunguri provides inputs and drugs on credit to members against their milk revenue. The chilling hubs also provide embedded services to members at interest rates of 8 to 12% compared to 18% for commercially available loans. In addition, the chilling hubs provide credit to their members at competitive rates in comparison to commercial loans.

Breed improvement requires financial support. It is estimated that a good quality heifer could cost upward of KShs. 100,000 (~USD 1,500). It is often difficult to justify adequate return on investment for smallholder farmers on this type of investment because of low production. This reality undermines the ability of this category of farmer to access investment funds from commercial banks.

Investment in chilling hubs has been supported by development partners. The sustainability of this model, through private sector investors, could ensure continued improvement in smallholder dairy productivity. The continued support of the development partners will be required until such a time as private investors take up this role.

Innovation in the dairy sector is risky, but the sector needs to innovate and grow. This is particularly important with respect to the commercial medium and large scale dairy farmers. To mitigate the risks inherent in sector innovations, development partners could establish an Investment Fund to minimize these risks. These funds could be accessed through a challenge mechanism.

7.2.7 Extension, training and knowledge transfer

Private and public sector institutions in the dairy sector require capacity building to play their respective roles. While the National Dairy Master Plan provides a framework for engagement by sector stakeholders, the lack of a common industry vision undermines the development of the sector.

The KARI, Naivasha, is the site of research in animal health and dairy productivity. Breed improvement through genetic research and embryo transfer has contributed to increased dairy sector productivity. Research into livestock diseases, particularly ECF and FMD, is undertaken at KEVEVAPI. Research is mainly a government function. The linkage between research and industry needs is weak. The extension services are weak in that services liberalization has not attracted substantial private sector participation and is not linked to private industry development of the dairy value chain. Also the extension services are weak in that services liberalization has not attracted coordinated private sector and farmer group participation.

The challenge has always been the transfer of research technologies to the dairy farmer, particularly the smallholder farmer. The liberalization of the livestock sector as part of the SAPs created a vacuum in the provision of extension and veterinary services. Government substantially withdrew from the provision of extension services with the result that farmers were denied a valuable source of knowledge. This challenge has persisted. The NGOs have attempted to fill the void left by the withdrawal of government extension services, but this has not adequately addressed the challenge.

The Dairy Technology Institute (DTI) at Naivasha has traditionally trained technical staff for the dairy industry. However, the Institute has fallen on hard times due to budgetary constraints and the reduced role of government in extension services. The universities, Egerton and Nairobi, provide courses in veterinary science and animal production at undergraduate and post-graduate levels. The graduating numbers are few in relation to the needs of the industry. In any case, university graduates need to work with technicians to adequately cater for the needs of the dairy farmer. Innovations in dairy sector training could involve development of modular courses at the agricultural colleges, Baraka, Egerton, AHITI, DTI in Naivasha, and other regional centers which could be linked to farmer field schools in selected milksheds. This could be a public private partnership approach involving government, at both national and county levels, and the private sector, particularly the processing sub-sector. This type of training could be structured to provide certified short specialized courses that could also target the youth.

7.2.8 Environmental issues and potable water sources

The link between the dairy industry and the conservation of the environment is not clearly understood in the policy dialogue. This is partly due to the functional nature of government departments, and partly due to lack of knowledge and awareness of the implications dairy farming activities have on the environment, particularly land degradation, water pollution and greenhouse gas emission. This is an area of urgent intervention. The Ministry of Environment and Natural Resources is responsible for environmental conservation and climate change mitigation. It is also responsible for water resources

management. While structures to effectively manage the water resources are in place through the water service provider companies (WASPs) and Water Service Boards, the management of the environment, particularly with respect to agricultural and dairy farming activities has not received adequate attention. The concept of mainstreaming environment as a cross-cutting concern in economic activities has not been effectively implemented. This is an area of attention by government, economic actors and development partners.

Intensification, higher production per cow than before, reduces the carbon footprint. This could be part of a bonus system payment to increase volume of milk and simultaneously reduce the footprint. Potable water is conditional for cow health and production and for hygiene on farm and at MCCs.

Manure is valuable as fertilizer and for soil structure. Dairy farming can contribute to the much needed manure and crop diversification to restore soil fertility. Development partners could invest in pilot projects to demonstrate Climate Smart Dairy Production.

7.2.9 Industry associations, producer groups and farmer organizations

The dairy processors are organized under the Kenya Dairy Processors Association (KDPA). The association tends to focus on member interests with minimal focus on improving shared value across the value chain. In championing member interests, in particular, the association enforces regulations against milk hawking by informal traders. There is no evidence of a shared value on the future of the dairy industry. The association is weak in policy advocacy and tends to rely on the leadership of KDB in improving sector business environment. Producer associations in the sector include: KENDAPO, KENFAP, KDFF and KLBO. The latter is an important industry association in that it promotes genetic improvement through breed registration. The impact of these associations on the dairy industry, particularly with regard to the needs of the smallholder farmers is minimal.

The cooperative sector is a major player in the dairy industry. The chilling hubs are anchored on the partnership between donor projects and the cooperative societies. Examples of successful models of co-operatives include Muki Farmers' Cooperative Society and Meru Central Cooperative Union. Notwithstanding their governance challenges, the cooperative societies are the pillars of the smallholder dairy segment. Besides the newly emerging Kenya Dairy Farmers Federation under EADDP facilitation, there are few associations of dairy cooperatives for joint policy development, pressure on government, cooperative education and governance.

7.2.10 Dairy sector institutions, governance and policies

The institutional framework for the dairy sector is Ministry of Agriculture, Fisheries and Livestock Development; the KDB; the Livestock Development Services responsible for extension and regulatory services; the KARI; and the KAGRC. There is an elaborate legal framework within which the sector is regulated. This includes the Dairy Industry Act, Cap 336; the Standards Act, cap 496; the Public Health Act, Cap 242; the Foods, Drugs and Chemical Substances Act, Cap 254; the Veterinary Surgeons Act, Cap 366; and the Kenya Agricultural Research Act of 2012.

The policy framework for the dairy sector has not kept pace with the private development of the sector. The Kenya National Dairy Master Plan (2010) and the National Livestock Policy (2008) are yet to be adopted by parliament. While the policy framework for the dairy industry is the responsibility of the national government, the development of the sector, including veterinary and extension service, has been devolved to the county governments (Constitution of Kenya, 2010). This transition into the devolved governance system creates opportunities and challenges for the development of the sector. The growth of the sector will depend on how this transition is managed, and the ability of the sector to seize opportunities presented by the devolved government to upscale productivity and competitiveness.

The growth and competitiveness of the dairy industry require a clear vision and roadmap. In effect therefore, the sector players should develop a common vision of the industry, and thereafter structure a collaborative mechanism to carry the vision forward. This calls for a platform from which the stakeholders, including the development partners, could champion the development of the sector.

7.3 Strengths, weaknesses, challenges and opportunities in the dairy sector

Kenya has a well-established dairy industry with a development infrastructure which includes research institutions, regulatory boards and basic extension services. The weak policy and institutional framework constrain the development of the sector (Table 7.2). Opportunities are indicated in a large domestic

market and potential in export markets. The quality of milk needs attention if the potential in the sector is to be fully exploited.

7.4 Emerging issues in the dairy sector

Arising from the discussions in the previous sections, emerging issues in the dairy sector can be articulated as follows:

- The predominantly smallholder nature of the sector constrains sector investment, and hence growth. This structure cannot sustain a growth oriented industry.
- Weak research and extension linkage with the private dairy value chains, and the inadequate farmer training and public sector support undermines the growth potential in the sector
- The expanding population and income levels, and the growth and existence of export markets, provide opportunities for the growth of the dairy industry. Productivity improvement measures are necessary to unlock this potential.
- The policy regulatory and institutional framework for the sector is not aligned to the needs of a development oriented sector. Reform of this framework is urgent.
- Private sector associations are weak and self-centered. A vibrant sector should be anchored on strong private sector participation and institutions including platforms covering all players in the value chain.
- Support to the dairy sector by development partners is not coordinated. This leads to duplication and a waste of development resources. The need for a coordinated sector support strategy is indicated.

Table 7.2: SWOT analysis of the dairy sector

Strengths	Weaknesses
<ul style="list-style-type: none"> ▪ A well-developed sector with established market infrastructure ▪ Supportive policy and institutional framework ▪ Contributor to rural livelihoods ▪ Employs 700,000 households ▪ Allows women participation in the economy. 	<ul style="list-style-type: none"> ▪ Land fragmentation leading to move to more expensive zero-grazing system of dairy farming ▪ A policy and legal framework that has not kept pace with changes in the operational environment ▪ Weak extension and veterinary services, particularly farmer training ▪ Poor road infrastructure and electricity grid, and costly power ▪ Weak farmer organizations ▪ Concentrated processor segment.
Opportunities	Threats/challenges
<ul style="list-style-type: none"> ▪ Large domestic and regional markets ▪ Expanded possibilities in value addition ▪ Expanding middle class leading to sustainable demand for milk and milk products. ▪ Favorable climate for dairy farming in the highlands and central regions. 	<ul style="list-style-type: none"> ▪ Environmental degradation and climate change impacts ▪ Reduction of milk losses, improvement of hygiene and quality ▪ Low investment in appropriate technology along the value chain ▪ Weak governance systems in the co-operative sector ▪ Inadequate attention by county governments to sector development.

7.5 Prospects for sustainable growth

7.5.1 Economic, environmental and social performance

The point has been made that the dairy sector accounts for 4 per cent of GDP and employs 700,000 households, mainly in the rural areas. Female-headed households constitute 12.3 per cent of the households that sold milk (Tegemeo). They are predominant in Nyeri (23.1 per cent) and are lowest in Kinangop (4.5 per cent).

The environmental impact of the dairy farming activities has not been quantified, and hence this is an outstanding agenda. In particular, the relation between the dairy herd and greenhouse carbon emission should be established.

7.5.2 Production and other models of sustainable dairy sector growth

The dairy sector in Kenya has shown resilience. Productivity has improved over the last decade mainly due to breed improvement and improved technologies and agricultural practices. The opportunities in the marketplace, both domestic and export, are not fully realized. This potential calls for a growth oriented industry.

The dairy industry is smallholder driven (80 per cent). This constrains innovation and investments; hence, productivity improvement. The case for a segmented approach to sector development should be made. Policy incentives should aim to commercialize dairy farming through enhanced private sector participation, particularly in the smallholder segment. Incentives, both fiscal and technical, should aim to increase the medium and large dairy industry segment. This approach will improve sector productivity and competitiveness. This is a sustainable model of development.

The sustainability of the dairy sector will require close attention to environmental conservation and climate change mitigation. This aspect has not received adequate attention, and hence it is an area of opportunity for investment by development partners.

7.6 Collaboration prospects

7.6.1 Donor programs and collaboration among sector players

Donors actively supporting the dairy sector include the Bill & Melinda Gates Foundation, through the EADDP; USAID, through the Kenya Agricultural Value Chains and Innovation grants; IFAD, through the Smallholder Dairy Commercial Project; and SNV Netherlands Organization, through the Kenya Market-led Dairy Program.

Two concerns of note are that there is no alignment in donor support programs to achievement of specific objectives, e.g. improved value chain performance, and there has been no attempt by government to preclude donor support that undermines the market orientation of the sector and, in particular, private sector investments. There is a clear need to ensure effective collaboration by all players, public, private and sector development. This approach could be focused on a clearly defined and agreed vision of the sector.

7.6.2 Public, private collaboration and linkage with donor policies

The Agricultural Sector Development Strategy (2010-2020) clearly articulates the objective of the agricultural sector. Commercialization and value addition are important objectives. It follows, therefore, that government must provide leadership in sector development. The policy and regulatory regime should be supportive of private investments. The chilling hub model has shown promise in linking the private sector investments (donor-funded) to cooperative societies to create a productivity enhancing business model. This model could be upgraded to enhance the role of the private sector through strategic investments at key nodes in the value chain.

For synergy to accrue in public and private sector interactions, the development sector (donors) should aim to support the business orientation of the dairy sector. Donor support should target the poverty oriented livelihood farmer category without interfering with the activities of the growth oriented smallholder dairy farmer. This will call for balance in approach to development. The approach could be guided by a clear vision of the sector and through active facilitation of the public sector.

7.6.3 Collaboration in the funding of dairy sector development

The chilling hub model has demonstrated the impact on sector growth of a well-structured funding mechanism involving the co-operative societies and development partners. The business orientation of this model is a key success factor. The cooperative societies/unions have also demonstrated ability to mobilize resources for sector development (e.g., Githunguri and Meru Central). Githunguri has been particularly successful in mainstreaming smallholder dairy farmers into the market through effective management of the dairy value chain. It is unlikely that most cooperative societies could reach this level of integration, given that, unlike Githunguri, they are distant from the market. However, they can achieve this if they diversify to producing butter, UHT and cheese that can be transported to market areas at lower cost than whole milk.

In general, what is clear is that the collaboration of processors and chilling hubs/co-operative societies holds promise for a sustainable industry. The policy study (SNV/PPD) proposes a cluster development approach to up-scaling the chilling hub model. This approach could provide opportunities for the entry of

strategic investors (e.g., Nestle, DSM, Parmalat, FrieslandCampina and Danone) into the sector, thus up-scaling the industry.

This business oriented collaboration could be anchored on the vision of the sector with the attendant sector transformation. The role of government is critical in guiding the evolution of this common vision and in the coordination of sector players to address common objectives.

7.6.4 Potential for regional integration

Kenya exports to the EAC are minimal and irregular and mainly comprise UHT products. Brookside is a major player in Northern Tanzania (Moshi and Arusha), although the Moshi Plant, originally acquired to strengthen the market outreach of Brookside in these markets, is currently not operational. There is evidence that the milk is imported in bulk for processing in Kenya. There are no recorded imports of dairy products from Uganda. It is understood, however, that Sameer, whose Daima brand started in Uganda, could be an importer of Uganda milk into Kenya. The quantity of these imports needs verification.

Trade within the EAC is governed by the Protocol on the establishment of an EAC common market. With a common external tariff of 60 per cent (except for infant formula) and the provision for free movement of goods within EAC, the potential for intra-EAC trade in milk and milk products is great. Productivity constraints reduce milk and dairy products supply that in turn limit cross-border trade. Similar constraints hinder intra-COMESA (Kenya is a member of COMESA) trade. The potential in the regional markets can be unlocked through deliberate and innovative policies and programs of productivity and competitiveness improvement. This approach assumes urgency in view of the increasing population and incomes within the regional countries. The demand for milk in all regional countries will increase. This demand will be met from regional countries and foreign imports. Increasing intra-regional trade in dairy and dairy products is a viable strategy of economic development within the region.

8 Rwanda dairy profile

8.1 Country background

Rwanda is a small country covering an area of 26,338 Km² (Appendix 3.5). It is therefore a landlocked country and according to the Netherlands African Business Council (NABC) (2013; p 1) it has "... a population of 12,012,589 (July estimate) and a real GDP growth rate of 7.1% (2013 est.).... It has established a stable government, secured peace and safety in its territory, made great strides in restoring and reforming its economy and in 2010 was named by the World Bank as the world's top reformer." Rwanda is the most densely (413 persons/km²; NABC, 2013) populated country in Africa. Ninety per cent of the Rwanda labor force is in agriculture.

Since Rwanda emerged from the devastating Genocide in 1994 in which economic and social infrastructure were destroyed, it has recovered. The Government of Rwanda (GOR) has developed the Vision 2020 in which dairy supports the vision's pillars, and key strategic documents that are addressing poverty reduction, agricultural growth and, specifically, dairy sector growth. The key dairy related documents developed include the Strategic Plan for Transformation of Agriculture III (PSTA III), Updating the Master Plan of the Milk Chain in Rwanda, and the National Dairy Strategy (NDS).

Because of high altitude, Rwanda has a mild tropical climate characterized by two rain seasons (February - May; September - December) but of varying total rain season durations of seven to nine months and annual rainfall of up to 1,500 mm. The rainfall pattern is influenced by altitude that reaches 4,500 m on the highest mountain peaks in the north. Virtually the whole country is suitable for cattle rearing and milk production; however, the Eastern Province accounts for at least 40% of the milk produced.

The dairy subsector is important in Rwanda through its contribution to the agricultural GDP of 15% and to the overall country GDP of 6% (NDS, 2013). In addition, it contributes to the livelihoods of rural and urban households through income generation and food security. Supported by an increase in the cattle herd size that is now close to 1.33 million (MINAGRI, 2013), annual milk production has steadily increased from 112,463,000 liters in 2003 (SNV, 2008) to approximately 445 million liters in 2012 (MINAGRI, 2013). Based on the production in 2012, the farm-gate value of milk was estimated to be USD 129.7 million. In general, the dairy sector has been on a growth trajectory and has witnessed dramatic growth since 2001. Arguably, it has been reported that Rwanda is now faced with a surplus milk challenge that, if there are no new strategies to dispose of it, is expected to increase to 100 million liters in 2017 (MINAGRI, 2013).

8.2 Dairy value chain

The dairy value chain of Rwanda will be presented in relation to the players in the chain, production, transport and milk collection systems; processing, distribution, animal production (including AI), veterinary and financial services; extension, training and knowledge transfer systems and services; environmental issues, and potable water resources; industry associations, producer groups and farmers' organizations; and dairy sector institutions, governance and policies. The information presented here was obtained from desk studies and interviews of organizations and individuals listed in Appendix 5.

8.2.1 Key dairy value chain players and partners (projects, donors etc.)

The dairy value chain in Rwanda is made up of smallholder farmers that produce milk and trade among themselves or largely supply milk to informal milk aggregators (transporters), milk kiosks and buyers (e.g., restaurants, grocers, & police & military) and to formal milk aggregators, milk collection centers (MCCs), milk kiosks, and largely artisanal cheese makers. Milk transporters are also key value chain players. There are in excess of 90 MCCs that have been built; however, some are not active. For example, in Nyagatare District where there is the largest concentration of MCCs, out of 17 MCCs only 11 were operating (MINAGRI, 2013). Reasons for failure to operate included lack of breakeven milk quantities (2,000 liters/day) collection because of low prices offered to farmers by the MCCs, relatively high levies to pay back the loans for MCC construction, competition from other buyers that offer higher milk prices, poor governance, and equipment breakdowns.

An initial 61 MCCs constructed prior to 2012 have a cooling capacity of 195,000 liters. The major milk processor is Inyange Industries that is currently (2013) processing 50,000 liters per day during the wet season when milk deliveries are high. Supporting these direct players in the value chain are input suppliers of semen, veterinary drugs, and feeds but to a limited extent, NGO dairy projects, a dairy quality assurance laboratory, and public extension services.

The key players in the Rwanda dairy value chain include:

- **Breeding Services:** Rwanda Agriculture Board (RAB) Centre for Artificial Insemination (Government), and Eastern Region Animal Genetic Improvement Cooperative
- **Dairy Stakeholder Organizations:** Cheese Makers Association, Milk Sellers Association, National Federation of Dairy Farmers, Nyagatare Dairy Farmers Union, and Rwanda National Dairy Platform (under the Private Sector Federation of Rwanda),
- **Farmers:** Key value chain actors in the formal market are rural and peri-urban smallholder, medium and large scale commercial dairy farmers.
- **International NGOs and funding agencies:**, Dutch Embassy, FAO, Global Communities, Heifer International, IFAD, Land O'Lakes (USAID-funded RDCP II), Send a Cow, and SNV
- **Laboratory Services:** RAB & Dairy Quality Assurance laboratory
- **Private Sector:** Dairy cooperatives, milk collectors (cooperatives and private), milk chilling centers (MCCs), microfinance institutions and banks (e.g., Banque Populaire du Rwanda, Duterimbere, Kenya Commercial Bank, Rwanda Development Bank (BRD), & Urwego Opportunity Bank), milk kiosks (~1500 in Kigali only), veterinary input companies (e.g., Agrotech, Megavet & StarVet)
- **Processors:** Blessed Dairies, Inyange Industries, Masaka Dairy, Nyanza Dairy Plant, Rubirizi Dairy Plant, and Zirakamwa Meza Nyanza Dairy Ltd
- **Public Sector Institutions:** Livestock Infrastructure Support Program (LISP), Ministry of Agriculture and Livestock Resources (MINAGRI), Ministry of Trade and Industry (MINICOM), National Agricultural Export Development Board (NAEB), Rwanda Agriculture Board, Rwanda Agriculture and Livestock Inspection and Certification Services (RALIS),

8.2.2 Production systems

Milk production in Rwanda is primarily from smallholder dairy farmers that own on average two cows; however, there are larger farms particularly in the Kigali peri-urban area. There are five key milksheds in the country, the eastern, Kigali, northern, southern and western milksheds that have different production systems. The Eastern Milkshed has the largest cattle population (60%) and, because of relatively large land sizes that can be up to 25 ha that offer adequate land to grow forages, compared to the national average of 0.7 ha/household, has semi-extensive grazing systems. However, in general, the GOR has adopted a policy to intensify farm dairy production through use of zero-grazing systems. The latter is the production system prevalent in the peri-urban Kigali Milkshed, the Southern and other milksheds. However, in the high altitude areas of the Northern and Western milksheds characterized by excessive slopes and rugged terrain, particularly the Gishwati area, the production system is extensive grazing on Kikuyu grass (*Pennisetum clandestinum*) pastures fortified with *Trifolium* spp. (clover) pastures.

