EVALUATION OF GOOD DAIRY FARMING PRACTICES ON SMALLHOLDER FARMS MARKETING MILK IN THE FORMAL AND INFORMAL CHAINS

THE CASE OF KIAMBU WEST DISTRICT, KENYA

A Research Project Submitted to
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DEDICATION

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LIST OF ABBREVIATIONS

AEZ----------Agro Ecological Zones
AI----------Artificial Insemination
AKEFEMA-- Association of Kenya Feed Manufacturers
ASAL----------Arid and Semi Arid Lands
CMT----------California Mastitis Test
COMESA-----Common Market for Eastern and Southern Africa
CCP---------- Critical Control Points
ECF----------East Coast Fever
DLP----------Department of livestock production
DLPO----------District Livestock Office
DVS----------Director of Veterinary Services
EAC----------East African Community
FAO----------Food and Agriculture Organization
FGD----------Focus Group Discussions
GDP---------- Gross Domestic Product
GDFP---------Good Dairy Farming Practices
GMP----------Good Manufacturing Practice
GoK----------Government of Kenya
GTZ----------German Agency for Technical Cooperation
GVP----------Good Veterinary Practice
HH----------Households
ILRI----------International Livestock Research Institute
KARI----------Kenya Agricultural Research Institute
KCC----------Kenya Co-operative Creameries
KDB----------Kenya Dairy Board
KEBS----------Kenya Bureau of Standards
KEFRI----------Kenya Forestry Research Institute
MCC----------Milk Collection Centers
MOA----------Ministry of Agriculture
MoLD----------Ministry of Livestock Development
NARP----------National Agricultural Research Project
SDP---------- Smallholder Dairy Project
SPS----------Sanitary and Phytosanitary standards
SRA----------Strategies for Revitalizing Agriculture
TOT----------Training of Trainers
VCD----------Value Chain Development
WTO----------World Trade Organization

ABSTRACT

This study evaluated Good Dairy Farming Practices (GDFP) on smallholder farms marketing milk in the formal and informal chains in Kiambu West district of Kenya between July and August 2009. The objective of the study was to compare and identify gaps that need to be managed to improve quality of milk. A total of 40 farms: twenty farms in the formal and twenty in the informal channel were selected through a stratified random sampling process. A checklist on GDFP parameters was used to guide and record observations on individual farms. The key variables investigated included animal health and the use of medicines; animal welfare; animal feeding and water; milking hygiene; environmental management and record keeping. In addition, Focus Group Discussions with farmers in both chains were done to obtain an insight into problems constraining farmers in adopting GDFP. A case study involving Limuru co operative, Limuru milk processor, Kenya Dairy Board, milk traders and consumers was also done to obtain an overall picture of the extent and effect of inadequate GDFP on the milk chain and possible strategies for improvement.

The findings of this study show that the current practice of screening and testing milk deliveries from farms done by dairy cooperatives, processors and traders does not help to improve quality. The study further reveals that smallholder dairy development programs have had little impact in improving the quantity and quality of milk and management practices at farm level. This is because in terms of comparison, there were no significant differences ($p>0.05$) in management practices between farms marketing milk through the formal and those in the informal chains.

Overall, the status of Good Practices on smallholder farms was found to be unsatisfactory with major gaps existing in housing conditions of dairy cattle, feeding and milking hygiene. Mastitis is emerging as the most common disease in zero-grazing systems with a prevalence rate of 65% mainly due to the poor housing conditions since about 62.5% of the farms had cattle sheds without concrete floor. Fodder was found to be a limiting factor on many farms in both quantity (75%) and quality (82.5%), while the quality of commercial feeds available in the market was questionable owing to lack of Good Manufacturing Practice (GMP) standards.

It was found that inadequate GDFP has negative impact from production to marketing continuum through reduced cattle productivity, post harvest losses and lack of bargaining power at farm level, while at the national level high bacterial counts and residues affect processing of dairy products and less competitiveness in international markets. The study reveals that low farm-gate price of milk and high cost of feeds are factors with a major impediment on adoption of GDFP.

A proposed intervention plan using a strategic tool box: an integrated GDFP approach through a holistic mastitis control program is discussed and appears feasible. Opportunities exist, through a shared vision, Systems innovation and Thinking, which can transform smallholder farmers into entrepreneurs to take dairy farming as a business and therefore enhance GDFP.

Thus it is concluded that building the capacity of small holder farmers on GDFP would be a better strategy of improving milk quality rather than the testing of numerous deliveries. It is recommended that a strong focus on dairy cattle management and a milk payment system based on quality rather than quantity should be adopted by industry stakeholders.

1.0 INTRODUCTION

1.1 Background

Kenya has a population of about 36 million people (CBS, 2008). Close to 80% of the population live in rural areas and derive their livelihood from crop and livestock production. The country is divided into seven agro ecological zones (AEZ) and has a total land area of 582,650 km^2, out of which land comprises 569,250km^2 while water bodies occupy 13, 400km^2 (CBS 1999). Only about 16% of the country mainly the highlands and the lake region (AEZ 2-3) with annual rainfall of over 1100mm is suitable for agriculture, while the remaining 84% which receive 150mm-1100mm rainfall is Arid and Semi Arid Land (ASAL) used for ranching and pastoralism.

Kenya's agricultural sector is the mainstay of the national economy and provides the basis for the development of other sectors. Its direct contribution to Gross Domestic Product (GDP) is 26% out of which half is from livestock sub sector. The livestock sub sector employs over 50% of the agricultural labor force and supports feed manufacturing, veterinary, farm equipment, value adding industry such as processing meat, milk and leather (MoA, 2004). The national objectives of the agricultural sector are: attainment and maintenance of domestic supply of food; production of raw materials for industries; creation of gainful employment and increases in incomes of those involved in production; conservation of natural resources and production of agricultural commodities for export.

The dairy industry, dominated by smallholders, is the most well developed of the livestock sub sector and is practiced in the Medium and High potential areas. It accounts for about 33% of the agricultural GDP and is a major source of livelihood for more than 1 million people employed directly and indirectly in the sub sector.

For the dairy sub sector to continue contributing significantly to overall goal of economic growth, wealth creation, food security and poverty alleviation, smallholder dairy production which is a dominant feature must be transformed from subsistence to a commercial and profitable business enterprise. Government policy documents such as SRA (2004-2014) and Vision 2030 indeed emphasize strategies for transformation of agriculture. One such strategy with a potential to contribute towards the commercialization of the dairy sub sector along the concept of value chain approach and which this research project sets out to explore is Good dairy farming practices (GDFP).

Good dairy farming practices is an important tool recognized world-wide as necessary in producing and marketing of safe, quality milk and milk products to satisfy the expectations of the food industry and consumers (FAO, 2004).The aim is to ensure that milk is produced by healthy animals under acceptable conditions for animals and in balance with the environment. These practices include: animal health and use of medicines; animal welfare; animal feeding and water; milking hygiene; and environment.

The dairy sector in Kenya is dominated by smallholder farmers who account for over 80% of milk marketed through the formal and informal chains. Most of the milk marketed by smallholder farmers is of poor quality and does not meet national standards due to high bacterial counts (Mwangi et al 2000), contains high somatic cell counts and drug residues (Gatonye, 2007) and causes serious safety concerns (Arimi, 2000). Previous initiatives by the smallholder dairy project and other projects have concentrated mainly on improving productivity, poverty reduction strategies, identifying general constraints and policy issues in the sector (Omore, 1999; USAID, 2008). However, no focused study

has been done to evaluate the use of