In general, the differences in infrastructure, rainfall, topography, and location determine the production systems. In this regard, the Eastern Milkshed, particularly the Nyagatare area, has relatively low rainfall and an associated relatively long dry season of at least three months while Gishwati in the Northern Milkshed hardly has a dry season because of high altitude that gets relief rainfall, and hence cows continue feeding off pastures. Invariably, in Nyagatare fodder conservation is necessary to bridge the feed shortage during the dry season. Because of the peri-urban location, where milk demand is high, in the Kigali Milkshed milk prices are higher, and hence smallholder farmers are able to provide some supplementary feeds including maize bran to their cows which are kept under zero-grazing.

Of note is the Igikumba Cy'umudugudu (Kraal Approach) model developed by the GOR but open to funding. In this model farmers share a common kraal but individually look after their cows but services including vaccinations are jointly provided, usually at a fee, to the group. While this is partly a social program that has the objective of creating economies of scale for service provision, it is at variance with the zero-grazing units that are individually owned. In addition to this system, there is also the shared cow approach that is being tested in which two families share a cow and look after it jointly and they share the milk produced by the cow. While there could be demerits arising from ultimate ownership the merits (benefits) outweigh the demerits. Although the two systems are for different contexts, their merits have not been compared.

Most of the milk produced is from Ankole cows although farmers in the Kigali Milkshed have crossbred cows largely of the local Ankole and Holstein-Friesian breeds. In general, according to MINAGRI (2013), the local Ankole cows make up 72% of the cattle population while crossbreds of the Ankole and dairy breeds constitute 20% and purebred dairy cows make up 8% of the cattle population. Also, from 2009 to 2012, 2931 crossbred cattle and 212 purebred cattle were imported privately or with partial GOR support. The dairy breeds in Rwanda are the Holstein-Friesian, Jersey, Brown Swiss (largely in Northern Milkshed), and lately Fleckvieh. Based on the potential productivity of the breeds, milk production per cow has been low at estimates of 1.2, 4.6 and 6.7 liters/day for Ankole, crossbred, and purebred dairy cows, respectively. However, it is estimated that the crossbred and purebred cows produce 82% of the milk supply.

While the GOR has a breeding policy that prescribes 60% and 40% crossbreeding with Jersey and Holstein-Friesian, respectively, these ratios are practically difficult to implement in the face of predominantly farmer preference for the high milk producing Holstein-Friesian. The policy further prescribes areas for each breed in which the Holstein-Friesian is to be used where land size does not limit fodder production whereas the reverse is true for use of the Jersey. Ironically, despite the dry season feed shortage in the Eastern Milkshed, the Holstein-Friesian is recommended for use on the assumption that land is available to produce feeds for conservation and use during the dry season.

8.2.3 Milk transportation from farm to market

Milk transportation is largely at three points along the dairy value chain beginning with transportation from the farm directly to local buyers, aggregators, MCCs or processor. From the farm to the MCC, there have been NGO programs under the EADDP, RDCP II, SNV and others to train farmers on milking hygiene and milk handling best practices. The GOR has banned use of plastic jerry cans to transport milk for the formal milk distribution channels. As a result, those delivering milk to large scale processors including Inyange Industries are required to use rust free metal cans. However, use of plastic jerry cans is still prevalent in the informal milk marketing channel.

The mode of transport from the farm to MCCs and other buyers or milk collectors is largely by bicycle. A milk transporter can collect and mix milk from several farmers and take the milk to an aggregation point or a MCC. Increasingly, transporters are now collecting milk at aggregation points where milk is tested using the platform tests (alcohol and lactometer tests). In some cases farmers take milk from their farm on foot to an aggregation point or MCC. In the peri-urban areas, and even elsewhere, farmers are increasingly using motorcycles and the motorized tricycles to take milk to MCCs, milk kiosks and processors. Transporters also take milk from aggregation points to MCCs.

Some transporters use vehicles to take the milk from aggregation points to MCCs. Also, some MCCs have these satellite milk aggregation points to reduce the distance covered by farmers to bring milk to the MCCs, and hence ensure that milk reaches the MCC where there are milk cooling facilities within two hours after milking. Milk transportation from the MCCs to the processors or retail kiosks is through private transporters or MCC vehicles. Some MCCs have contracts for processors to collect the milk but at a lower price than when the MCC delivers the milk. For example, Inyange Industries the largest processor collects milk from some MCCs under contract.

In general, despite training on milk handling best practices, some transporters have not paid good attention to milk hygiene and cases of transporters adding water to increase milk volume have been reported, particularly during the dry season when milk demand exceeds supply.

Among the dairy value chain players, transporters were also found to be earning the highest profit margins of 15 to 25 percent (MINAGRI, 2013). However, in general processing takes the largest percentage of the final consumer price (~52%) largely a result of the high cost of packaging (in Rwanda plastic suitable for milk pouches is banned) whereas farmers get only 16% compared to about 50% in most dairy countries.

8.2.4 Aggregation and marketing of raw milk

Milk aggregation has been done at MCCs and satellite aggregation centers but, as stated above, farmers can send milk directly to processors or milk kiosks for direct sale to consumers. While there were 61 MCCs that were funded by the GOR, apart from those privately funded, there were another 35 budgeted for during the 2012 to 2013 period (MINAGRI, 2013).

Related to the latter are the critical considerations for success of MCCs including the location, availability of electricity and potable water, cooling efficiency, hygiene and milk quality, producer incentives such as grade based milk prices, and financial solvency. A large number of MCCs, in fact the majority is not operating at a profit margin partly a consequence of collecting insufficient milk volume to financially break even and access to competitive markets, but these considerations were at times disregarded. According to MINAGRI (2013), a MCC with a cost recovery of 60%, for MCC establishment in which 40% of the establishment cost was a grant from the GoR, should collect a minimum daily milk quantity of 2500 liters. For example, with regard to location some MCCs in Gishwati area are only seasonally accessible because of poor roads, while many operate on electricity generators which are expensive to run compared to the costs of those on the electricity grid. Further, the cooling tank efficiency is in question for most MCC tanks; consequently, milk is not rapidly cooled to 4 °C within the expected two-hour period. The poor quality of milk has been related to presence of high somatic cell counts from mastitic milk and high total bacterial counts. Therefore, cleaning of the tanks, milk testing and grading

are issues that are being addressed through interventions by public, private and NGO sectors and groups. Limited availability of potable and hot water remain a major challenge that is compromising milk quality and hygiene at MCCs.

8.2.5 Milk processing and distribution

The informal sector handles 75 to 85% of the marketed milk in the country. The remainder is collected by processors and cheese makers. The main processor is Inyange Industries located in Kigali which is currently processing 50,000 liters of milk per day. All the other processors including Masaka Dairy in Kigali, Nyabisindu in Nyanza District and Blessed Dairies in Gicumbi District individually process less than 10,000 liters per day. The demand for processed milk was historically not high because of a relatively higher price (almost three times) than that of raw milk sold in the informal sector mostly through retail kiosks and afforded by the majority of consumers. Recent developments including the introduction and expansion of a school milk feeding program coordinated by the GOR but open to funding by any other benefactors have increased demand for UHT milk, a product that is produced by Inyange Industries. The demand for milk from Inyange Industries has also increased from a big demand from UN refugee camps in Goma, Democratic Republic of Congo. The processors also produce limited quantities of cheese largely Gouda. Cheese is also produced by artisanal cheese makers that are mostly in the Northern and Western milksheds.

Distribution of milk and cheese has mostly been through retail outlets in urban areas. Inyange Industries is piloting a franchise model in which franchisees are selling milk to consumers through their "Milk-Zone" franchised outlets. This is a strategy to increase the sale of processed milk with the attraction that consumers bring their own containers and, as a result, they buy the milk at about half the price of packaged milk. Because Rwanda banned use of thin plastic, the milk packaging material used is more expensive than plastic packaging used in other countries. During the interviews, it was established that some of the milk zones can sell up to 1,000 liters of milk by mid-day each day and were being limited by slow delivery replenishments from Inyange. The daily sales from these Milk Zones were said to have surpassed the 8,000 liters per day that was sold in Kigali before the advent of the Milk Zones.

For the informal sector, most milk is sold through kiosks scattered around most urban areas. Kigali had as many as 1,500 such kiosks. They often boil the milk before selling it or they can sell it before boiling but at a lower price, as low as USD 0.45 compared to USD 1.20 per liter for packaged pasteurized milk. These kiosks have been the dominant milk distribution channel but there have always been public and statutory concerns about the lack of milk quality monitoring and lack of milk traceability. The informal nature of this business has not been consistent with the general thrust of the GOR to promote the formal dairy sector.

Per capita consumption of milk in Rwanda has been estimated to be 40 liters per annum but, according to a survey conducted by the East African Dairy Development Project (EADDP), one-third of the country's population does not consume milk for a variety of reasons including absence of a milk drinking culture and limited availability in some areas. In order to increase milk demand and reduce the milk surplus estimated to be 52 million liters in 2012 (MINAGRI, 2013), there has been a drive by the GOR and other organizations, particularly NGOs working in the dairy sector, to promote milk consumption.

Because plastic is banned in Rwanda, there has also been a concern that the milk packaging material allowed is expensive, and hence Rwanda milk cannot be competitive against milk and dairy products from countries that allow their industries to use plastic. However, there have been informal exports of fresh and fermented milk mostly to the DRC and Burundi. The limited range of dairy products does not make the dairy sector competitive, particularly in the face of competition from beverages including soft drinks and fruit juice that are in the same price range. It has been acknowledged that the diversity of dairy products should be increased to directly or indirectly increase milk consumption.

8.2.6 Commercial animal feed and fodder supply services

Feed shortages are prevalent during the dry season in Rwanda. Limited forage production is a key dairy production constraint that needs to be addressed. This has been recognized in the NDS with farms in the Eastern Milkshed experiencing severe feed shortages during the dry season that reduce milk production. Conservation of forages such as grass hay and maize silage is a key strategy for reducing feed shortages during the dry season and for increasing cow productivity. While there has been a recommendation for adoption of concentrate feeding, the profitability of this practice depends on the milk price to feed cost per kilogram ratio which has been estimated to be at least a ratio of 1.2:1, milk price per liter to cost of concentrate per kilogram, in Rwanda but seems valid across East Africa. The high altitude and rugged topography of the Northern and Western milksheds favors Kikuyu planted pastures fortified with clover

legumes. This is a sustainable farming system but rotational grazing systems and pasture management could still be improved.

8.2.7 Veterinary and animal production services

Veterinary services in Rwanda are largely provided by the GOR through MINAGRI and the Ministry of Local Government through district and sector veterinary officers. Dairy farmers access veterinary drugs freely and most drugs are abundant in veterinary pharmacies. Veterinary equipment is available in veterinary pharmacies and drugs can be imported duty and tax free. The GOR has a MINAGRI administered Ministerial Order on operation of veterinary pharmacies. According to MINAGRI (2013) there are 90 veterinarians in the country but only 11 are in private practice. However, the University of Rwanda has a veterinary faculty that is annually producing at least 30 veterinary graduates. The GOR also has agro-vets at the administrative sector level who operate under the Ministry of Local Government. There are therefore 416 agro-vets, one per sector. On average, an agro-vet is responsible for 3,150 cattle. In addition, the agro-vet attends to other livestock in the sector and performs other public duties. Not surprising, the agro-vet service to the dairy farmers is inadequate for a number of reasons. First, the agro-vet to farmer ratio is too low and it is not unusual for a farmer not to be visited even in a year. Second, the agro-vets lack capacity as they are inadequately trained in dairy management and most do not have transport to visit farmers; as a consequence, farmers have to pay for transport when the agro-vet visits. The GOR has encouraged provision of agricultural extension by the private sector but this has not been taken up. Some progressive MCCs provide veterinary services to their members for a fee. To implement such a program they often hire their own veterinarians or para-veterinarians that are trained when the opportunity arises. Dairy projects including the EADD and RDCP II have trained such staff and supported establishment of peer training systems, particularly within MCCs.

The GOR, through the Rwanda Agriculture Board (RAB), often conducts vaccinations annually or in response to outbreaks against most of the important diseases including foot and mouth disease, anthrax and black leg. There are cases of brucellosis (10% incidence) in the country's cattle herd. East Coast fever is also endemic and contagious bovine pleuro-pneumonia that had been eradicated, resurfaced about two years ago. While RAB has a few well equipped veterinary diagnostic laboratories, the distribution across the country is limited and this is a constraint faced by veterinary services.

There have been no reports of zoonotic disease transmission across the whole dairy value chain, particularly tuberculosis and brucellosis that are important in the milk trade. This is a result of mandatory milk boiling which eliminates micro-organisms. Of concern has been the high prevalence of mastitis that has been found to be as high as 60% in some areas. The insidious losses from mastitis are not recognized by farmers and most milk buyers do not test for somatic cell counts and antibiotics so as to reject milk from cows with mastitis. Much needs to be done to create awareness through public sector-led research and extension on the importance of mastitis prevention and control.

8.2.8 Financial services

Apart from MCCs that were built with a combination of a loan from the BRD commercial bank and other sources, provision of financial services to the dairy sector has been weak. However, some MCCs have been able to secure loans from banks and microfinance institutions (MFIs) to buy equipment. The Rwanda Dairy Competitiveness Program II (RDCP II), through a partner, INSPIRED, conducted a study that revealed that 22% of smallholder dairy farmers were creditworthy (MINAGRI, 2013) and return on dairy investment was 115%. Creditworthiness was defined as a profit margin of more than double the bank interest rate which has been around 18% in the country. In general, the creditworthy farmers were selling almost double the quantity of milk than non-creditworthy farmers. The larger quantity was mostly a result of milking cows twice a day. This demonstrates that increased cow productivity is likely to increase profit margins. The study further revealed that 82% of dairy farmer clients that were accessing loans were getting loans through using non-dairy assets as collateral security. Most of these borrowers would pay back the loans from non-dairy income sources. This is untenable as it creates the impression that dairy business is unviable.

INSPIRED has gone further and facilitated financial institutions (microfinance institutions and banks) to develop financial products for dairy farmers. Four financial institutions have so far launched financial loan products for the dairy sector and some MCCs and farmers have already secured loans from these financial institutions. Of concern has been the absence of cattle insurance products. This is beginning to receive attention by the GOR and some insurance companies.

8.2.9 Extension, training and knowledge transfer systems and services

As described above for veterinary services, extension services have been limited by inadequate extension agent capacity, a low extension agent to dairy farmer ratio, and a weak private sector.

The GOR has advocated for private provision of extension services, but in a country where the agro-private sector is still weak, this has not been possible. Often, private sector players such as input suppliers would offer embedded services but some of the key dairy inputs including semen are still being provided and subsidized by the GOR. While central and subsidized semen distribution is good for the growth of the dairy herd, ultimately, this should cede and be left to the private sector. However, extension has been conducted by the GOR with support from its partners including international organizations (IFAD) and NGOs (RDCP II, EADDP, Send a Cow, & Heifer International).

The GOR has six dairy specialists whose capacity not known but ideally each of the 30 districts requires a dairy specialist (MINAGRI, 2013). Dairy extension is weak in the country, and hence this should be an area of focus in order to increase dairy production. There is a limited flow of knowledge down to the farmer. However, some MCCs that worked with the EADDP have piloted extension models that are anchored on MCC staff and linked to sector extension staff. The sector extension staff is often constrained to offer dairy extension services but when combined with MCC staff its capacity is boosted.

There are no institutions in the country that train dairy specialists and practical (hands-on) type of training. However, three universities offer training in animal health and production. The training programs offered are at certificate, diploma and degree levels for six months, two years, three years and four years. These three universities have now been merged into one university (University of Rwanda) with one college of agricultural and veterinary sciences but with faculties at different campuses. There is need for the curriculums of these universities to have a strong dairy focus in order to drive the development of the dairy sub-sector.

8.2.10 Environmental issues, and potable water resources

Dairy production intensification brings-up issues on environmental sustainability. The pasture-based production systems that are prevalent in the high altitude Northern and Western milksheds are suitable for the topography that has slopes. Intensification should be on making the pastures more productive through better rotational grazing and inorganic fertilizer application, particularly phosphate application. Planting field crops such as maize for feeding cattle is an erosion risk on such steep slopes. In the Eastern Milkshed dairy cattle feeding is still based on an extensive type of grazing. If cattle numbers are not controlled, the lands can be easily eroded. The GOR instituted a policy of individual use of land; hence, a farmer is accountable for damage on the piece of land he uses. This has at least reduced the potential damage that arises from common property systems in other African countries that has led to what is termed the "tragedy of the commons." Across the systems of production, conservation of forages during the rainy season should be advocated in order to increase the supply of feed during the dry season, and hence reduce pressure on the grazing lands.

While dairy is often associated with manure disposal hazard, the small herd sizes do not often produce large quantities of effluent. Most of the effluent is used as organic fertilizer in crop fields and is regarded as a key input from the dairy. Where there is intensification, as advocated in Rwanda through adoption of zero-grazing, there is a risk of polluting rivers and streams with high nitrogen that can lead to eutrophication.

The GOR Ministry of Infrastructure subsidizes construction of concrete biogas units that integrate well with zero-grazing dairy units. Many biogas units have been constructed in some parts of Rwanda through this program, which has also been funded by GTZ and other donors.

Water and, in particular, potable water is not available in most milksheds except in the high altitude-areas in the Northern and Western milksheds (MINAGRI, 2013). In some of the milksheds, for example, in the Eastern and Southern milksheds cows do not access sufficient water quantity. This is worse during the dry season and in zero-grazing units. During the dry season farmers can spend two USD per day to buy water from water vendors. Most farmers do not know that a cow producing 10 to 12 liters of milk per day requires 40 to 50 liters of water per day. The need for more water distribution at farm and MCC levels is high across milksheds. Most MCCs rely on rain water during the rainy season but they have to fetch it from distant places during the dry season. Some MCCs in urban areas have access to piped water from the national water network. However, the quality of the water has been of concern. Recent test results from RDCP II showed the presence of contaminants across most MCCs. This is of concern because the water is used to clean milk handling and holding equipment at individual MCCs. Thus, un-potable water can also contaminate the milk. Few of the MCCs have water heating facilities to clean equipment and reduce milk contamination.

In order to address the potable water shortage, the GOR Livestock Infrastructure Support Program will support 35 new MCCs and water use and development associations to develop dairy infrastructure including installation of one water tank at each MCC for use by 1,000 people around the MCC. These people will then create an association for water use.

8.2.11 Industry associations, producer groups and farmers' organizations

Dairy farmers in Rwanda have been organized in groups for some time. Most of the groups start as associations that morph out into cooperatives. The cooperatives have to be registered initially at district and, ultimately, they are expected to register with the Rwanda Cooperative Agency (RCA) after fulfilling the conditions for registration. In fact, cooperatives can further develop into private companies that have more operational autonomy.

Table 8.1 Strengths, weaknesses, challenges and opportunities in the dairy sub-sector	
<p>Strengths:</p> <ul style="list-style-type: none"> ▪ Large & growing cattle population ▪ Favorable government policies & other programs promoting cattle herd growth & livestock products value addition ▪ Cold chain has been developed & many MCCs with untapped milk storage capacity ▪ Large unexploited processing capacity (at least 50% not used) ▪ Favorable climate for dairy ▪ Appropriate forages and crop species for dairy are available ▪ Dairy has been shown to be a good source of income in Rwanda ▪ Milk surplus that will lead to milk quality improvements 	<p>Weaknesses:</p> <ul style="list-style-type: none"> ▪ Limited land sizes for supporting dairy production, particularly for the very poor ▪ Land fragmentation leading to uneconomic units for dairy ▪ Road infrastructure not suitable in some milksheds and absence of electricity grid ▪ Inadequate water resources management ▪ Poor soil fertility, except on plateaus; integration of dairy farming for manure and crop rotation. ▪ Inadequate suitable dairy breeds ▪ Limited capacity to rear dairy cattle & offer support services ▪ Weak extension service ▪ Lack of technical training, market information, marketing channels, dairy equipment & transport ▪ Disease control systems are still evolving posing a risk to dairy cattle ▪ Land locked & too distant to ports that increases landing costs of dairy inputs & increases costs of transport ▪ Lack of recording systems and credible sources of data to facilitate planning ▪ Lack of an effective public and private dairy coordinating body ▪ Inadequate dairy platforms to lobby for the sector
<p>Opportunities:</p> <ul style="list-style-type: none"> ▪ Potential market for milk and dairy products – per capita consumption low – likely to grow with country target to be a middle-income country by 2020. ▪ Export markets with attractive financial returns exist, particularly in Burundi & DRC ▪ Membership of Rwanda in regional organizations including East African community can improve trade prospects ▪ Growing GDP implies growing purchasing power & middle class that demand dairy products ▪ Production of value added products including cheese that has niche market in EAC countries. 	<p>Challenges:</p> <ul style="list-style-type: none"> ▪ Competition from cheaper milk & dairy imports ▪ Absence of a dairy act ▪ Farmer share of final retail price is low, 16%, compared to 50% elsewhere – can discourage production ▪ Costs of production higher than in EAC countries e.g., Uganda & Kenya ▪ Consumer demand for raw and processed milk not increasing fast enough to clear milk surplus because of non-affordability (e.g., processed milk), accessibility & availability of milk ▪ Lack of milk quality-based pricing system ▪ Poor milk quality in the informal sector limits export & production of value added products ▪ Informal milk trading that compromises milk quality & outcompetes processed products ▪ Low investment in R&D and training ▪ Cross-border disease transmission ▪ Restricted flow of imported goods as a result of trans-boundary trade protocols & barriers ▪ Limited credit for farmers ▪ Unsustainable land use (e.g., little opportunity for crop rotations).

The cooperatives have often been the management running the MCCs whose ownership has often been contested. The GOR has been reluctant to surrender MCC ownership to the cooperatives because it considers the MCCs as public goods. Because governance of most MCCs has been weak and often degenerates to ownership by a few influential individuals, this reluctance to surrender ownership is justified.

The MCCs, through the cooperatives, can be members of district unions. This model of district unions has not been widespread except in Nyagatare District where there is the Nyagatare Dairy Farmers Union which started as the Umutara Dairy Marketing Cooperative. The unions are also members of the National Dairy Farmers Federation that in turn is a member of the confederation of farmers.

The need for a dairy coordinating body was recognized. This led to the establishment of the Rwanda National Dairy Board that was expected to play this role and represent the dairy private sector. In addition, the board was expected to lobby for the sector. Unfortunately, the board could not continue its activities for a variety of reasons including lack of a self-funding mechanism and legitimacy as a bona fide dairy value chain representative. Through RDCP II facilitation, the board has been reconstituted into the Rwanda National Dairy Platform (RNDP) which will operate under the Private Sector Federation (PSF) that falls under the Rwanda Development Board (RDB). The RNDP is expected to communicate with government, NGOs and all dairy stakeholders and provide a platform for addressing issues affecting the dairy sector.

8.2.12 Dairy sector institutions, governance and policies

The public sector in the country is involved in dairy through two key ministries, MINAGRI and the Ministry of Trade and Industry (MINICOM). MINAGRI has key departments that are in charge of activities and services including production, milk collection and export promotion components of the dairy value chain. These key departments are the National Agricultural Export Board (NAEB), RAB, and the Rwanda Agricultural Inspection and Certification Services (RALIS).

MINICOM has three key departments that have been engaged in the milk trade component of the dairy value chain activities. These are the Rwanda Bureau of Standards (RBS) that supervises and enforces milk standards, the PSF that now houses the RNDP, and the RCA. The RDB is another key GOR department that plays a role in dairy sub-sector development through public investment promotion. Other ministries that have been linked to the dairy sub-sector through some joint or related programs include Ministry of Education, Ministry of Finance, Ministry of Health, and Ministry of Local Government.

The GOR has recognized the dairy sub-sector as a key value chain that has been incorporated in the PSTA III and the Economic Development and Poverty Reduction Strategy Phase II (EDPRS II). MINAGRI drew up the NDS to pay particular attention to dairy development, clearly demonstrating the emphasis it is putting on dairy development. MINAGRI has also stated that it intends to transform the dairy sector from informal to formal and has, through RALIS, initiated drafting of a Ministerial Instruction to support this transformation partly by regulating milk quality and distribution. In addition, MINAGRI constituted a dairy sector working group with representatives from all key public and private dairy stakeholders that now has been replicated in milksheds to lead dairy development. The dairy sector working group reports to the Agricultural Sector Working Group. In general, the policies of the GOR on dairy are supportive and have been reflected in, for example, subsidized importation of dairy cattle and AI services to build a large milk production base. The GOR has announced its intention to let the private sector take over the delivery of AI services under a commercial model.

8.3 Strengths, weaknesses, challenges and opportunities

The major areas of strength relevant to dairy that Rwanda has include an existing diverse breed cattle population, a network of MCCs and a fast developing cold chain, high public sector dairy cattle genetics improvement support, unutilized processing capacity, a milk surplus, and favorable policies for dairy sub-sector support (Table 8.1). Prevalent weaknesses include the high population density that leads to small household land holding and, consequently, limited land to support dairy production in some areas; limited potable water supply; seasonal variation in milk production; and limited capacity to manage dairy cattle and offer dairy support services.

Opportunities for the dairy sector are the potential to increase milk consumption arising from one third of the population that does not consume milk; existence of opportunities for milk and dairy products export to neighboring countries including Burundi, the Democratic Republic of Congo and other East African Community (EAC) countries. Challenges facing the industry are largely competition from milk and dairy

imports from other EAC countries such as Uganda and Kenya. Intensification of milk production when land size per household is small, except in the north eastern region of Rwanda, is a challenge that can lead to exclusion of the very poor from dairy activities.

8.4 Emerging dairy sector issues

Emerging dairy sub-sector issues in the country include the following:

- Through the intervention of the USAID-funded RDCP III, milk transportation using insulated tanks is on the increase with the advent of another processor who has managed to put out a milk tanker to collect milk from MCCs.
- RDCP II is facilitating RALIS to lead a Seal of Quality (SoQ) initiative to ensure delivery of clean milk. To this end, RALIS began auditing MCCs and other dairy premises to award the seal of quality (SoQ) to those meeting the prescribed criteria.
- RDCP II is facilitating setting up of milk aggregation points to enable quick milk transportation to MCCs with cooling facilities.
- A Ministerial Instruction has been drafted through RALIS leadership in order to regulate hygienic milk handling and milk quality across the value chain.
- Inyange Industries has initiated a pilot program in which it is co-managing MCCs with farmers in order to improve milk quality and increase milk collection.
- The GOR has subsidized acquisition of dairy cows from Europe for any interested dairy farmer that could pay the purchase price, and, for the first time the Fleckvieh cattle breed has been brought in.
- The GOR, through the MINAGRI, has declared that it will promote the transformation of the dairy sub-sector from informal to formal. The informal sector has been handling 75 to 85% of the milk reaching the market (MINAGRI, 2013).
- NAEB began tracking informal milk exports and has revealed that as much as 1.1 million liters of fresh and fermented milk are informally exported mostly to Burundi and DRC. From July to September 2013 there was an increase of up to 70% per month. It is not known whether this will be a permanent increase.
- Rusizi, Mukamira and Burera public and private partnership processing plants which will be commissioned in 2014 will increase processing capacity by at least 80,000 liters per day.

8.5 Prospects for sustainable growth

8.5.1 Economic, environmental and social performance of sector

There is no doubt that the dairy sub-sector has been of increasing importance economically through the consistent increase in milk production that also has a downstream benefit on ancillary industries. The NDS projected that by 2017 milk production will increase from the current 445 million liters per year to 650 million liters per year that can be utilized locally (MINAGRI, 2013).

In relation to social performance, the dairy sub-sector has been used to alleviate poverty through key social programs, the "One Cow per Poor Family (Gir'inika)," the "Igikumba Cy'umudugudu" and the "One Cup of Milk per School Child". The One Cow per Poor Family program distributes cows to poor families and takes into account gender balance in the allocation. According to MINAGRI (2013), from 2006 to 2012, the program distributed 133,287 dairy cows to largely rural households. Ultimately, by the end of the program in 2016 the GOR aims to distribute to 350,000 beneficiaries and is likely to be realized. To this end, during our interviews with key informants it was reported that 183,744 cows had so far been distributed by GOR alone. NGOs have also donated heifers for the program and the total number of cows distributed was estimated to be 247,000 that can develop into dairy farmers or remain as just cattle keepers.

With regard to gender mainstreaming, the Rwanda Constitution dictates that women should take up at least 30% of decision-making positions. Most dairy organizations, particularly dairy cooperatives, are aware of this expectation. However, there is no perception that the prescribed proportion is a quota.

8.5.2 Production, economic and other models for sustainable dairy sector growth

According to MINAGRI (2013) and, as stated earlier, milk production is projected to increase to 650 million liters per annum in 2017 creating a surplus of 100 million liters per year. This is likely to be realized through the growth of the crossbred herd that is a result of the extensive GOR AI programs and those from the EADDP project in the Eastern Province. The crossbred herd growth is a latent resource that will substantially increase milk quantity. Clearly, the growth in milk supply in Rwanda has resulted

from introduction of dairy breed genetics through cow importation and AI. As mentioned before, in 2012, 82% of the milk in Rwanda came from the improved cows (crossbred & pure dairy breed). With the extension of the electricity grid from serving 17% of Rwanda households to 70% by 2018 (The New Times, 2013; p. 4), milk spoilage, and hence wastage that was estimated to be almost one third of milk produced (SNV, 2008) is likely to decrease because of the expansion of the cold chain for milk collection.

Despite the projected milk increase, MINAGRI (2013) cautioned that the anticipated milk production increase will only materialize when there are market incentives for farmers to continue producing milk. Failure to do so may lead to farmers not milking their cows and purchasing feed for cows to boost milk production. Thus profitability at farm level is critical for growth of the dairy sub-sector.

The quality of milk is poised to improve through the introduction of dairy hygiene and milk quality testing, inspection and certification programs. In addition, regulations will improve the framework to enforce maintenance of quality standards. These regulations, coupled with milk grading and quality premium payments and training, will improve milk quality standards. It is envisaged that improvements in milk quality will lead to production of better quality value added products. Cheese production is considered to be a competitive form of value addition. The cheese could compete in EAC markets provided it is of good quality. Clearly, models that enhance smallholder cattle productivity and subsequently an increase in milk quantity are likely to sustain growth of the sector.

8.6 Collaboration prospects

8.6.1 Donor programs, policies of, and collaboration status among, dairy funders and/or funded projects

The major donors that have directly or indirectly supported the dairy sub-sector in the country include the Bill & Melinda Gates Foundation, through the EADDP, Heifer International, IFAD, Send a Cow, SNV Netherlands, and USAID, through RDCP II. In general, these programs have supported the whole dairy value chain but mostly in specific districts. For example, EADDP worked in three districts in the Eastern Province while SNV is currently working in districts in the Western Province and RDCP II is working in 17 districts across the country's five milksheds. The EADDP project ended in June 2013. The SNV and RDCP II projects are on-going but RDCP II will end in 2016.

While the policies of the individual donors are not apparent, it is likely that they depend on a blend of internal donor policies and those of the country. In this regard, using USAID as an example, the Feed the Future is a USAID program that has prescribed indicators and targets that get inputs from USAID projects across the world. In Rwanda, a Feed the Future strategic objective that RDCP II will feed into is "Expanded economic opportunities in rural areas". Consistent with this objective, the dairy value chain is a key one in Rwanda, and hence it is likely to contribute to the achievement of the FTF strategic objective. Invariably, the GOR has to concur on the importance of the project in the context of priorities of the dairy sub-sector and the overall national plans.

Issues and recommendations raised during interviews include the following:

- Some donors support capacity building of the grant recipients and do not realize that country needs are different; for example, in Rwanda such capacity building is a priority.
- Partners in development should pool funds, based on viable business plans, and co-fund project and allow recipients of funds to innovate, get ownership and accountability.
- Because they had predetermined milestones, some donors did not follow national strategy and policy. They could have leveraged on such strategy and policies rather than engage in trial and error.
- Some donors have micro-managed project to the detriment of innovation and impact.
- Some regional projects were rolled-out as a "one size fits all" with little consideration for the different stages of dairy development in individual target countries.
- Some donor funded projects were good at identifying problems facing the dairy sub-sector but did little to facilitate solving of the problems.

Apart from meetings at some platforms that have been created including the dairy sector working group and agriculture sector working group, there are no other forums where the dairy projects and funders meet. Attempts to bring projects together to share their reports have not succeeded, except in the mandatory MINAGRI annual project evaluation.

8.6.2 Public-private and within private sector collaboration and some insights into donor policies on dairy

According to MINAGRI (2013), implementation of the NDS will only succeed if there is a strong public-private sector partnership. In this regard, RAB is expected to lead in development of the dairy sector, particularly at the production level. The funders and GOR should support the functioning of the RNDP to create a platform to address dairy sector issues. Specifically, the topics for discussion include accessing land from GOR for commercial forage production, maintenance of milk quality standards, and zoning land for dairy production. There have already been some public-private sector forums that have been hosted through the PSF. It is hoped that a functional RNDP will provide the platform for engagement of players across the dairy value chain and funders. The RNDP II could become a focal point for all those that have interest in development and investment in the dairy sector.

8.6.3 Opportunities for collaboration between public and private dairy funders, and between dairy funders and dairy projects

As described in sections 8.8 and 8.9, it is clear that dairy funders are not working across all the districts of Rwanda and across the whole dairy value chain. There is, therefore, room for funders to target certain parts of the value chain or target different districts. The country still needs substantial investment in the development of a public sector funded extension service for dairy farmers and to develop the capacity of extension workers. Milk quality improvement has been a major area of emphasis that requires collaboration between donors and between funders and implementers to develop a milk traceability system. Investment in value addition to milk is another key area where private sector funders and implementers can also collaborate.

8.6.4 Potential for regional integration

According to the Draft NDS (2012; p. 47), the results of a study on the regional markets found that an untapped potential exists for dairy products from Rwanda. The regional population is over 150 million people and the middle class segment is growing with greater amounts of discretionary income. In addition, the rate of urbanization is increasing where there are now more middle class consumers who will purchase dairy products. Market research focused on five key urban areas of Bujumbura, Bukavu, Goma, Kampala, and Mwanza. These urban centers have middle class consumers who represent the best opportunities for purchasing Rwanda dairy products at competitive price levels over the next five years.

The per capita milk consumption for Rwanda is lower than in some EAC countries, particularly Kenya. Unlike Kenya and Uganda, Rwanda has high costs of milk production that can make its product uncompetitive in regional markets, particularly in Kenya and Uganda. However, because of its proximity to Burundi and DRC, Rwanda can be a major supplier of milk to the markets in these two countries. At present, informal exports of milk to these countries at times exceed one million liters per month. It is likely that the perennial increase in milk production and improvements in productivity will reduce the cost of milk production and make Rwanda milk more competitive. Prospects of Rwanda farmers supplying milk to processors in southern Uganda have been mooted. There are indications that a big Kenyan milk processing company is interested in opening a processing plant in Rwanda in order to supply milk to their markets in DRC and Burundi. Such foreign direct investment is likely to foster regional integration of the dairy sub-sectors because dairy products from the same processor operating across borders can also cross borders.

One concern has been the high cost of packaging materials that the Rwanda processors have to use in place of plastics which are banned in Rwanda. The high cost of these packaging materials adds to the cost of milk leading to uncompetitive consumer prices. However, alternative eco-friendly and affordable materials are likely to be acquired and used soon. Rwanda would have a competitive advantage in supplying niche products such as cheese which can be produced relatively cheaply from the high altitude areas in the northern and western milksheds. However, the diversity of the cheeses has to increase and the aim should be to produce niche high value cheeses. The price of cheese in Uganda is more than double that of Rwanda cheeses. Uganda can be a potential cheese market provided the quality of Rwanda cheeses improves.

9 Tanzania dairy profile

9.1 Country background

Tanzania has a total land area of 884,000 km² of which 40 per cent is suitable for agriculture (Appendix 3.6). The human population in 2012 was 47.0 million of which 75 per cent lives in rural areas. Agriculture is the mainstay of the economy, contributing 45 per cent to GDP. The development policy frameworks for agriculture, and the dairy sector in particular, include The Tanzania Development Vision 2025; National Strategy for Growth and Reduction of Poverty I and II (MKUKUTA); The Agricultural Sector Development Strategy (ASDS, 2001); The Agricultural Sector Development Program (ASDP, 2003); Millennium Development Goals (MDGs); The Rural Development Strategy (RDS, 2001); National Trade Policy, 2003; The National Land Policy, 1995; The Environmental Management Policy, 1997; The Agriculture and Livestock Policy, 1997; National Livestock Policy, 2006; Kilimo Kwanza, 2009; The Livestock Development Strategy (2010-2015); The Public Private Partnership Act, 2010; and The Dairy Industry Act, No. 8 of 2004. These frameworks aim to intensify and commercialize agriculture through technology upgrade and private sector investments and participation. The goals of agricultural development are improved incomes, social welfare and poverty reduction. These goals are articulated in MKUKUTA, the National Strategy for Growth and Reduction of Poverty (NSGRP).

The Livestock sector contributes 13 per cent to agricultural GDP and 5.9 per cent to the national GDP. The dairy sector contributes approximately 2 per cent to the national GDP. Challenges in the livestock sector include high mortality rates, low reproductive rates and low quality of livestock products. The Livestock Sector Development Strategy (2010-2015) seeks to intervene in the sector by addressing sustainable management of land, water, pasture and rangelands; promoting private and public sector investments to improve sector productivity and competitiveness; controlling livestock diseases; strengthening capacity of research and extension services; and improving public governance, particularly regulatory and institutional frameworks.

9.2 Dairy value chain

Milk production in Tanzania is currently estimated at 2.0 billion liters per annum. The traditional herd, indigenous Zebus, accounts for 70 per cent of this production. The improved dairy herd, mainly crossbreeds, and currently estimated at 780,000, accounts for 30 per cent of milk production.

The dairy sector is concentrated in five milksheds. These are Central (Tabora), Eastern (Morogoro), Lake Victoria (Musoma, Kagera), Northern (Arusha, Kilimanjaro), and Southern Highlands (Iringa, Mbeya). The Lake Victoria region accounts for 40 per cent of total milk production. This production is primarily from the traditional herd. However, the Northern region accounts for 50 per cent of milk from the improved dairy herd.

Most milk is consumed on-farm or sold locally (70-80 per cent). It is estimated that 15-25 per cent of raw milk is traded in the urban and peri-urban areas through the informal market channels. The formal processed channel accounts for only 3 per cent of the total milk produced. Consumption is estimated at 45 liters per capita. This compares to WHO recommended consumption of 200 liters per capita

Being predominantly smallholder driven, the sector faces challenges of markets access. In the agro-pastoral and sedentary areas (Northern, Eastern and Southern milksheds), the cooperatives and farmer groups have organized cooling and bulking centers as the link between the farmer and processor. In Tanga (Tanga Fresh) and Iringa (ASAS), the integrated business model involving a major processor, who is also a large scale producer, and the co-operative union (Tanga Dairy Co-op Union), would appear, on face value, to be a sustainable mechanism for smallholder access to the market. Weak farmers' organizations (co-operatives and farmer groups), where these exist, constrain producer access to markets. In the Lake Victoria region and due to the pastoralist nature of the dairy production system, farmer organizations do not exist. This creates challenges in milk collection and bulking, thus hindering the operations of potential processor. It should be noted in this regard that the only UHT plant in Musoma has closed down, while Mara Dairies operates substantially below capacity.

9.2.1 Key dairy value chain players and partners (projects, donors and investors)

The dairy value chain players are livelihood-oriented smallholder farmers, owning mainly indigenous animals, and large scale dairy farmers owning over 50 animals. The latter category accounts for 32,100

dairy cattle, equivalent to 6 per cent of the national dairy herd. Other players are the co-operatives, integrated dairy farmers who are processors, transporters, processors and retailers. The value chain players include the following:

Civil society: Civil-society organizations supporting rural development in the agricultural sector include the Tanzania Association of NGOS (TANGO).

Dairy industry traders lobby group: Tanzania Milk Processors Association (TAMPA), Tanzania Milk Producers Association (TAMPRODA), and Southern Agricultural Growth Corridor of Tanzania (SAGCOT)

Dairy input suppliers:

- Imported genetics, artificial breeding equipment and supplies of frozen bull semen and embryos: ABS TCM Ltd, Bimeda/Alta genetics, Dairy Enterprise Trust Fund, Highchem/CRI, Coopers/CRV, Twiga Ltd/SEMEX, Best Farm Genetics, Fleckvieh, and World Wide Sires
- Liquid nitrogen: National Artificial Insemination Centre, and British Oxygen Company (BOC)
- Bred heifers: Government Livestock Multiplication Units, Tanga Dairy Farm, Kitulo Complex Dairy farm.
- Dairy equipment - milk cooling and processing, milk cans and bulk transport tanks: Desley Holdings Kenya Limited, DSS/Alfa Laval
- Milk packaging suppliers: TetraPak
- Veterinary inputs and vaccines: Mukpar, Bytrade, Coopers, Norbrook, and Ultravetis
- Commercial feed and ingredients: Interchick, Azam and Rajan (There are over 25 private feed millers in Tanzania).

Donor funded projects and NGOs: The EADD Project Phase II funded by the Bill & Melinda Gates Foundation, Heifer International, TechnoServe, ILRI More Milk in Tanzania funded Irish aid, SNV Dairy Scan study, and SAGCOT – a USAID Feed the Future initiative linking farmers to modern supply chains and technology.

Private sector milk buyers and processors: Milk buyers and processors include Brookside Dairy, and ASAS, Tanga Fresh

Public sector: Ministry of Agriculture, Ministry of Agriculture Training Institute (MATI), Livestock Training Institute (LTI), and Sokoine University of Agriculture (SUA) and National Artificial Insemination Centre (NAIC).

Parastatal institutions: Tanzania Dairy Board, and Dairy Farming Company (DAFCO)

Services: Economic and Social Research Foundation (ESRF) Policy Analysis Research, Government Veterinary Laboratories, Private Veterinary Companies, and Agrovets.

9.2.2 Production systems

The traditional production system is mainly agro-pastoralist and sedentary. Production is low (2 liters per cow) and milk is mainly consumed at home. Available surplus is sold to neighbors and collection centers. The production system in which crossbred cattle are kept involves smallholder farmers owning 1 to 5 dairy cows. Farmers use inputs (AI and veterinary services) to sustain production. Marketing of surplus milk is through collection centers or middlemen. The milk yield in the crossbred category is 5.8 liters per cow/day.

The medium and large scale dairy farmers have a strong commercial orientation. Milk is delivered to processors or processed on farm and sold direct to urban centers. This category of dairy farmers account for 6 per cent of the national dairy herd. Located in highlands and around cities, these farms achieve a yield of 10-15 liters per cow/day.

9.2.3 Aggregation and marketing of raw milk

The processors access raw milk from MCCs. There are currently 218 MCCs in Tanzania. They are owned by co-operatives, processors and individuals. An integrated model of milk collection, cooling, bulking and processing was noted in Tanga (Tanga Fresh) and Iringa (ASAS). In this model, a private investor, who is also a dairy farmer and processor, organizes the co-operatives societies, through their Union (Tanga Dairy Co-operatives Union) to deliver milk in bulk. The co-operative union is the "hub" through which the smallholder farmer accesses the market. The hub also provides embedded services (e.g., AI, input

supply, credit) to farmers. This model sustains the operations of both the smallholder dairy farmer and the processor and is therefore potentially viable.

9.2.4 Milk processing and distribution

There are over 50 processing plants ranging in capacity from 1,000 liters per day to 30,000 liters per day. Total installed capacity is estimated at 410,500 liters per day. Capacity utilization is estimated at 30 per cent. The main processed products are *mtindi* (fermented milk) pasteurized milk, yoghurt, cheese and butter.

Tanzania is not self-sufficient in milk. It is estimated that the quantity of processed milk has declined by 80 per cent in the last 15 years leading to the closure of 13 processing plants. Current annual imports (milk powder, infant formula and UHT) are estimated at 30 to 40 million liters of liquid milk equivalent.

Most processors, 90 per cent, are small scale operations processing less than 5,000 liters per day. The rest, 10 per cent, could be considered medium scale operations, processing in excess of 5000 liters per day. The few integrated processors already referred to (Tanga Fresh and ASAS) process in excess of 30,000 liters per day.

Distribution of processed milk is through retail outlets and supermarkets in the urban and peri-urban areas. The perishable nature of liquid milk limits the geographical coverage of the market. Fresh processed milk tends therefore to be sold in the urban centers close to the production and processing geographical areas. Long lasting processed products, yoghurts, UHT milk and butter access markets in Dar-es-Salaam and other major urban centers.

Indications were given during field consultations that, notwithstanding the low component of processed milk (3 per cent) and the rising income levels of communities, particularly in urban areas, the demand for this product could be limited. It was stated that due to the high cost of processing, primarily due to overheads arising from low capacity utilization, the price of the final product could be beyond the means of potential consumers. This point could be a subject for research.

9.2.5 Commercial animal feed and fodder supply services

Feeding cattle is a major challenge in the Tanzania dairy sector. Farmers rely on roadside grazing, extensive grazing and feeding residue from crops. The occasional purchase of commercial feeds and nutrients by smallholder farmers that keep crossbreed cattle is inadequate for stimulating high milk yields. In the medium and large scale farmer category, feed and fodder constitute a major item of dairy farming expenditure. Data on national feed and fodder production is scarce. What is clear is that pasture and water shortages are recurring challenges to smallholder dairy farmers. The uncertain land tenure system constrains sustainable land management and fodder production. It should be noted that fodder production is in competition with food and cash crops, particularly in the high milk production potential areas.

The processed fodder is low in quality and expensive to the smallholder farmer. Concentrates are of inconsistent and/or poor quality. The effect is that smallholder dairy farmers are unable to improve productivity of their dairy herd. Where embedded services are available, through the co-operative unions, this challenge is minimized.

9.2.6 Veterinary and animal production services

Inability to establish disease free zones hampers the country's potential for export of animals and animal products. Common diseases are East Coast fever (ECF) and other vector borne transboundary diseases. However, Tanzania is Rinderpest free. Despite few private veterinary service providers, the Government of Tanzania (GoT) is largely responsible for provision of veterinary services. This is the case with the livelihood (subsistence) and smallholder dairy farmers. Commercial farmers are able to take care of their animal health needs. Immunization against ECF and provision of acaricides is primarily the role of the GoT but there is also private sector involvement for example VETAGRO in Arusha. Notwithstanding these efforts, 30 to 40 per cent of calves die each year due to preventable diseases, particularly ECF and trypanosomiasis.

The low dairy genetic base of the indigenous cattle limits milk production and productivity. Interventions to improve production of dairy livestock include strengthening of existing government owned LMUs,

promoting the use of AI and embryo transfer technology, strengthening capacity of local governments to provide AI field services, and promoting the formation of breed societies that could initiate a system of breed registration. The latter system does not exist at the moment.

9.2.7 Financial services

The provision of financial services in the dairy sector is constrained by the existing production systems. In the absence of collateral, banks are unwilling to lend to the sector. The low proportion of the formal milk marketing channel segment (3 per cent) aggravates this challenge. The cooperative societies are ideal for credit (and input supply and AI) but the management of these units is weak and, as a result, is often unable to provide embedded services. Weak management is partly a consequence of the board appointing poor managers and also members that do not understand the business of a cooperative society.

The over reliance on government for heifer supply through the LMUs, and the public sector oriented research and extension services, do not create a culture of commercial business. In this environment, the financial services sector has not taken root. However, it is understood that the Cooperative Rural Development Bank (CRDB) of Tanzania has basic lending programs for the dairy sector. The Agricultural Development Bank of Tanzania is now operating, although with a weak capital base. It is expected to develop unique financial products for the dairy sector.

Under the Business Sector Program (2008-2013), DANIDA supported, through soft loans, the development of SMEs in the agricultural sector including commercial farmers. Some of these SMEs are in the dairy sector. This support is allocated through the Private Agricultural Sector Support Trust and the SME Competitive Facility. This approach to the development of the agricultural sector has not, as far as could be learned, been replicated by other development partners.

9.2.8 Extension, training and knowledge transfer systems and services

Research is government responsibility through the National Livestock Research Institute, Central Veterinary Laboratory and Sokoine University of Agriculture. Collaboration will be sought from NGOs, the private sector and international organizations (ILRI, ASARECA and SACCAR). Extension services are the responsibility of Local Government Authorities (LGAs) and the private sector. Government will rehabilitate Rural Livestock Centers for farmer capacity building, strengthen research-extension-farmer linkages, promote private sector participation in the extension services and inputs supply, and establish the National Livestock Extension Fund (NLEF).

Information flow from the national to grassroots institutions will be strengthened through the district, ward and village structures, while farmers' empowerment will be enhanced through Farmers Field Schools (FFSs). These schools could be linked to regional training centers where certificate level short courses could be developed and offered. These could particularly target the youth.

It was noted during stakeholder consultations that while dairy sector extension services are the responsibility of local authorities, the technical staff are assigned to the relevant ministry. In essence therefore, there is a disconnect between district level structures and technical assistance within the line ministries. This constrains delivery of extension services on the ground.

While the policy frameworks envisage enhanced private sector participation in sector extension services, this has not taken root. Government subsidized extension services inhibit private sector participation in input supply and AI services. Indeed, the training of AI technicians coupled with grants from USAID to stimulate private AI services has not achieved the expected results. The lack of results needs to be analyzed further, apart from government subsidy there could be many other reasons for failure including insufficient cattle numbers, poor quality of semen or of insemination. Many attempts have been made to improve AI but with little success. Deliberate facilitative role of Government will be necessary to enhance private sector participation in the dairy sector.

9.2.9 Environmental issues, and potable water resources

Government understands the linkage between dairy farming and the management of the environment and water resources. Policies on sustainable land management are also in place under the National Action Plan and National Adaptation Plan for Action (NAP and NAPA).

Water and pasture are negatively affected by uncertain land tenure, particularly lack of pasture ownership rights. Migratory farming systems (extensive livestock farming) degrade the pasture and undermine water resource management. Excessive livestock holding is an added challenge in environment and water management. The challenge is in the implementation of these policies. The Environmental Management Act provides the framework for environmental conservation and management. Implementation is, however, at the local levels (districts, wards and village). Weak capacity at local levels constrains implementation of environmentally sustainable development plans. The link between the traditional herd in the pastoralist areas and environmental degradation is understood.

The challenge is to implement environmentally sustainable livestock development programs. What is not well understood is the linkage between the quality of the dairy herd and greenhouse carbon emissions. This is an important area of study. A case could be made for the reduction in dairy herd size in specific milksheds and increased productivity through genetic and nutrition improvement. This would reduce carbon emissions while adding to the productivity of the sector. Animal waste, particularly manure, could be used to generate renewable energy (e.g., bio-gas).

Other aspects of environmental conservation that could be addressed as part of sustainable dairy farming is water harvesting (water pans) and fodder production. This approach requires technical support from national level systems. The devolution of the proposed dairy innovation platforms (e.g., TDB platform) to the district level could, to a large extent, address this need.

An innovative approach could be promotion of Climate Smart Dairy Production thereby incorporating environmental sustainability in the sector. In this respect, development partners could invest in a pilot demonstration project.

9.2.10 Industry associations, producer groups and farmers' organizations

Industry associations are few and weak. The Tanzania Milk Producer Association (TAMPRODA) was established in 2002 to represent the interests of dairy producers. The association also strives to support the development of a business oriented sector. Tanzania Milk Processors Association (TAMPA) represents the interests of processors. The co-operative societies link smallholder farmers to the market by providing bulking and logistical services. In rare cases, the cooperatives offer embedded services to their members (e.g., input supply and AI). The National Livestock Development Strategy envisages, through capacity building, inputs supply and market linkage creation to improve smallholder dairy sector productivity and commercialization.

Notwithstanding the weak advocacy and institutional capacity of private associations in the dairy sector, there is evidence that targeted advocacy has yielded results. For example, TAMPA has successfully advocated for the removal of value added tax (VAT) on processed milk. The processed milk is now zero rated for VAT purposes.

The private sector, through the business associations, has engaged government in the development of the Tanzania public-private-partnership (PPP) policy, culminating in the enactment of PPP Act in 2010. It has also been actively engaged in the development of the Private Sector Development Policy that is now in draft form. The private sector is weak in evidence-based advocacy; as a consequence, this weakens private sector voice in policy development. The multiplicity of private sector associations, inevitably with overlapping mandate, weakens business advocacy. For example, Agricultural Council of Tanzania has 134 member associations representing in excess of 2.7 million individual smallholder farmers. The constituent associations and individual members are also members of TAMPRODA, TCCIA and other sector associations. This is expensive and unwarranted. Besides this it creates confusion in advocacy and weakens the voice of business in policy advocacy.

9.2.11 Dairy sector institutions, governance and policies

At the apex level, the Ministry of Livestock and Fisheries Development has the policy responsibility for dairy sector development. Other supporting ministries include Ministry of Agriculture, Food Security and Co-operatives; Ministry of Water; and the Prime Minister's Office – Regional Administration and Local Government (PMO-RALG). The latter ministry is important in that it co-ordinates policy implementation at grassroots level through district level structures.

Policy implementing agencies within the Ministry of Livestock and Fisheries Development are the Division of Veterinary Services; Research, Training and Extension Division; and the Division of Livestock Product and Marketing. Other agencies are the TDB, Livestock Training Agency and the Tanzania Veterinary Laboratory Agency.

The primary policy implementation agency in the dairy sector is the TDB. Established in 2005 under the Dairy Industry Act, No. 8 of 2004, the TDB is mandated to regulate activities of the dairy industry, research and develop markets, collect, analyze and disseminate data and information on the dairy industry, and improve technological advancement skills in the industry.

Working with sector stakeholders, the TDB has spearheaded the campaign to upscale the industry. Under the banner “*Maziwa Zaidi*” the industry stakeholders have committed to implement four impact pathways, viz. institutional innovations, genetic improvement, technology adoption and increased consumption of dairy products (Box 9.1).

Box 9.1: Innovations in the dairy sector

Under the vision, “Maziwa Zaidi”, the Tanzania Dairy Board is promoting private sector participation in the dairy industry development. Innovative impact pathways underscore this initiative, viz: improved herd, capacity building, technology adoption and expanded market for dairy products.

Stakeholder participation is anchored on the Annual Dairy Stakeholder Council, involving 1200 stakeholders; and the Dairy Development Forum, involving government, private sector associations and development partners. These structures are supported by innovation platforms in each milkshed which are linked to farmer working groups. The policy framework for this engagement is the National Dairy Masterplan, under development; the Dairy Sector Development Vision, Miwa Zaidi; and the dairy hubs. The formation of dairy hubs is being promoted by the TDB with the support of development partners, particularly, Heifer International and Bill and Melinda Gates Foundation that are funding EADD II.

Effective dairy sector planning requires accurate data and information. The existing data on the dairy sector is inadequate for sector planning and should be up-dated. This is an area that development partners could support.

9.3 Strengths, weaknesses, challenges and opportunities in dairy sector

The potential for sector development is great; the challenges are many and varied (Table 9.1).

Table 9.1 SWOT analysis: Tanzania dairy industry	
Strengths	Weaknesses
<ul style="list-style-type: none"> • An established policy and institutional framework (MoLD, TDB, PMO-RALG) • Specific focus of government on livestock development (NLP and NLDS) • Though small, existence of established medium and large scale farmer category that could anchor sector development • Emerging innovative business models linking small-scale farmers to processors through integrated “hubs” (Tanga). 	<ul style="list-style-type: none"> • Predominance of livelihood and smallholder dairy farming category with limited capacity to transform the sector • A public sector orientation in production and extension services that constrains commercialization of the sector • High cost of production • Weak farmer organizations (co-operatives) and associations which are unable to run the coop business and advocate for policy reforms • Low quality and high cost of feeds which limits productivity • Shortage of dairy stock (poor calf rearing and breeding/reproduction) • Poor business climate and a multitude of overlapping regulations and control agencies
Opportunities	Threats/challenges
<ul style="list-style-type: none"> • A large domestic and regional market • Potential support from development partners • Political support in the development of the sector policy, research and extension services • A devolved system of governance which emphasizes local empowerment in sector development • Favorable climate in highlands, coast and central regions for dairy farming • Many development partners prepared to partner with stakeholders to develop the sector (Heifer International, SNV and Bill & Melinda Gates Foundation (EADD II)). 	<ul style="list-style-type: none"> • Unpredictable weather patterns affecting production of milk • Environmental degradation and climate change challenges with negative impact on the dairy sector • Competition from regional suppliers, particularly Kenya.

9.4 Emerging dairy sector issues

Arising from previous discussions, the emerging issues in the development of the dairy sector are as follows:

- Government policy is to promote consumption of processed milk. This is to address safety and health risks associated with consumption of raw milk; however, only 3 % of all milk produced and 9 % of all milk marketed is processed (Quick Scan, 2014). Most consumers boil milk before consumption and there is no clear evidence of health risks though it is known that bacterial toxins are not removed by boiling. This issue requires further analysis. Clearly there is need to promote the supply and demand of good quality milk through the formal market channels.
- In response to an increase in population, rising incomes and an expanded regional market (regional integration), the demand for milk and milk products is rising. This demand cannot be satisfied due to low milk production and cow productivity. Milk production is primarily from the traditional herd (70 per cent) with an average production of 2 liters/day. Increasing milk production will require improved genetic make-up of the dairy herd; and improved management of the sector along the value chain.
- Dairy processors (90 per cent) are mainly small-scale operators. They lack appropriate technology in processing and products development. Related to this is seasonal milk production and low processing capacity utilization leading to high costs of production and high product prices. This has a limiting effect on the demand for milk and dairy products.
- Milk collection, cooling, bulking and logistics require appropriate technology and viable organizations. The dairy sector intermediary organizations (co-operative societies and farmer groups) are weak in both technology adoption and management. Although development projects are assisting, more effort is required to support cooperative business improvement, governance, and education of coop members. The result is weak management of the logistics part of the value chain, leading to poor milk quality and wastage. This, in turn, reduces the return to smallholder farmers from their dairy farming activities.
- The seasonal nature of the milk production with the resultant “flush” and “shortage” creates an unstable market for the logistics and processing parts of the value chain. The stabilization in milk supply could be achieved through appropriate fodder and feed practices, use of imported skim milk powder with butter oil and milk collection from other areas; for example, Tanga Fresh collects milk from Morogoro. These are outside the reach of smallholder farmers.
- Adapting milk price according to volumes delivered and a segmented approach to dairy support, targeting the medium and large scale dairy farmers, could be a viable development strategy. Also, smallholders can develop into commercial dairy or work in the agricultural input and processing sector.
- The policy framework for the development of the dairy sector is in place. The requisite institutions are also in place. The challenge is policy implementation. The emerging positive support role of TDB, particularly the development of a stakeholder driven vision, Maziwa Zaidi, is an innovation that could upscale the dairy industry.
- In general, private sector associations in the dairy sector are emerging as a credible voice for the industry. However, these associations lack the capacity to provide evidence-based advocacy.
- Research and extension services are primarily the responsibility of GoT, which has not demonstrated strength in carrying out this mandate. The result is weak training and extension services and inadequate linkage between research and on-farm technology transfer. The GoT involvement in extension services further precludes private sector participation. The GoT should facilitate effective engagement of the private sector in input supply, including AI, feeds and forages, equipment, veterinary services, supply of veterinary medicines and vaccines.
- Over 30 per cent of calves die due to poor management and preventable diseases including ECF. Disease control is the responsibility of Government. This responsibility assumes effective partnership with the private sector. Disease control and management of research outputs require a strong partnership between government and the private sector.
- The development of the dairy industry in Tanzania will require a common framework along which government, private sector and development partners can collaborate. The Maziwa Zaidi initiative provides a viable framework for the sector development. However, it is necessary that stakeholders, particularly development partners, coordinate their development support programs under this common framework.
- The conservation and management of the environment should be seen as integral to development of a sustainable dairy industry. This means that communities and the business sector should be educated on the link between sector development and the environment. Greenhouse carbon emissions, access to potable water on farm and at MCCs and climate change mitigation should be a major focus of industry development.

- The development and implementation of environment management plans at the local level requires institutional capacity way beyond what is now available. Related to this is the need to clearly identify environmentally suitable geographical areas for dairy farming. The need to develop capacity to sustainably manage the environment in tandem with the dairy sector development will require adequate capacity. Development partners could support this process.
- The conservation and management of the environment should be seen as integral to the development of a sustainable dairy industry. This means that communities and the business sector should be educated on the link between the sector development and sustainability of the environment. Greenhouse carbon emissions and climate change mitigation should be a major focus of the industry development.
- Meaningful development interventions in the dairy sector should be based on accurate and authentic sources of information. Information on the demand and production of milk is necessary to ensure precise development plans. This is an activity that development partners could support.

9.5 Prospects for sustainable growth

9.5.1 Economic, environmental and social performance of sector

The dairy sector has not realized its potential. In relation to increased population, the production in the sector has declined by 80 per cent in the last 15 years (TAMPA). However, total milk production in the country has increased steadily. The milk quantity being processed /formal market has decreased, but it is debatable whether this has constrained the welfare of the smallholder farming communities. The poverty level, at 50 per cent of the population, could be positively impacted by the development of this sector.

The linkage between dairy farming and the environmental degradation is underpinned in policies. The operationalization of these policies remains a challenge, but, as has been observed, the impact of the dairy sector on carbon emissions is not clearly understood. Neither is this outcome reflected in the existing agricultural policies.

Related to this is weak capacity at local level to implement environmental management frameworks, particularly the Environmental Management Act. In the pastoralist and agro-pastoralist dairy farming areas, the link between livestock farming and environmental degradation is understood. What is lacking is the capacity or political will to confront this challenge. Because of the cultural aspects of pastoral farming, policy compliance is difficult. Other challenges add to this problem; for example, the conflict between pastoralists and sedentary farmers, particularly in the Lake Victoria and Central milksheds, creates social tensions. Related to this is human and wildlife conflict arising from invasion of livestock into the traditional national parks and reserves. It is obvious that hard decisions will have to be made to limit the impact of pastoralist practices on the environment, and natural resources, particularly wildlife.

9.5.2 Production, economic and other models for sustainable dairy sector growth

Sustainable growth of the dairy industry in Tanzania should be anchored on key innovations in policy, regulatory and institutional frameworks. Most of these were discussed under the previous section on emerging issues. The potential innovations that could transform the sector are:

- Using the cluster development approach in value chain management, building on emerging integrated business models in Tanga (Tanga Fresh) and Iringa (ASAS). This "hub" model was piloted in EADD I in Kenya and valuable lessons have been learned. Sustainability of the "hub" model will depend on the extent to which the private sector is integrated in the business processes. Attracting a strategic private investor in this model is a key success factor.
- Creating a shared vision of the dairy industry. Maziwa Zaidi vision could provide a framework around which dairy industry stakeholders could mobilize resources for sector development. This can be supplemented by innovation platforms that are clearly linked to the grassroots development structures, this vision has the potential to transform the sector.
- Strengthening the research and extension services with emphasis on genetic improvement, disease control and productivity improvement initiatives. Reduction of calf mortality, currently estimated at 30-40 per cent, is a priority. The important role of co-operatives as active partners in value chain development should be recognized and strengthened.
- Technology transfer across the value chain, from genetic improvement, feeds and forages for improved nutrition, on-farm logistics, husbandry, processing and products development, should be recognized as key to the development of the sector. In this respect, technology transfer programs, including dairy training schools, should be given priority.

- Strengthening sector development institutions, particularly the TDB and research institutions. In the absence of strong institutions, adequately funded and linked to the private sector, the development of the sector will be constrained.
- Linking national level policy to grassroots implementation. This is a recurring challenge. Policy implementation requires adequate capacity at grassroots level. District implementation structures should therefore be strengthened to play their role. Important capacity, in this respect, is the ability to mobilize technical assistance from the line ministries. This could mean that technical staff in line ministries are re-deployed and made accountable to local authorities.
- Segmenting the dairy sector into livelihoods smallholder commercial dairy farmers, and medium scale dairy farmers could allow targeted sector interventions. The segmentation can be at least 3 categories or segments (and preferably more): (1) livelihood (agro-) pastoralists with indigenous cattle; (2) smallholder dairy farmers with crossbred cattle; and (3) medium/large scale with crossbred or purebred exotic dairy cattle. More useful segments could be recognized considering location (rural versus peri-urban) and marketing (formal versus informal). The focus of development interventions should be the improvement of market access opportunities through development of market infrastructure and linking commercial dairy farmers to processors and the retail segments. Livelihood dairy farmers could be supported by poverty reduction oriented NGOs and development partners. It should be understood, however, that livelihood dairy farmers also market milk surplus. They should be linked to the market as a matter of development interventions, but it should not be expected that this category will transform the dairy sector.

9.6 Collaboration prospects

9.6.1 Donor programs, policies of, and collaboration status among, dairy funders and/or implementers

Major development partners in the dairy sector include SNV (Dutch Development Organization) with a focus on the dairy value chain; Rural Livelihood Development Company (RLDC), linking the poor to the market; Irish Aid and DANIDA, with value chain initiatives in different regions of Tanzania; International Livestock Research Institute (ILRI), case study on dairy value chain; USAID/Land O'Lakes, commercialization of the dairy value chain; and Bill & Melinda Gates Foundation that is focusing on smallholder dairy development using the hub concept (EADD II).

Heifer International has long standing projects in Tanzania, mainly in poverty reduction interventions at the production part of the value chain. The orientation has changed to value chain development with a focus on market access development. Support projects will be consolidated in and the Southern milkshed. Heifer International is also the project manager for EADD II.

There is no apparent collaboration between the development partners in the sector. The role of government in coordinating development interventions is not seen. The result is duplication and wastage of resources. The evolving Dairy Platform could serve as the co-ordination mechanism for stakeholder engagement. The Livestock Sector Development Strategy could provide a framework for coordinated development initiatives in the dairy sector.

9.6.2 Public-private and within private sector collaboration and some insights into donor policies on dairy

The thrust of government policy in livestock development is private sector participation and commercialization. The challenge is to actualize this policy. The private sector responds to profit. The current structure of the dairy industry does not, on the face of it, provide attractive profit opportunities.

Production systems are traditional – free range and semi-zero grazing in the smallholder sector; feed and fodder is a challenge in regard to medium and large scale farmers; milk bulking and transportation is a high cost venture; and capacity utilization at processor level is low (30 per cent). This scenario does not portend a profitable sector.

Public private sector dialogue through business associations is taking root. Indeed the Public Private Partnership Act, 2010, provides the mechanism for collaboration between government and the private sector in the development process. Similarly, and through stakeholder participation, the Private Sector Development Policy is under development. The policy, when formulated, will entrench the private sector as the engine of growth in the country. The challenge is always policy implementation. The dairy stakeholders will have to build the essential capacity for policy implementation and, in particular, linking national policy to grassroots implementation processes.

Public-private-partnership requires strong facilitation, including fiscal incentives and infrastructure development. Herd improvement will require a more commercial orientation. Current practice of livestock Multiplication Units and Heifer in Trust (HIT) are social in orientation and therefore unable to anchor a commercial dairy sector. However, some smallholder farmers may be able to grow into commercial dairy farmers. Strengthening the role of the private sector in dairy sector development will require clearly articulated policy, complemented by adequate capacity in sector institutions to implement policy.

9.6.3 Potential for regional integration

Current milk production in Tanzania is about 2.0 billion liters per annum. Thus, milk production is increasing, 10 years ago production was 1.2 billion liters, an increase of 5 % per annum. However, what has declined is the quantity sold through the formal market. In comparison, production in Kenya is 5.0 billion liters per annum. Tanzania imports the equivalent of its production in liquid milk equivalent. Imports are mainly from Kenya, South Africa and New Zealand. It is unlikely that Tanzania could be a net exporter of milk in the medium term, noting in particular that the increasing population and the rising middle class will demand more milk than is likely to be satisfied from the domestic supply.

There is benefit in intra-regional collaboration in genetic improvement. This could entail strategic alliances between breeders in Kenya and Tanzania. It could also entail technical and technology transfer through exchange of training visits among the mutual countries including South Africa. Under the World Bank supported East Africa Agricultural Productivity Program covering Kenya, Ethiopia, Tanzania and Uganda, Kenya is the regional center of excellence in dairy sector development. This program provides an opportunity for regional collaboration in the development of the sector. For this approach to achieve the envisaged outcomes, there is need for a clearly spelt out strategy for the sector development and a mechanism to facilitate this process. This is an area of potential support by development partners.

Data on cross-border trade in dairy products is not readily available, probably because this is unrecorded. Enhancing intra-regional trade in the dairy sector will require accurate data through sector mapping. The development partners could support this intervention.

10 Uganda dairy profile

10.1 Country background

Uganda covers an area of 241,038 km² of which about 37,000 km² has water bodies (Appendix 3.7). The Uganda population is growing at a rate in excess of 3.5% per annum and currently stands at 36.9 million and more than 60% are youth. The GDP of Uganda is over 20 billion (USD547/capita) with 23% coming from agriculture. Poverty and equity are estimated to be 38% (World Bank 2009). About 80% of the population, the majority being women, is engaged in agriculture. Uganda has a viable growing pasture-based dairy industry that recorded a more than threefold increase in milk production from 1991 to 2013. Though increasing, annual milk consumption remains low, 55 liters/capita, compared to the FAO recommended annual consumption of 200 liters/capita. From 1999 to 2004, Uganda had a remarkable production increase of greater than 5% per year (Dobson 2005).

In the East African region, Uganda has the advantage of fertile land resources, a favorable climate (good rainfall and low temperature variability) for milk production and dairy farmers' willingness to adopt productivity enhancing technologies continues to increase. Because dairy cattle rearing is largely pasture-based, the Uganda dairy sub-sector has one of the lowest costs of production (Hemme et al., 2007).

Unfortunately, the Uganda dairy industry was devastated by the civil war that ended in 1986. Rehabilitation of the dairy industry occurred in the period 1987 to 1992 under the Ugandan Government National Rehabilitation and Development Plan. The plan had a clear goal to self-sufficiency in milk by re-establishing dairy farm production capacity, improving milk collection, processing and marketing, and strengthening dairy extension services.

There are five distinct milksheds along the cattle corridor extending from Mbale in the east to Kabarole in the west and stretching down to Kabale in the south-west (Appendix 3.7). According to the National Livestock Census (2008), the cattle population stands at 12.8 million of which 10.6 million (93.6%) are indigenous cattle, and 1.52 million milked cows (0.65 million exotic dairy breeds) producing an average 1.2 liters of milk per cow per day or approximately a total 1.85 million liters of milk per day. With an estimated growth of 4% per annum, Uganda national annual milk production is estimated at 1.19 billion liters. The western region has the highest number of milked cows estimated to be 0.41 million while the northern region has the least number of milked cows estimated to be 0.16 million.

Total milk processing capacity is now estimated to be 1,018,000 liters which is handled by 14 registered processors (DDA 2013). It is estimated that about 80 percent of all milk produced is marketed through informal channels and less than 20% is marketed through formal channel (Agriterria, 2013).

10.2 Dairy value chain

The Uganda dairy value chain is presented according to its meta-institutes that include suppliers of dairy inputs and services, milk producers/farmers, milk aggregators, transporters, milk buyers/processors, retailers, and consumers. The production of milk is largely from indigenous and crossbred cattle reared under three pasture based production systems distinguished by levels of intensification. Milk transportation remains varied from deliveries by foot, bicycle, motorcycle, trucks, and insulated bulk tankers.

10.2.1 Key dairy value chain players and partners (projects, donors etc.)

The key dairy sector value chain players and development work partners given below are grouped under the headings: private sector, dairy traders, input suppliers, public sector, parastatal institutes, civil society, donor-funded projects and non-governmental organizations.

Civil society: Civil-society organizations supporting rural development in the agricultural sector include the Uganda National Farmers Federation (UNFFE), and the National Organic Agriculture Movement (NOGAMU).

Dairy input suppliers:

- Imported genetics, artificial breeding equipment and supplies, frozen bull semen and embryos: ABS TCM (U) Ltd and World Wide Sires
- Liquid nitrogen: National Animal Genetic Resource and Database Centre (NAGRC-DB), Medical Research Institute (MRI), Mulago Hospital, and Heifer International (HI)
- Bred heifers: Keirungi Farm, private enterprises
- Dairy equipment -milk cooling and processing, milk cans and bulk transport tanks: Snowman
- Milk packaging suppliers: Raily Packaging (Mukwano), and Multiple Industries
- Dairy products cultures: Makerere University
- Veterinary inputs and vaccines: Coopers, ERAM, Norbrook, MSJ Vet Pharmacy, MTK Uganda Ltd, and Quality Chemicals all sold through local agro-veterinary distributor shops
- Commercial feed and ingredients: Unga(U) Ltd, Maganjo Millers, Ugachick Ltd, Biyinzika Farmers, and Nsava Feeds.

Parastatal institutions: Dairy Development Authority (DDA), National Agricultural Advisory Service (NAADS), and the National Agricultural Research Organization (NARO).

Private sector milk buyers and processors: Milk buyers and processors include Sameer Agricultural and Livestock Limited (SALL) formerly the Dairy Corporation Limited (DCL), Pearl Dairies Limited, Jesa Farm Dairies, J.B.K Dairy Products (U) Ltd, and Shumuk Dairy products (U) Ltd.

Public sector:

- Ministry of Agriculture Animal Industry and Fisheries (MAAIF), Directorate of Animal Resources - Ugandan Public Animal Health Service
- Dairy training and extension in animal health, production and extension colleges include: Makerere University Department of Veterinary Science, Bukalasa Agricultural Training Institute, and Arapai Agricultural College. There are approximately 35 graduates trained in clinical medicine annually from Makerere University Veterinary School.
- Dairy Genetics production and supply: National Animal Genetic Resource and Database Centre (NAGRC-DB).

Services:

- Feed laboratories: Makerere University
- Veterinary laboratories: Makerere University, Small Animal Clinic, Kiboga District under JICA, Mbale District Local Government, Mbarara District Local Government, and Mukono District
- Dairy ICT providers: Grameen Foundation through MTN Uganda

10.2.2 Production systems

Uganda has three broad milk production systems. The first is the pastoral system which has farms with greater than 50 indigenous cattle grazing on coarse pasture throughout the year. They are milked twice a day but do not get any supplementary feeding. The second system consists of peri-urban small-scale mixed crop and livestock farms that keep, on average, less than 10 mixed dairy cow breeds. The third system consists of commercial dairy farms (above 200 acres in size) that keep 20 to 100 pure and crossbred dairy cows largely on planted pastures supplemented with grain by-products and oilseed cakes.

Characterized by a 'low input-low output' approach, ecological and socio-economic settings determine cattle production systems in Uganda. The dairy production systems are further categorized by level of intensification and vary according to land use, feeding strategies and herd structure, which are linked to costs and investments, milk yields and labor use, and result in different degrees of intensification. Semi-zero grazing and zero grazing are the most intensive dairy production systems with the latter having the highest prevalence (Mubiru et al., 2007). Increasing milk demand is driving dairy farms to intensify so as to increase household returns (Garcia et al., 2008).

The cattle production systems can be further classified as follows:

Peri-Urban: Small-intensive (1 exotic cow under zero grazing), fenced-grazing (15 exotic cows), and large-intensive (45 exotic cows, and selling milk directly to urban processors/retailers) However semi-intensive systems exist in other areas too.

Rural: Small-extensive (3 indigenous cows), intermediate-extensive (13 indigenous cows), pastoralist semi-nomadic (35 indigenous cows), and agro-pastoralist (40 low grade cows and 25% exotic).

10.2.3 Milk transportation from farm to market

In general, cows are milked twice a day and the milk is either sold to neighbors or vendors or transported to a milk chilling center by foot, bicycle, ox or donkey pulled carts. Some peri-urban or rural intensive production system farmers own motorbikes or pick-up trucks and they often pool milk with neighbors and transport the milk in metal churns to the MCC or informal selling points. From the MCCs, milk is transported to milk buyers either in metal milk churns either using a truck, lorry or in trucks with bulk insulated tanks. The multiple transfer processes from farm to primary and secondary collection points and finally to processing plants exposes the milk higher contamination chances, and hence milk quality is often compromised. Uganda has outlawed transportation of milk in plastic containers and unlicensed milk boiling for sale to the public; however, enforcement of this regulation remains weak.

10.2.4 Aggregation and marketing of raw milk

There are two main channels of marketing milk and milk products in Uganda, the formal and informal markets. The informal market commands the largest share (80%). Problems of raw milk include adulteration with un-potable water. Moreover, most categories of vendors incur little overheads, except transport to consumers, as no value is added to the milk, and no taxes are paid.

There are three tiers of vendors in the informal sector, primary, secondary and tertiary vendors. The primary vendor buys milk at about USD 0.14 from a farmer and sells it directly to the consumer or to another vendor at roadside pooling centers or to a MCC at USD 0.24. Primary vendors most commonly sell their milk to privately owned MCCs or MCCs which serve processors whose milk quality requirements are less stringent than those of other processors. In general, because of low buying prices, slow mode of payment as well as stringent milk quality requirements, primary vendors do not favor processors. However, a few primary vendors supply some MCCs, particularly where private vendors are not active.

Secondary vendors buy milk from roadside milk pooling centers. The milk pooling centers are largely under a tree, which provides shade for the vendors and their milk while waiting for secondary vendors from urban areas, mainly Kampala, to purchase the milk. Using vans and pick-up trucks, milk is collected in metal cans from various centers until the van is full. The most commonly used vans have an individual carrying capacity of 80 to 120 twenty-liter milk cans.

Tertiary vendors, on the other hand, are in urban areas where they buy milk from secondary vendors at USD 0.16 per liter. They boil the milk and sell it for USD 0.40 per liter at various nightspots while still warm or after chilling. Some secondary vendors also boil and/or cool milk and sell it at retail outlets. It is difficult to estimate with certainty the amount of milk that is nationally traded through the informal market sector.

Formal traders include MCCs, bulk transporters and processors that handle an estimated 12.3% of total national milk.

10.2.5 Milk processing and distribution

The major processors are SALL and Pearl Dairies which processes 170,000 liters per day into butter oil and powder. Medium to small processors include SBJ Dairies and Jesa Dairies each processing in excess of 40,000 liters per day into mainly pasteurized milk and yoghurt. Of all the fresh milk marketed by farmers, the SALL handles over 10 percent. There are about 13 dairy processors (total installed capacity = 1,018,000litres; daily actual collection = 624,000 liters/day). Thus processing capacity utilization is 61%; however, utilization capacity can be as low as 41% during low milk supply seasons. Current milk processing capacity utilization for SALL is 36%, Pearl Dairies Limited 30%, JBK Dairy Products (U) Limited 9%, Jesa Farm Dairy 4%, Shumuk Dairy Products (U) Limited 4 %, and Birunga Dairy 2%. Fifty four per cent, 45%, 0.6% and 0.4% of processing capacities are in Kampala, Mbarara, Jinja and Fort Portal, respectively.

New private investment is focused on increasing processing capacity by over 830,000 liters. This has been initiated in Mbarara (e.g., UCCCU), Mbale and Entebbe. In general, Uganda processors produce the following value added products: pasteurized milk, milk powder, yoghurt, butter, ghee, cream and UHT. Ninety-nine percent of milk processing occurs in Kampala and Mbarara.

10.2.6 Commercial animal feed and fodder supply services

Balikowa (2004) reported that 25% of south western Uganda households planted improved pastures, mainly *Pennisetum purpureum* (Napier grass), *Chloris gayana*, *Brachiaria* spp., *Pennisetum clandestinum* (Kikuyu grass), and legumes; however, due to no milk price differential across seasons only 5% of the farms preserve fodder for dry season feeding. Most animals thrive on sub-optimal energy levels for most of the year. Few commercial farms conserve fodder or engage in commercial fodder production. Most farmers graze exotic (pure dairy breeds) and crossbred cattle during the wet season, and stall-feed them in the dry season; however, only 20% of the farmers stall feed their exotic cows and crosses during both the wet and dry seasons (EADD, 2009). The percentage of farmers practicing stall-feeding, in addition to grazing of exotics and crossbred cattle, has been increasing over the last ten years from 5% to 30% while that of farmers relying entirely on grazing their exotic cows and crosses decreased from 89% in 1999 to 51% in 2009.

About 9% of farms give supplementary concentrate feeds (USD 0.71/kg) or maize and wheat by-products (2-3 kg/cow per day) to cows in milk. Nearly all the farms feed rock salt but, rarely, mineral salt blocks. About 4% of the dairy producer households use supplementary feeds. Only 38% of those supplementing with grain-based diets use commercial dairy meal, 5% use home-made compound dairy rations while 50% supplement with milling by-products (EADD, 2009). Some households/farms use by-products from the brewing industry. A few farms such as Jesa Dairy Farm in peri-urban Kampala have adopted the total mixed ration (TMR) feeding system (Balikova, 2011). It can be uneconomical to feed commercial concentrates for the purpose of boosting milk production (FAO, 2010). The minimum ratio of milk price per liter to the concentrate price per kilogram should be 1.2:1 (milk price: concentrate price).

10.2.7 Veterinary and animal production services

The government of Uganda liberalized and decentralized veterinary services leading to many actors providing veterinary services but without adequate regulation and supervision. With the resurgence of infectious diseases, and increased economic and health risks, there is need to understand relational patterns of actors to ensure good governance and address emerging and re-emerging animal disease risks. Ilukor et al. (2013) reported that important social relations in veterinary service delivery are the cooperation of the private veterinarians and para-vets, private and government veterinarians in intensive production systems, and cooperation among NGOs, government veterinarians, and community based animal health workers in pastoral areas. Uganda dairy is exposed disease risks such as FMD from pastoral animal movements. Though there is a regulatory framework for the public veterinary department to control notifiable diseases, this has been neglected due to a low operational budget allocation.

Staff absenteeism, insufficient and unpredictable budgets, weak legislation, exclusion of technical staff from decision making processes and policy illogicality are the major problems in veterinary service delivery. Given the existing fiscal challenges reducing funding to veterinary departments, correct prioritization of services, and designing of appropriate policies and institutions can improve delivery of animal production services in Uganda. Access to quality medicines and vaccines remains an issue and most agro-veterinary shops are not offering requisite extension services resulting in improper use of medicines.

10.2.8 Financial services

The former producer boards were major sources of credit to farmers, consequently, their abolition led farmers to rely on the traditional commercial banking system, which, sadly, did not have customized agricultural loan-products (Bategeka, 2013). MFIs and related institutions have failed to develop appropriate farm loan products. The interest rates charged by MFIs are not only high but repayment periods are short, and hence make loans from MFIs unsuitable for dairy, which is a long term business.

The most significant Government of Uganda (GoU) and development partners support to rural financial services sub-sector is the GoU's Microfinance Outreach Plan. The banking sector witnessed stability and grew (both in terms of size and number of institutions) considerably during the year 2011. The policy framework provided for sufficient space for private sector provision of financial services in rural areas. However, the financial products microfinance institutions offer to their clients are hardly suitable for financing agriculture as they still do not offer long term financing for agriculture. Continued entry of new banks stimulated competition and branch network expansion. The bulk of loans and advances from credit institutions were for trade and commerce, transport and communications got 9.3% and only 0.9% of the loans were advanced to agriculture including dairy. Further GoU Ministry of Finance reforms and regulation of the finance sector that includes strengthening MFIs and Savings Credit Cooperative Organizations (SACCOs) have been summarized (SNV, 2008). Other Uganda banks with an Agriculture portfolio include Uganda Development Bank, Bank of Uganda, Centenary Bank and Stanbic Bank.

The national budget of Uganda allocates less than 10 percent of the budget to the agricultural sector but donors give substantial support to the sector. A number of donors have financed long-term agricultural projects. These projects have not only provided resources to undertake specific activities but they have also been used to top-up the allowances of the Ministry of Agriculture Animal Industry and Fisheries (MAAIF) headquarter staff, which can cause distortions and lack an exit strategy. Some donors have even by-passed MAAIF and directly supported sector agencies as evidenced by the creation of the Plan for Modernization of Agriculture secretariat (Bategaye, 2013).

10.2.9 Extension, training and knowledge transfer systems and services

Government agricultural sector reforms, particularly PMA, abolished the traditional system of agricultural extension services, and privatized to National Agricultural Advisory Services (NAADS) system. Although the NAADS mandate is promoting private/demand driven extension services, it ended up providing agricultural inputs such as improved seeds, equipment, livestock and milk coolers. At least 25 percent of the NAADS budget is earmarked for input provision (World Bank, 2010), which could distort markets. There is need for reforms to make NAADS fully functional and effective (Bategaye, 2013). While reform efforts have started, farmers are still not willing to pay for extension services. Also, in general due to low production scale, smallholders cannot afford to pay for extension.

10.2.10 Environmental issues, and potable water resources

Environmental issues include:

- Overgrazing and soil erosion resulting from land use practices under different production systems, pasture establishment and management during dry and wet seasons, land ownership, fencing and grazing systems used. The management system determines the scale of impact. In the traditional cattle corridor, overgrazing occurs in the dry season.
- Manure accumulation and poor management on intensive farms practicing zero grazing/stall feeding systems within or near major urban areas experience the problem of accumulation and failure to dispose manure. Smell, flies and pollution of surface and underground water aquifers with nitrogen/phosphate compounds are other effects of peri-urban intensive dairy systems. Peri urban dairy effect on pollution in Lake Victoria has not been clearly determined.
- Methane emissions estimated using the cattle Livestock Analysis Model (LAM) showed that the cattle sector in Uganda requires significant investments to increase production levels to reduce methane emissions in line with the Clean Development Mechanism under the Kyoto Protocol (FAO 2011).
- Polythene bags and flooding affect intensive smallholder dairy farms that continue to suffer from the effect of poor disposal of polythene bags used to carry groceries from markets and shops. Dairy animals die from blocked digestive tracts after ingesting plastics. Except for Rwanda, other EAC countries should have policy to ban plastics and relevant implementation programs.

10.2.11 Industry associations, producer groups and farmers' organizations

Industry associations, producer groups and farmer organizations are discussed in this section. Balikova (2011) summarized Uganda dairy industry and associations as follows:

Dairy producers associations: Uganda National Dairy Farmers Association (UNDFA) which currently is not active mainly due to lack of sustainable financing of its activities.

Input suppliers: Uganda National Agro-Input Dealers Association (UNADA) which is the national apex organization for private dealers of agro inputs and offers embedded extension service to promote their products.

Dairy cooperatives regulation: Established in 1991, the Uganda Cooperative Alliance is an organization mandated by GOU to audit and regulate cooperatives.

Milk producer cooperatives: Leadership, poor management and governance of cooperatives has been a challenge. From an initial 367 registered primary dairy farmer cooperative societies, only 214 are still active. Of the active societies, 128 (60%) are in south-western region, 54 (25%) in the central region, 13 (6%) in the eastern region, 10 (5%) in the northern region and 9 (4%) in the mid-western region while Karamoja region has no active livestock/dairy cooperative society (Balikova, 2011). Primary cooperatives are organized into district level cooperative unions and the latter are brought together under the regional/national dairy cooperative unions e.g., Uganda Crane Creameries Cooperative. UCCC has formed a Union to improve efficiency and scale and has strategic plans to include youth in dairy production and milk transportation to the MCC's.

Milk Traders Association: The Uganda National Dairy Traders Association (UNDATA) was registered under Companies Act (Cap 110) in 1999 with support from the Uganda National Chamber of Commerce. Members include individuals and organizations that trade in milk and dairy products (transporters, small-scale processors, cooler operators, farmers and vendors). UNDATA promotes, maintains and improves collection, transportation and marketing of quality milk and milk products in Uganda and export markets. SNV Uganda has recently facilitated and launched UNDATA strategy that includes capacity building of its member traders.

Processors Association: The Uganda Dairy Processors' Association (UDPA) registered under the Companies Act (Cap 85) in 2003 with the assistance of Land O' Lakes and the Dairy Development Authority (DDA). Members include large dairy processing companies, SMEs involved in milk processing and marketing, dairy farmer's organizations and milk traders. Though functional and an opportunity to develop the sector, the UDPA platform remains weak.

10.2.12 Dairy sector institutions, governance and policies

The Uganda dairy sector institutions, governance and policies are as follows:

- The MAAIF is responsible for all functions in the agriculture and livestock sub-sectors. Administratively, the MAAIF is divided into two directorates, namely Directorate of Animal Resources and Directorate of Crop Resources.
- The Directorate of Animal Resources in the MAAIF is the main public institutional player in the livestock sub-sector. Its mandate is to ensure the achievement and maintenance of self-sufficiency in animal products and by-products (including fisheries, apiculture and sericulture products).
- The DDA was established by the Dairy Industry Act in 1998 with a mandate to develop and regulate Uganda's dairy industry. It is supposed to coordinate implementation of all government policies, which are designed to achieve and maintain self-sufficiency in the production of milk in Uganda.
- The National Animal Genetic Resources Centre and Data Bank (NAGRC & DB) was established through the Animal Breeding Act of 2001. The mandate of NAGRC & DB is to promote, regulate and control import, export and market animal genetic material, including quality assurance. The organization is responsible for overseeing a transition from the mainly public delivery of AI services to commercial private sector led delivery. In view of increasing privatization of breeding services, there is need to review its role and responsibilities if it is to remain public.
- The NAADS, established in 2001, is a government agency mandated to implement the transition from the public funded to private sector funded agricultural advisory/extension services. It has changed its role to become a procurement body and, therefore, no longer considered to be effective. Efforts are underway to restructure it to resuscitate the collapsed extension and veterinary services.
- The National Agricultural Research organization (NARO), established in 1990, is a semi-autonomous public sector national agricultural research organization with the mandate to undertake, promote and coordinate research on all aspects of crop, livestock, fisheries and forestry. NARO is the apex body that coordinates the National Agricultural Research System (NARS). The council also appoints the directors of public agricultural research institutes. However, country interviews revealed the need for NARO to involve private stakeholders in determining its research priorities.
- The Uganda National Bureau of Standards (UNBS) is a statutory body established by an Act of Parliament in June 1983 but began operating in 1989. The mandate of UNBS is to develop and

promote standards, and undertake quality assurance, laboratory testing and metrology. UNBS collaborates with DDA to formulate and review national dairy standards. UNBS and DDA participated in the regional efforts to develop harmonized East African Community standards for milk and milk products.

- The Uganda Bureau of Statistic (UBOS) was established in 1998 and it is a semi-autonomous government agency responsible for coordinating, monitoring and supervising the National Statistical System. The UBOS carries out data collection and analysis as well as national information dissemination as part of its functions. UBOS, in collaboration with MAAIF, regularly collects and analyzes data on the livestock industry and publishes the findings.
- The EAAP Project run by the Association for Strengthening Agricultural Research in East and Central Africa (ASARECA) and funded by World Bank is also being implemented in Uganda. It seeks to invest in commodities that have been identified in ASARECA’s Strategic Plan as being of sub-regional importance for mitigation of food insecurity. Both ASARECA and EAAPP seek to contribute to the AU/NEPAD’s CAADP Pillar IV agenda which focuses on revitalizing, expanding and reforming Africa’s agricultural research, technology dissemination and adoption efforts, guided by the Framework for Africa’s Agricultural Productivity.
- ASARECA has worked with multi-donor pooled funds but some donors have pulled out because impacts from pooled funds may be difficult to partition. However, harmonized reports are easier to manage. The ASARECA approach has received accolades from regional stakeholders as a functional donor and government collaboration model. I the model the activities and procedures include value chain and key stakeholder consultation to prioritize constraints, capacity building of grant recipients in proposal development, award of funds through a bidding process, mentoring and close supervision of recipients during project implementation, and managing the results compilation and dissemination.
- Other Important Institutions include Africa Institute for Strategic Animal Resource Services and Development, Uganda Industrial Research Institute, National Drug Authority, Uganda Investment Authority, and Uganda Veterinary Association.

10.3 Strengths, weaknesses, challenges and opportunities in dairy sector

Strength, Weakness, Opportunity, and Threat (SWOT) analysis for Uganda dairy sector are given in Table 10.1.

Table 10.1 Strengths, weaknesses, opportunities and threats in the dairy sector	
<p>Strengths</p> <ul style="list-style-type: none"> ▪ Supportive government ▪ Available land resources ▪ Low cost pasture based milk production systems ▪ Dual purpose animals available & preferred ▪ Existence of stakeholder associations and groups ▪ Some organized farmer milk producing associations that have assisted in structuring milk collection systems ▪ Suitable environmental conditions and government support giving the region potential for high milk production ▪ High milk quality rich in solids e.g. 4.2% fat content ▪ Existence of good regulatory and legal framework e.g. Dairy Development Authority, Uganda National Bureau of Standards ▪ Existence of a network of development & other institutions both for academics and research ▪ Presence of dairy processors associations (Uganda Dairy Processors Association) ▪ Increasing population currently estimated at 38 million which gives ready markets ▪ Available byproduct feed resources e.g. raw materials for dairy concentrate feed formulation/production. 	<p>Weaknesses</p> <ul style="list-style-type: none"> ▪ Low purchasing power of the population due to low income and poverty ▪ Poor infrastructure affecting marketing and service delivery ▪ Lack of market information and linkages ▪ Weak farmer associations/cooperatives in some areas ▪ Low purchase power and low milk consumption capacity ▪ Insufficient human capita l- inadequate training of dairy experts, milk traders, veterinary and extension workers ▪ Low productivity in north and eastern Uganda due to lack of organized groups and milk collection centers ▪ Poor marketing and advertisement ▪ Inadequate facilitation of regulatory and enforcing agencies ▪ Expensive loans ▪ Poor milk hygiene practices at milk collection centers and farm level ▪ Poor animal husbandry practices ▪ High cost of production, especially in support factors e.g., water, power unreliability, transport-high cost of diesel, and packaging materials ▪ Seasonal milk production
<p>Opportunities</p> <ul style="list-style-type: none"> ▪ Kenya, Rwanda, Tanzania and Southern Sudan markets due to deficient milk production and large markets. 	<p>Threats</p> <ul style="list-style-type: none"> ▪ Unregulated markets that make farmers prone to exploitation throughout the value chain ▪ Cheap milk imports distorting local milk markets

<ul style="list-style-type: none"> ▪ Dairy associations and enterprises could easily seek for improved and favorable trading policies and practices ▪ Opportunity for specialized banking for the dairy sector ▪ Local markets could be expanded to yield to economies of scale for efficient production and profitability ▪ The country's economy is growing providing a conducive environment for dairy production and marketing. ▪ Low cost of production if quality grass based feed is optimized 	<ul style="list-style-type: none"> ▪ High cost of borrowing with current rates unfavorable to dairy production due to its long turn-around time ▪ Lack and weak enforcement of import duties on dairy imports ▪ National and transboundary disease prevalence & spread ▪ Conflicts/civil fights both internal and regional ▪ Competition from alternative beverages e.g. black tea/coffee and juices from imported concentrates. ▪ Implementation of EAC customs without a proper framework ▪ COMESA and other Unions lifting import duties for dairy products, especially those coming from East African countries.
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10.4 Emerging dairy sector issues

The Uganda dairy sector has made tremendous progress from the rehabilitation days in the mid 1980's to the current. Like any other sector, there are emerging dairy sector issues that are summarized below:

- EAC-expanded market through elimination of non-tariff barriers and introduction of common visa improved infrastructure (standard gauge rail, inter country highways/road and ICT/Sea cable) and financing.
- Livestock Genetics Society for East Africa (LGSEA) was recently formed by dairy industry stakeholders to promote self-regulation in the dairy breeding sectors in East Africa which will assist the privatization of breeding services by NAGRC-DB.
- Entry to the Uganda dairy sector of new dairy players at national level (e.g., Pearl Dairies; 300,000 liter capacity powder milk plant in Mbarara), regional level (Brookside Dairies, Kenya), and international level(FrieslandCampina, Netherlands).
- Discovery and exploration of commercial oil could improve Uganda GDP, transport and energy sector but can negatively impact agriculture development as more people turn to the lucrative oil and related businesses. However, it could increase disposable income, and hence increase milk and dairy products consumption.
- Climate change, inadequate mitigation strategies and lack of finance
- A new EADD Phase II project has recently been launched and will work in south western region.
- There is need to address milk quality along the entire dairy value chain.

10.5 Prospects for sustainable growth

Prospects for sustainable growth in the Uganda dairy sector include models that increase levels of production and incomes, integration of the value chain so as to benefit from national, regional and global dairy players as the case in Kenya where the international milk processors FrieslandCampina and DSM are seeking local partners. Venture Dairies East Africa has also initiated discussions with UCCU that if successful can show case an integrated dairy growth model.

The hub model to increase economies of scale, dairy producer bargaining power and both access to services and markets remains a sustainable model for poverty alleviation. A modified processor led hub model that starts with decentralized small milk coolers should be tried. Strong market incentives that reward year round consistent production of quantities of good quality milk should be encouraged. Increased production will result from strengthened breeding programmes that produce appropriate dairy animals for the various production systems. Pastoral and extensive production systems can be encouraged to use tropical dairy breeds such as Girolando and milking Gyr (5/8 Holstein 3/8 Gyr). Site specific private extension models sustained by milk levies and incentive schemes should be pioneered. Research and knowledge to improve pasture quality, herbage yield and commercial fodder services should be encouraged and financed through localized innovation grant schemes.

The Uganda dairy value chain actors range from pastoralists with extensive to intensive fenced and zero-grazing production systems, MCCs and microenterprises to national corporations. Thus, developing a holistic approach to deal with such diverse actors is challenging. Development agents and processors have specific strengths, and combining and coordinating these strengths will prove

helpful in dealing with the diverse actors and the specific challenges they are facing. Division of tasks by development agents and stakeholders can offer specific support services in specific contexts to different actors in the value chain. This will also require efficient and well-governed coordination of MAAIF and its NAADS and NARO agencies (Batega, 2013).

Investments in dairy production enterprises should be holistic to consider gender equality, rural health and prosperity, improve rural communities and the economies that are profitable and sustainable.

10.6 Collaboration prospects

10.6.1 Donor programs, policies of, and collaboration status among, dairy funders and/or implementers

USAID's wide-ranging work in Uganda supports U.S. policy objectives in peace and security, democracy and governance, health and education, economic growth, and humanitarian assistance. USAID implements three major U.S. presidential initiatives in Uganda: Feed the Future for the agricultural sector, the Global Health Initiative and the Global Climate Change Initiative. USAID has elected to use the private sector and NGOs in the delivery of agricultural services.

There has been collaboration among implementers including Heifer International and Grameen Foundation that have jointly implemented mobile extension systems, particularly for breeding and dairy herd management. Heifer International also collaborated with Send a Cow under the EADD I program, particularly on artificial breeding programs resulting in more than 30,000 inseminations during the life of the project.

The just ended EADD I was implemented from 2008 to 2013 by Heifer International Uganda in partnership with TechnoServe, ILRI, ABS TCM Ltd and ICRAF. The EADD I project objective was to develop and support a sustainable dairy value chain that would result in increased income, market share and market participation of smallholder farming households in 15 districts.

During the period 2001 to 2004, a consortium of Land O' Lakes, Heifer Project International and World Wide Sires implemented the Uganda Private Sector Dairy Industry Development Activity which was funded by USAID to the tune of USD 5.8 million. Land O'Lakes also implemented a program to increase the productivity and competitiveness of Uganda's dairy sector with support from USAID and the United States Department of Agriculture (USDA). This was a Food for Progress project that monetized 11,100 tons of red wheat and worked with Uganda Eastern Dairies Company (11 Cooperatives) between 2005 and 2006.

10.6.2 Public-private and within private sector collaboration and some insights into donor policies on dairy

This section discusses public-private-partnerships and collaboration and gives insights into donor policies on the Uganda dairy sector.

The MAAIF new sector agencies are autonomous but they are not adequately coordinated by the parent ministry thus hampering efforts to deal with emerging sector challenges including breakdown in veterinary and extension services. There is need to review operational vacuums created by sector reforms and policy. Also, the new sector agencies response to the new dispensation needs to be evaluated. Key reforms relating to land tenure were incomplete. This has affected private sector participation in agriculture due to concerns over poorly defined property and tenure rights.

With the exception of Rwanda, Uganda and the other four countries have low public spending on agriculture. This has created a funding vacuum that is being filled, effectively or ineffectively, by donors. Yet, the interests of donors are not necessarily consistent with the dairy value chain constraints in Uganda; for example, NAADS transition to a procurement agency resulted in weak extension and veterinary services delivery.

Weak local private sector entities such as Uganda farmer cooperatives should be strengthened through promoting and prioritizing their participation in public-private-partnerships in order to genuinely achieve the objective of a private sector led economy.

10.6.3 Opportunities for collaboration between dairy funders, and between dairy funders and implementers

There is need for a dairy funders/donors and implementers and key stakeholders' discussion platform such as the stakeholder platform initiated by the BMGF funded Dairy Genetics East Africa. Through the platform, comparative advantage of each dairy donor/funder and their implementers/partners involved in the Uganda dairy sector should be determined. Opportunities for inter donor agency cooperation in the Uganda dairy value chain should include all those stakeholders that have a common goal to assist the Uganda dairy sector i.e., philanthropists, traditional donors, and dairy company corporate social responsibility programs. Improved coordination and collaboration across agencies should be within the spirit of a "united delivery approach" as experienced in the Uganda post war rehabilitation projects where there was collaboration of donors and efficient use of funds. Donor collaboration should enhance learning in formulation and implementation of country level dairy value chain development initiatives. Enhancing each donor's implementer competency and expertise results in an effective development partner approach.

Donors can pool funding resources with prospects for cross-sector collaboration and community mobilization strategies that can leverage these opportunities. This is a critical element to developing the Uganda dairy sector and a needed step in building a better industry. Numerous opportunities exist to boost household income with renewable energy endeavors, establish a new "green dairy production", and expand community infrastructure to support more sustainable dairy production systems founded on the hard work of women farmers. Programs that offer unique opportunities include regional dairy production milk sheds as a central strategy in achieving community food security and rural development. In view of the current poor milk quality constraints, there is need to link the entire dairy value chain processes with public health and nutrition. Through small dairy value chain targeted grants from fund pools, programs that enable public health and nutrition goals can be strategically linked with the development of local dairy farm economies.

There is need for collaborative work on dairy production systems and rural development grants and loan programs that offer great promise for regional dairy production systems to spur rural economic development across Uganda. The inter-financial resources can also be used to encourage innovative private dairy extension, commercial fodder production and marketing strategies, and establishing decentralized new rural cold chain infrastructure.

Sameer Agriculture Livestock Limited, Pearl Dairies and Jesa Dairies (in the near future, Brookside Dairies) are lead firms in milk processing that have high bargaining power and can assist in coordination of the Uganda dairy production systems. These companies should be the most promising way for donors to partner with and develop the dairy sector.

10.6.4 Potential for regional integration

Uganda's strategic development goal is to transform its economy to middle income status; which at a bare minimum requires a doubling of real per capita incomes. This goal can only be realized through activities that make Uganda competitive and increase regional trade thus sustaining rapid growth in productivity per worker, and hence raise standards of living. Integration into the EAC region requires pooling sovereignty which Uganda is already doing through implementation of the Common External Tariff system. Partner states have ceded their right to determine their own trade policy to the regional level. Uganda's dairy sector will continue to benefit from the increased regional demands from South Sudan, DRC, Rwanda and Kenya. "This offers investment opportunities in dairy subsector and indirectly could generate income and employment opportunities to farmers. Farmers and their organizations would benefit for instance from capacity development, competition in collection/processing and regional integration" (Agriterra, 2012).

Milk is a bulk and perishable commodity therefore trade primarily takes place in milk powder, UHT milk and luxury products such as cheese and yoghurt. The potential for intra-regional trade in these products is still in its infancy as seasonal variation in supply is similar across EAC partner states and all are normally in a deficit situation. Kenya is by far the region's strongest dairy producer and exporters and is responsible for 86% of the total. Uganda ranks second after Kenya with 9% of regional dairy exports (Jensen and Kayser, 2010). With recent installations of milk drying facilities in Mbarara by Pearl Dairies and further expansion by SALL, Uganda is becoming the largest producer of powder milk in the region and is now exporting powder milk to Kenya. This

is happening despite challenges in milk quality and is a result of direct benefit from EAC regional integration.

Trans-boundary movement of wildlife and pastoralists with their livestock is also a major problem in dairy. Collaborative research among East African countries and improvement of diagnostic and epidemiological research capacity will enable the partners to use state-of-the-art molecular biology laboratories with capability for rapid diagnosis of notifiable diseases so that appropriate control measures can be applied. Also, production of vaccines and joint training of technicians as done for genetics by Uganda NAGRC-DB, Kenya KAGRC and Tanzania NAIC should be a regional collaborative effort.

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Appendices

Appendix 1 – Terms of reference

In May 2013 the 14th Annual Meeting of the Inter-Agency Donor Group (IADG) on pro-poor livestock research and development focused on the topic "Development of Livestock Value Chains through strengthened Public-Private Cooperation". A number of development agencies (IFAD, ASARECA, BMGF, ILRI, Netherlands government) informed the meeting on their activities in the dairy sector in East Africa. It was agreed that better coordination by development agencies on dairy development would be good for all parties and for the development of the dairy sector as a whole in East Africa. The Netherlands offered to take the lead in organizing a trajectory geared at exploring possibilities for coordination and for creating synergy within the different countries and possibly across countries. It was suggested to include the following countries: Tanzania, Kenya, Uganda, Rwanda, Burundi, and Ethiopia. Focus will be on commercializing dairy value chains.

It has also been agreed that Australia will do the same for Southeast Asia, building on the experience gained in the East Africa trajectory.

The aim is to organize a workshop in the first quarter of 2014 in East Africa, with possible participation of key policy makers, lead persons in the industry and farmer organizations, and high level representatives of relevant development agencies and knowledge institutes.

The purpose of the (concept) background document covered by the terms of reference (see Appendix 1) was to provide a sound and inspiring basis for a constructive, open discussion on actions by the various stakeholders. It is also expected that the final document will serve as an important and highly valued reference document for all stakeholders.

1.1 Assignment and deliverables

1.1.1 Analytical framework

For the proper implementation of this assignment a clear and comprehensive analytical framework will need to be set up and agreed upon with the guiding group. Rather than reinventing the wheel, the study should collate information from major original studies and reports on the sector in the six countries over the past 10 years, with stakeholder consultation (including donors) focusing on validation and gap filling, rather than new data collection & analysis. The assessment is expected to result in a background report that will inform and guide the program and the proceedings of the workshop. This report should have a concise executive summary, whilst the main report should not exceed 50 pages. The report should contain country profiles and a more general analysis. The below section details these components:

1.1.2 Country assessments

For each of the countries (Kenya, Tanzania, Burundi, Rwanda, Uganda, and Ethiopia) make a ten-page description of the structure, emerging issues, challenges and opportunities of the dairy sector (10 years back and 5-10 years ahead); based on available reports from governments, trade and production statistics at (sub)national level, international organizations, companies, chambers of commerce, farmers' organizations, knowledge institutes, NGOs, and experiences from development projects;

Based on country descriptions containing the following information, the performance of value chains and sector in economic, environmental and social terms (including gender roles in production, marketing and delivery of inputs and services) and prospects for sustainable growth should be evaluated (SWOT analysis):

- **Value chains** - To identify the major value chain constraints and required interventions in production and marketing systems:
- **Markets & market dynamics** - market size, products, expected trends; marketing strategies of main players in the different segments (formal, semi-formal and informal; domestic and import/export); market concentration ratio in the formal market; distribution channels and outlets for different segments and trends; consumer segments served; consumer practices, perception and appreciation of value of milk and dairy products; benchmarking of dairy product prices against prices of basic consumer products; regulations on milk quality, safety, quality and safety regulations and enforcement; trends and barriers for crossborder/regional trade in dairy products & inputs (part. feed & fodder);
- **Particular attention should go to the question how the transition from informal to formal value chain affects the livelihoods of smallholder dairy farmers, or in other words: How do smallholders maximize their livelihoods in dairy value chains?**
- **Milk collection, bulking, and processing** - processing systems, size and number of units and ownership structure of producers and processors, volumes collected and processed, trends and developments; farmer organizations - numbers, characteristics and performance including farm gate prices and milk pricing system;

- *Primary production* - dairy production systems with technical details per system: production, sourcing and production of feedstuffs and rations, (incl. parameters like feeding costs and milk/concentrate price ratio); sourcing and production of breeding/replacement stock; health problems/costs; description of the position, role and interdependencies of the dairy production system within the overall farming system; smallholder inclusion; statistics should include a segmentation of farmers (small, medium size and large); production systems (pastoral, mixed crop-livestock, semi-urban/landless); genetic resource base (locally adapted breeds and crosses with exotic breeds, breeding strategies);
- *Inputs and services* - animal health services and drug supply; animal identification and performance recording, breeding and AI services (incl. source/type of semen), extension services; feed & forage supply; financial services, use of telecommunications/IT incl. cell/smart phones and internet for data collection and information dissemination.
- **Enabling environment** – *To identify the major opportunities and constraints in the context that the dairy sector is operating in:*
 - *Business climate*- priority of dairy sector in government policies, foreign investments;
 - *Policies* - incl. rural development/poverty reduction, livestock sector development incl. breeding programs, food safety and quality assurance policies, food security incl. school feeding programs;
 - *Dairy sector organizations* - strengths and strategies of farmers' associations, leading industry associations, and sector organizations like Dairy Boards;
 - *Coordination* – public-private dairy sector/value chain coordination platforms and their functioning;
 - *Training and Knowledge Transfer* - capacity building, R&D, education, innovation, and exchange activities, including overview of relevant training and research institutes.
- **Donor programs**
 - Overview of donor supported programs, with aim, scope, approach, activities, implementing agencies, budgets, and key results so far;
 - Results and lessons learned from implementation of projects/programs over the past decade;
 - Future plans and focus of donors.
- **General analysis**
 - Main challenges and solutions for dairy sector development. Priority issues and challenges to be addressed at various aggregation levels.
 - Gap analysis: which challenges do not get the attention they deserve, how they could be addressed, and what are potential contributions by national governments, private sector parties, civil society actors, and donor agencies.
 - Possibilities for development agencies to better coordinate and create synergies within and between countries.
 - Connections to Global Agenda of Action of the Livestock Dialogue and the Global Plan of Action for Animal Genetic Resources.
 - Recommendations for action.

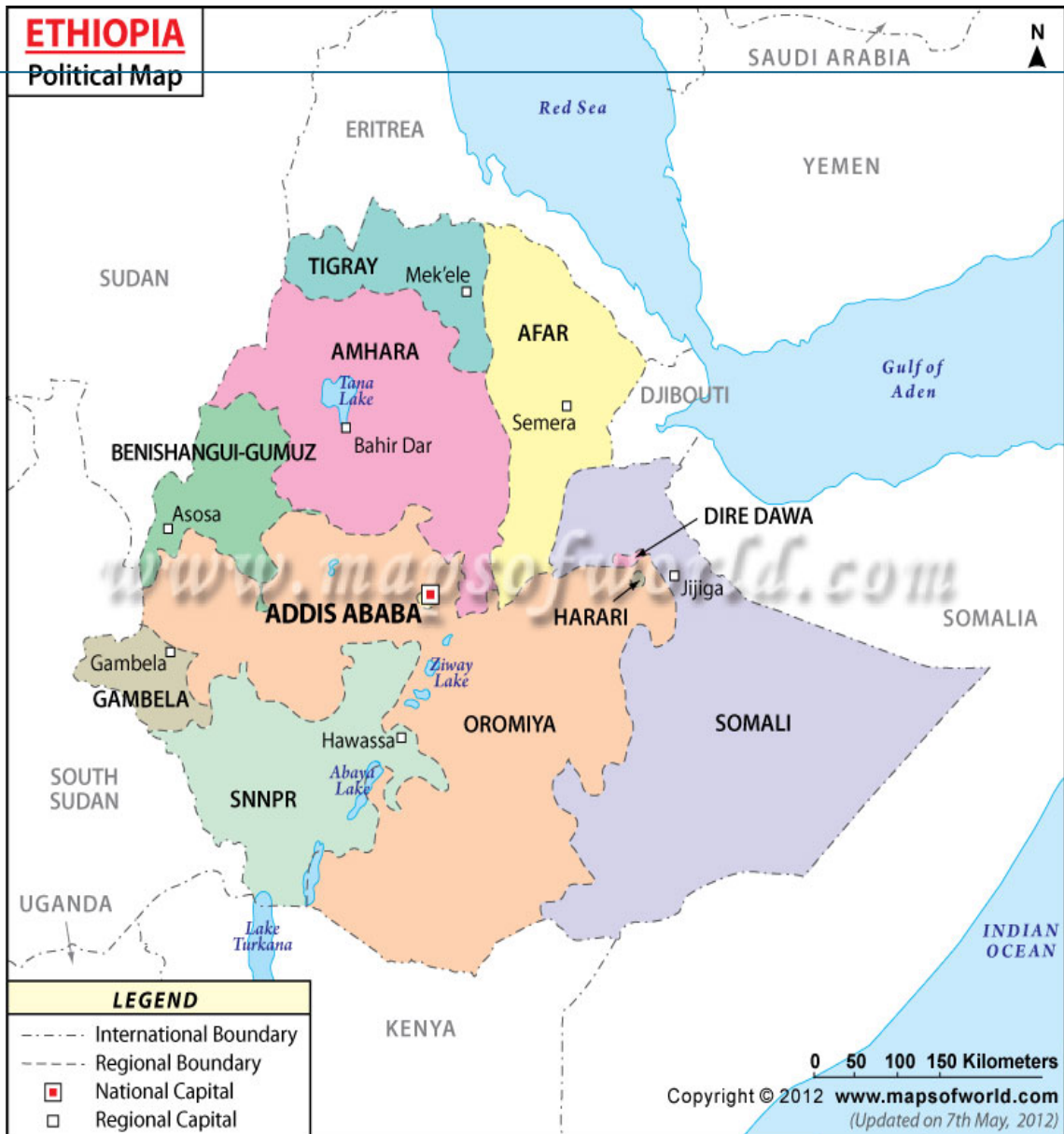
Appendix 2 – Donor programs in Ethiopia & the five East African countries

	Donor	Project Title	Funding	Lead Implementer & partners	Duration
Burundi					
	IFAD	Livestock Sector Rehabilitation Support Project Projet d'Appui à la Reconstruction du Secteur de l'élevage (PARSE)	USD 17.8 million	Government of Burundi	2008 to 2014
	World Bank	The Agriculture and Livestock Modernization Project (PRODEMA)	USD 12 million	Government of Burundi/World Bank	2011 to 2015
Ethiopia					
	Embassy of the Kingdom of the Netherlands, Addis Abeba	Enhancing Dairy Sector Growth in Ethiopia (EDGET)	USD 12.9 million	SNV Netherlands Development organization & Wageningen UR (WUR)	2012 to 2017
	USAID-FTF	Agricultural Growth Program-Livestock Growth Project (AGP-LGP)	USD 35 million	Citizens Network for Foreign Affairs (CNFA)	2012 to 2017
Kenya					
	Bill & Melinda Gates Foundation	East Africa Dairy Development Program II (EADD-II)	USD 5.5 million	Heifer International, International Livestock Research Institute (ILRI), International Centre for Research in Agroforestry (ICRAF), Technoserve & ABS TCM Ltd	2014 to 2018
	DFID	Africa Enterprise Challenge Fund - improve heifer quality and increase milk production	£0.3 million	Kenya	2011-2017
	Embassy of the Kingdom of the Netherlands, Nairobi	Kenya Market-led Dairy Program (KMDP)	EUR 5 million	SNV Netherlands Development organization: Collaborators, WUR, the Friesian; PUM; Dairy Training Centre (DTC), Bukura; Dairy Training Institute (DTI), Naivasha	2012 to 2016
	IFAD, Government of Kenya, Beneficiaries	Smallholder Dairy Commercialization Programme	US\$19.8 million	Government of Kenya	2006 to 2015

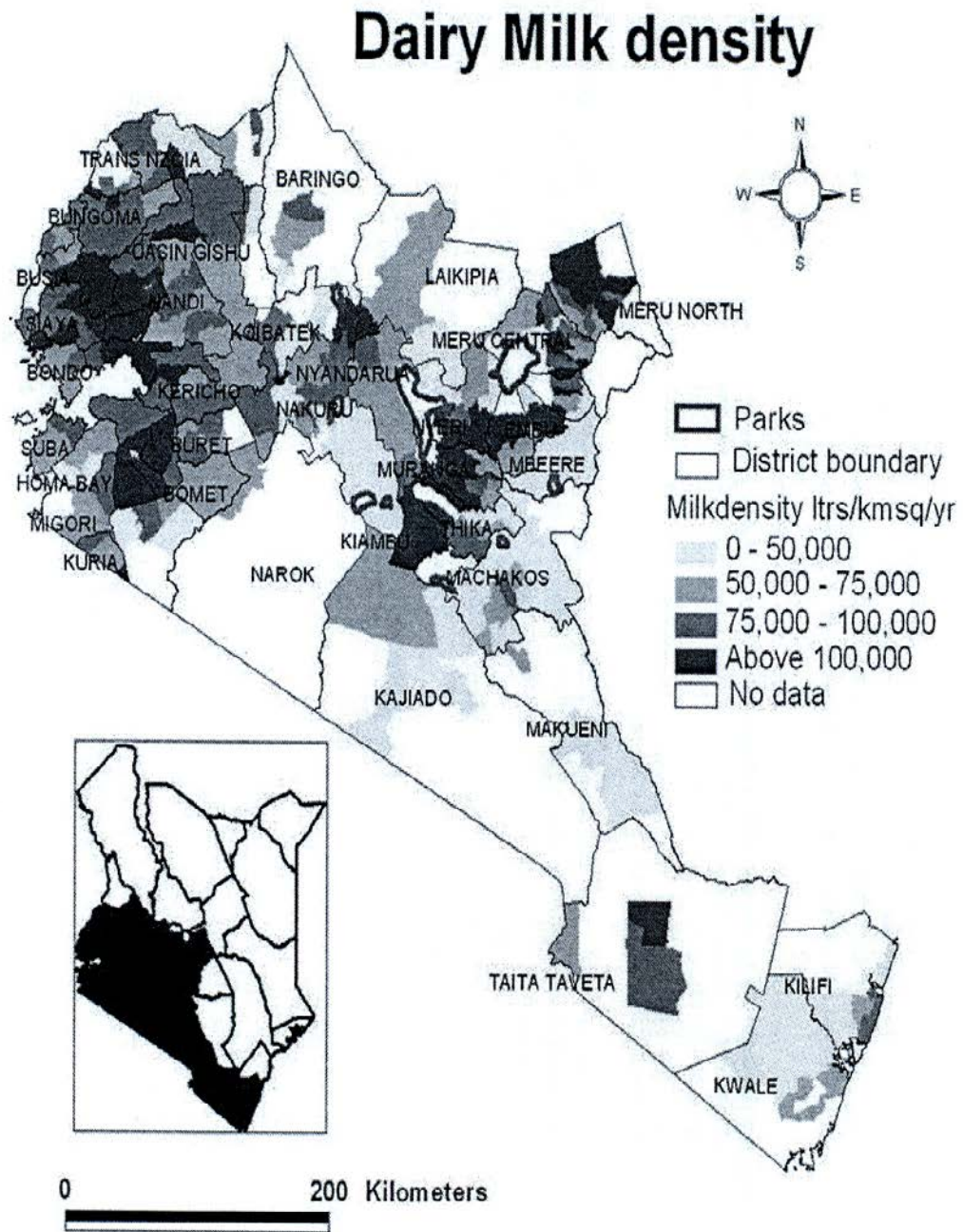
	Intergovernmental Authority on development (IGAD)/COMESA/EAC	Dairy value chain - feasibility study			2013 to 2015
	USAID	Kenya Agricultural Value Chains Enterprises (KAVES)	USD 40 million	FINTRAC, local grants	2013 to 2018
	World Bank	East Africa Agricultural Productivity Program (EAAPP)	USD 30 million	Government of Kenya as Centre of Excellence, assisting regional dairy development in Tanzania, Burundi, Rwanda, Uganda & Ethiopia	2010 to 2015
Rwanda					
	Embassy of Kingdom of Netherlands (EKN), SNV Netherlands Development Organization	Ongoing programs assisting in capacity building & vocational training, Gishwati, Gicumbi, Gako farm and studies Community Processing Centre.		SNV Netherlands Development organization	Ongoing
	IFAD/African Development Bank (ADB)	Livestock Infrastructure Support Programme (LISP)	USD 35.35 Million	Rwanda Government	2011 to 2015
	USAID	Rwanda Dairy Sector Competitiveness Programme II	USD 15 Million	Land O Lakes/ABS TCM Ltd	2012 to 2017
Tanzania					
	Bill & Melinda Gates Foundation	East Africa Dairy Development Program II (EADD-II)	USD 12 Million	Heifer International, ILRI, ICRAF, Technoserve & ABS TCM Ltd	2014 to 2018
	Goal Ireland/ILRI	More Milk in Tanzania	USD 2 Million	ILRI	2013 to 2017
	IFAD/ILRI	Enhancing Dairy Based Livelihoods in India & the United Republic of Tanzania through Feed & Innovation and Value Chain Development	USD 1 Million		2011 to 2014
	SNV Netherlands Development Organization & EKN	Mastercard Foundation Project, Quick Scan Dairy Scoping Study & Ongoing country programs		ASAS (in Iringa), Shambani Milk (Morogoro) & CAFER (Nombe) Tanga Fresh	Ongoing
	Sokoine University, Tanzania/ILRI	Integrated Dairy Goat and Root Crop Production in Tanzania	USD 356,706		2011 to 2014

Uganda					
	Agribusiness Initiative (aBi) Trust (Multi-Donor Pooled Fund, USAID, EU, Sweden, Belgium, Netherlands Embassy, DFID, and KfW)	Dairy Enterprise Loan Programs	US\$8.4 million	aBi Trust	2012 to date /Ongoing
	Bill & Melinda Gates Foundation	East Africa Dairy Development Program II (EADD-II)	USD 8 million	Heifer International, ILRI, ICRAF, Technoserve & ABS TCM Ltd	2014 to 2018
	Netherlands Government SNV Netherlands Development Organization	Eastern Uganda & UNDATA	USD 0.5 million	SNV	2012 to 2015
	World Bank EU, Sweden, Belgium, Netherlands Embassy, DFID and KfW, GoU (30%)	National Agriculture Advisory Services (NAADS), The Agricultural Technology and Agribusiness Advisory Services (ATAAS)		Government of Uganda/NAADS	2007 to date ATAAS 2011 to date
Regional Projects					
	Bill & Melinda Gates Foundation	Germplasm for Dairy Development in East Africa		University of New England (UNE)/ILRI/Institute for People Innovation & Change in Organizations (PICOTeam) Ethiopia, Kenya, Tanzania,& Uganda	2013 to 2014
	Corporate concept proposal in response to the BMGF call from RELOAD (reducing losses/adding value)	Reduction of Post-Harvest Losses and Value Addition in East African Food Value Chains	US\$ 10 million yet to be secured	Kenya, Uganda, Ethiopia & Germany	2014 to 2019
	GIZ	Safe Food Fair Food: from Capacity Building to Implementation - Risk-based Approaches to Improving Food Safety and Market Access in Smallholder Meat, Milk and Fish Value Chains in Four African Countries	USD 1,6 Million	Ethiopia, Mali, Tanzania, Uganda	2012 to 2015

Appendix 3.3: Map of Ethiopia showing the provinces and neighboring countries



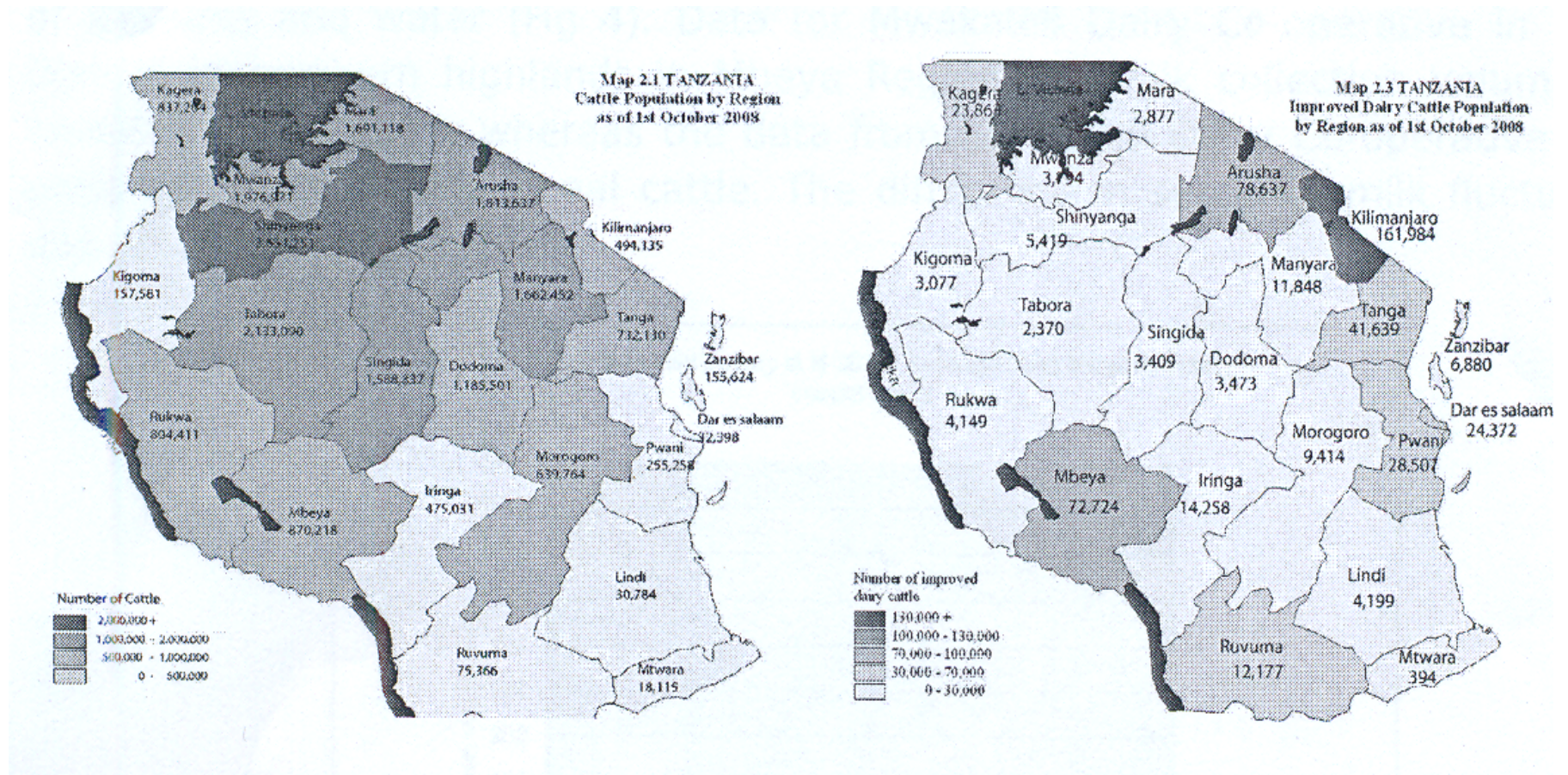
Appendix 3.4 - Map of Kenya the provinces and the major cattle rearing areas



Appendix 3.5: Map of Rwanda showing the provinces



Appendix 3.6: Map of Tanzania showing provinces and major cattle rearing areas



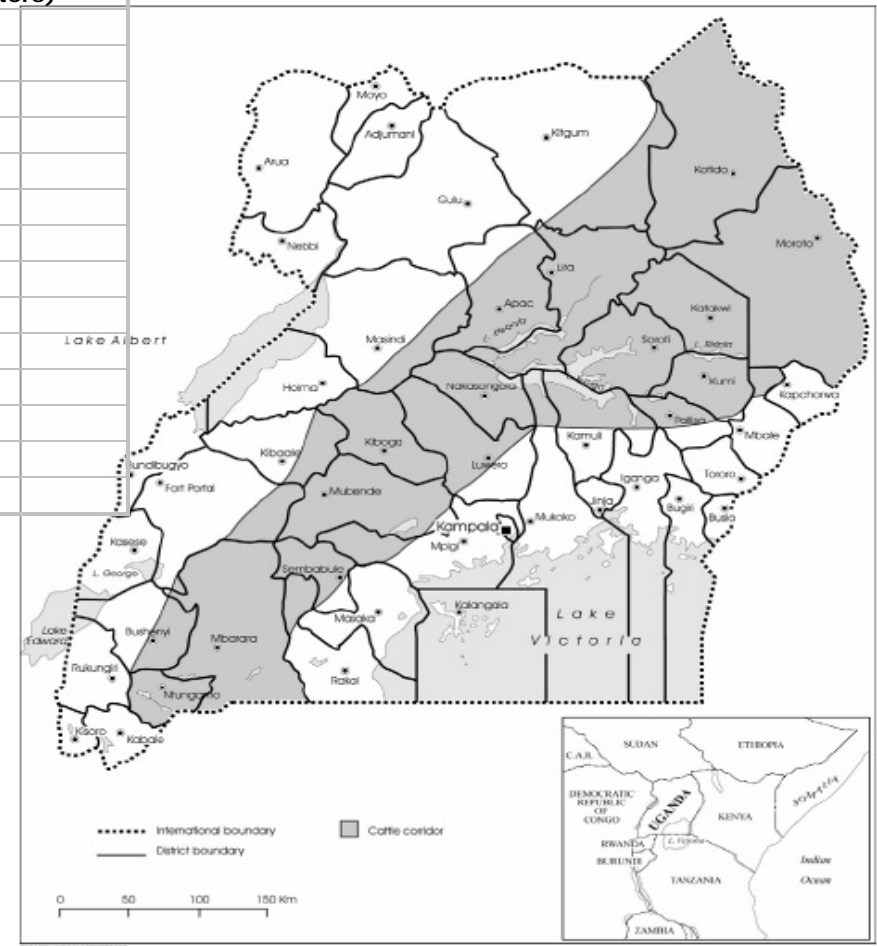
Appendix 3.7: Map of Uganda showing the provinces and the cattle corridor



Appendix 4 – Milk collection centers in Burundi

Table Milk collection centers in Burundi		
MCC	Province	Capacity (liters)
Ciya	Bubanza	500
Mpanda	Bubanza	1,000
Musiga	Bubanza	500
ISABU Mahwa	Bururi	1,000
Matana	Bururi	1,000
Bugendana	Gitega	1,000
Bugenyuzi	Karusi	1,000
Gitaramuka	Karusi	1,000
Bukkeye2,000l	Muramvya	2,000
Kiganda	Muramvya	500
Mbuye	Muramvya	500
Rutegama	Muramvya	3,000
Gashikanwa	Ngozi	1,000
Mubuga	Ngozi	1,000

Annex 3: Map of the Cattle Corridor



Appendix 5 – List of key institutions and individuals interviewed in the six study countries

Appendix 5.1 List of key institutions and individuals interviewed in Burundi

No.	Institution/Individual	Purpose/Function	Location	Contact Details/Comment
1	Formerly Burundi Agribusiness Program (BAP), but with IFAD PARSE program	Dairy value chain experience	Bujumbura	Dr Pierre Ndikumagenge, PARSE, IFAD
2	Institut des Sciences Agronomiques du Burundi or Burundi Institute of Agronomic Sciences (ISABU)	Agricultural research & development	Bujumbura	Madame Dévote Nimpagariste, Directeur du Departement des Productions A L'ISABU, Tel. +25779955694, dedenimp@yahoo.fr ; dpisabu2011@yahoo.fr
3	Agro–Pastoral Productivity and Markets Development Project –Projet de Productivite et de Developpment des Marchis Agricoles (PRODEMA)	Dairy agro-pastoral production and marketing	Bujumbura	Dr.Nduhirubusa Jeremie, Tel:+25779759293; Mob: +25777749293, nduhirubusaj@yahoo.fr ; nduhirubusal@gmail.com
4	Food Agriculture Organization of the United nations FAO/CAUR Burundi, B.P. : 1250, Bujumbura, Burundi	Dairy – Animal Production Consultant	Bujumbura	Venuste Nahimana, Consultant en Productions Animales, Tel: +25722206022, Mob: +25779926261; Venuste.Nahimana@fao.org
5	IFAD Fonds International de DeveloppementAgricole, Programme d'Appul a la Reconstruction du Secteur de l'Elevage (PARSE)	Dairy project funder & implementer	Bujumbura	Tharcisse Sebushahu, B.P.: 3029 Bujumbura 2, Tel: +25777742841, +25779946971, sebushahuth@yahoo.fr PARSE Coordinator:
6	Association des Industriale du Burundi (Industrial Association of Burundi)	Dairy processor	Bujumbura	Mr Ndikumasabo Herménégilde, President/Chairperson; Tel: 25776925604
7	Ministry of Agriculture & Livestock (MINAGRIE), National Centre for AI (CNIA)	Dairy – national AI program	Bujumbura	Dr.Didier Ntirwinyegeza, Director General AI, MINAGRIE; Tel: +25779925313
8	Ministry of Agriculture & Livestock (MINAGRIE), CNIA	National AI program	Bujumbura	Mr Ndiraisha Bosco, Liquid N Plant Manager, MINAGRIE; Tel: +25779247438
9	Bukkeye Processing Milk Chel (Laiterie Ntazimba)	Dairy processor, private investor	Bujumbura	Mr Anselme Ntazimba, hakizanselme@yahoo.fr , +25777757321, +25778757321
10	Natura Products, Industrie Agroaliimentaire de Buterere (IAB) SA Dairy	Dairy processor - Private investor	Bujumbura	Mr Juma Mohamed, Director- Proprietor, Tel:+2577776596, Jmohamed53@yahoo.fr ; Iab_industries@yahoo.fr ; Nestor Sibomana, Milk Technologist, Mob: +25779923306; nestordondogori@hotmail.fr

Appendix 5.2. List of key institutions and individuals interviewed in Ethiopia

Date	Contacted Persons	Organization
03/12/2013	1) Dr. Gebre Egzia Abher G. Yohannes, 2) State Minister of Livestock	Ministry of Agriculture; +251-919-909389; gebre.gy@yahoo.com
	3) Dr. Barry Shapiro, Senior Program Development Specialist	ILRI, +251-911-397094; b.shapiro@cgiar.org
	4) Dr. Azage Tegegne, Manager LIVES and Deputy to the director Generals Representative in Ethiopia	LIVES, ILRI campus; a.tegegne@cgiar.org +251-911-246442
	5) Ronald Hodson, Country Program Manager 6) Zelalem Atnafe, Monitoring and Evaluation Advisor	SNV-EDGET; Hodson@snvworld.org +251-912-630386; +251-911-178977
04/12/2013	7) Robson Mutandi, Representative and Country Director, Ethiopia and South Sudan, 8) Hanneke Vermeulen, Associate Professional Officer Ethiopia and South Sudan	IFAD, ILRI campus; r.mutandi@ifad.org +251-911-523950; h.vermeulen@ifad.org +251-929-016413
	9) Dr. Emiru Zewde, Manager	ALLPIS; emiruz@yahoo.com ; +251-911- 442671
	10) Tracy Mitchell Livestock Value Chain Advisor AGP/LMD 11) Girma Kassa, Deputy Chief of Party AGP/LMD	CNFA; tmitchell@livestockmarketdevelopment.com ; +251-919-812932; gkassa@livestockmarketdevelopment.com ; +251-911-128781
	12) Haddis Tadesse, Country Representative, Ethiopia	Bill &Melinda Gates Foundation Haddis.tadesse@gatesfoundation.org +251-930-097460
	13) Melaku Berihun, Manager MAMA dairy	Sebeta Agro Industry PLC melberi@yahoo.com +251-911-219350
	14) Yirdaw, Daniel and Fekadesilasie	EAFIA, EDCBA and EMPPA yirdaw1@yahoo.com +251-911-346749 danielalemu@yahoo.com +251-911-572905 fekadesilassie@yahoo.com +251-911-617042
	15) Buruk Yemane, Manager and President	Ethio Feeds PLC and EAFIA; berukyemane@yahoo.com ; +251-911- 194745
06/12/2013	16) Dairy workshop organized to discuss on preliminary findings in the area of study with stakeholder including smallholder farmers.	EDBD, Ethiopia Dairy Business Development edbd.services@gmail.com

Workshop participants		
	17) HirutYohannes, Rut &Hirut Producer/Processor PLC	+251-911-617042
	18) Wendmneh Ashebir, Hibrt Dairy Coop	+251-911-667284
	19) Tariku Wordofa, Smallholder Farmer	+251-913-387744
	20) Fekade Selasie Tadesse, EMPPA	+251-911-617042
	21) Eshetu Kebede, Smallholder farmer	+251-910-986742
	22) Abule Ebro, ILRI/LIVES	+251-916-820289
	23) Eyob Alem, MOA representative	+251-912-835040
	24) Daniel Alemu, EDCBA-coordinator	+251-911-572905
	25) Raphael Mwai, EADS team member	+254-722731728
	26) Tsehay Redda, EADS team member	+251-911-248031

Appendix 5.3 List of key institutions and individuals consulted and interviewed in Kenya				
No.	Institution/Individual	Purpose/Function	Location	Contact Details/Comment
1.	Kenya Dairy Board	Regulation	Nairobi	Machira Gichohi - 0722-700717
2.	Department of Livestock Development	Policy	Nairobi	Luke Kessei - 0721-475111
3.	Department of Co-op Development and Marketing	Policy	Nairobi	Justus Kiago - 0721-470038
4.	Kenya Livestock producers Assoc.	Sector Advocacy/Development	Nairobi	Ezekiel G. Muiruri - 0725-933914
5.	Kenya Dairy farmers Federation	Sector Advocacy/Development	Nairobi	Dr. Rawlynce Bett - 0726-681441
6.	Mukurinwe – iniW. Dairy	Co-operative/Milk production	Nyeri	Gerald Warui – 0722396334
7.	Brookside Dairies	Processor	Thika	John Gethi – 0735222264
8.	New KCC	Processor	Nairobi	Dr. K. Langat – 0703478469
9.	Meru Central Dairy Cooperative Union Ltd	Processor/Dairy development	Meru	Dr. Mutua -
10.	SNV	Development Partner	Nairobi	Anton Jansen – 0719343308
11.	Heifer International	Sector Development	Nairobi	Crispin Mwatate - 0722-837161
12.	Eastern and Southern Africa Dairy Association (ESADA)	Advocacy/Development sector	Nairobi	Peter M. Ngaruiya - 0721266481; 0703501532

Appendix 5.4 List of key institutions and individuals consulted and interviewed in Rwanda				
No.	Institution/Individual	Purpose/Function	Location	Contact Details/Comment
1.	Dr Theogene Rutagwenda, D.G., Animal resources, MINAGRI	Livestock programs & policies	Kigali	+250788303309; Rutagwendat2006@yahoo.com
2.	Dr Michel Ngarambe, LISP	Building MCCs under MINAGR & donor funds	Kigali	ngarambemic2000@yahoo.fr
3.	Dr Charles Kayumba, Country Director, Heifer International	Cattle distribution & extension – funder/implementer	Kigali	+250788302803; Charles.kayumba@heifer.org
4.	Rwanda Dairy Competitiveness Program: Frank O'Brien, Chief of Party (COP); Dr Dennis Karamuzi, Deputy COP; Prof. Humphrey Hamudikuwanda, Senior Technical Advisor	Dairy value chain development, USAID funded	Kigali	+250786112468; frank.obrien@idd.landolakes.com +250788305014 dennis.karamuzi@idd.landolakes.com +250783115771 hhamudikuwanda@gmail.com
5.	SNV Rwanda: Dr Innocent Matabishi, Ag. Advisor-Dairy and Bee keeping; Ranjan Shrestha, Sector Leader; Dr. Paul Kimbugwe, Senior Advisor Agriculture; Benjamin Nzigamasabo, Consultant Dairy Program	Dairy NGO implementing dairy project	Kigali	+250788309056; jmatabishi@snvworld.org +250789539907, ranjan@snvworld.org +250787859027, pkimbuqwe@gmail.com bzingamasabo@snvworld.org
6.	Angelique Barongo, Send a Cow	Cow distribution & cattle extension programs – funder/implementer	Kigali	Angelique.barongo@sendacowrwanda.org
7.	Dutch Embassy: Teddy Muffels, Agricultural Counsellor, & Marie Nizeyimana, Policy Officer, Agribusiness	Cattle importation activities	Kigali	+250280280281 Teddie.muffels@minbuza.nl +250786790658/ +31631001512,+250788832828

				marie.nizeyimana@minbuza.nl
8.	FAO representative: Jeanne d'Arc Mukamwiza Matuje, Programme Assistant	Dairy programs	Kigali	Tel:+250252583719 Mob: +250788461545 Fax: +250252583726 Darc.matujemukamwiza@fao.org jamatuje@yahoo.fr
9.	Il. Jean Claude Bahati, Food Technologist, QA Manager, Inyange Industries	Milk Processor – Inyange Industries	Masaka- Kigali	+250788161900, +250788380850 bjclaud@inyangeindustries.com claud.bahati@gmail.com www.inyangeindustries.com
10.	Milton Ngirente, Managing Director, Blessed Dairies Ltd	Milk transporter, processor, milk kiosk & milk bar operator	Gatana, Gicumbi	+250788652783; ngirentemilton@yahoo.fr info@besseddairies.com www.blesseddairies.com
11.	Shadrack Hakizimfura	Agro-Veterinary Distributor	Kigali, Gishwati, Rusizi, Rubavu	+250788628222; agrapha@yahoo.fr
12.	Gahiga Gashumba, National Dairy Farmers Federation of Rwanda	Farmer representative	Kigali	+250788831591; gahiga@yahoo.com
13.	Emmanuel Niyongira, Global Communities, Agriculture Specialist	NGO, USAID funded EJO HEZA	Kigali	+250788464114, +250252591500 Kacyiru Nord, Plot1091, PB: 7026, Kigali eniyongira@rw.globalcommunities.org
14.	Andrew Kagabo, Program Manager	GIRINKA, One Cow per Poor Family program	Kigali	+250788305015; kagaandrew2002@yahoo.com
15.	Jonas Kamili, Agri Relationship Mgr. Corporate/Food & Agriculture Department, Banque Populaire du Rwanda Ltd	Financial services	Kigali	32 Avenue des Forces Armées P.O. Box 1348 Kigali, Rwanda Mobile: + 250 78 868 0584 0788898711; Jonas.KAMILI@bpr.rw

Appendix 5.5 List of key institutions and individuals consulted and interviewed in Tanzania

No.	Name/Institution	Purpose/Function	Location	Contact Details/Comment
1	Dr. Bohela Lunogelo, Executive Director, Economic and Social Research Foundation (ESRF)	Policy analysis	Dar-es-Salaam	esrf@esrf.or.tz or info@esrf.or.tz
2	Dr. M.M Bahari, Asst. Director, Ministry of Livestock and Fisheries Development	Policy: Livestock Development	Dar-es-Salaam	ps-mlfd@mlfd.go.tz
3	Dr. Yacob Y. Masanga, Asst. Director, Ministry of Livestock Development	Policy: Livestock Development	Dar-es-Salaam	ps-mlfd@mlfd.go.tz
4	Mr. Deogratus Mlay, Manager, Technical Services Dept. Tanzania Dairy Board	Dairy Development Regulation	Dar-es-Salaam	deomlay@gmail.com
5	Ms. Letezia William, Agricultural Council of Tanzania (ACT): Policy Officer	Policy Advocacy	Dar-es-Salaam	(+255) 22 2124851 act@actanzania.or.tz
6	Mr. Ezamo S. Maponde, Asst. Director, Private Sector Development: Prime Minister's Office	Policy Development	Dar-es-Salaam	Tel: +255 22 2135076 http://www.pmo.go.tz
7	Edward Mariki, Executive Director, Tanzania Milk Processors Association (TAMPA)	Policy advocacy	Dar-es-Salaam	tampa_office@yahoo.co.uk
8	Michael Pandisha, Communication and Advocacy Officer, TAMPA	Policy advocacy	Dar-es-Salaam	tampa_office@yahoo.co.uk
9	Mrs. Feddy P. Tesha, Managing Director, Portal Investments Ltd	Milk Producer	Dar-es-Salaam	feddy_t@yahoo.com
10	Dr. Julius Niugu, Director of Environment, Vice President's Office, Ministry of Environment	Environment Management	Dar-es-Salaam	+ (255) 22 2113857/2116995
11	Mr. Patrick Emmanuel, Partnership and Sub-contracting Tanzania Chamber of Commerce, Industry and Agriculture (TCCIA)	Policy advocacy/Private Sector Development	Dar-es-Salaam	T : (22) 218-4670 F : (22) 218-2890 E : dsm@tccia.com
12	Mr. Alfred Funde, Senior Programme Officer, Heifer International	Dairy Development	Dar-es-Salaam	heifertanzania@heifer.org
13	Dr. Emmanuel Sikombe, Cluster Manager, Heifer International	Dairy Development	Dar-es-Salaam	heifertanzania@heifer.org
14	SNV, Tanzania	Dairy Development	Dar-es-Salaam	www.snvworld.org
16	Mr. Nezarlon Kitosi, EAAPP (Dairy) Coordinator Ministry of Livestock & Fisheries Development			nezarkitosi@yahoo.com +255754773211
17	Mr. Rénatus Mbamiló, Agricultural Council of Tanzania	Policy Analyst		mbamilorenatus@yahoo.co.uk +255714911544
18	Mrs. Illuminata J. Melewas, TAMPRODA	Producer	-	+255754262942
20	Mrs. Joyce Maru, ILRI	Capacity Development Officer		J.maru@cgiar.org +254707627645
21	Ms. Maria T. Ijumba, SNV-Netherlands Development Organization	Senior Advisor- Dairy Value Chain Development		Mijumba@snvworld.org +255788747169

22	Mr. Ronen Almog, CEO, Kijani Agro Ltd		ronen@kijaniagro.com	+255788287172
23	Mr. Devengwa K. Mmari, CEO, Tan Diaries Ltd		tandairies.desamilk@gmail.com	+255715918771
24	Ms. Feddy P. Tesha, Chairperson, TAMPA		Feddy_t@yahoo.com	+255754311860
25	Mr. Thomas L. Price, Senior Officer, GFAR		Thomas.Price@fao.org	+390657054775
26	Ms. Nana Brandes-Van Ro, Capital Development Specialist CGIAR/ILRI		d.brandes@cgiar.org	
27	Mr. Stuart Worsley, Head of Development Partnerships - CRP Program on Livestock & Fish, ILRI/CIAT/ICARDA/WORLDFISH		S.worsley@cgiar.org	+254700326836
28	Mr. Abel Songole, Research Assistant, Economic and Social Research Foundation		asongole@esrf.or.tz	+255757808808

Appendix 5.6		List of key institutions and individuals consulted and interviewed in Uganda		
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Appendix 6 – Summary of Ethiopia Dairy Directory

#	List	# of actors
1	Animal Drug Suppliers	43
2	Animal Feed Ingredient suppliers	48
3	Animal feed processors	27
4	Animal feed retailers	27
5	Artificial Insemination (AI) Service providers	22
6	Dairy Associations	9
7	Barn Design and Construction	4
8	Biogas Digester design and construction	3
9	Butter shops and butter traders	25
10	Cafes	34?
11	Consulting firms	40
12	Dairy cattle suppliers and brokers	19
13	Dairy cooperative and unions	97
14	Dairy Development Organization	17
15	Dairy Farms	140
16	Dairy Ingredient Suppliers	10
17	Dairy Processors	55
18	Farm Equipment Supplies	3
19	Financial Institutions	36
20	Forage seed Suppliers	17
21	Government Organizations	23
22	Hotels and Restaurants	67
23	Laboratory Equipment Supplies	10
24	Media and Communication	8
25	Milk Shops	80
26	Milk Traders	18
27	Packaging Suppliers	16
28	Processing Machineries	51
29	Research Organizations	6
30	Supermarkets	72
31	Technical Support Services Providers	12
32	Veterinary Services Providers	16
33	Others	2
	Total	1054

To explore
the potential
of nature to
improve the
quality of life



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The Centre for Development Innovation works on processes of innovation and change in the areas of food and nutrition security, adaptive agriculture, sustainable markets, ecosystem governance, and conflict, disaster and reconstruction. It is an interdisciplinary and internationally focused unit of Wageningen UR within the Social Sciences Group. Our work fosters collaboration between citizens, governments, businesses, NGOs, and the scientific community. Our worldwide network of partners and clients links with us to help facilitate innovation, create capacities for change and broker knowledge.

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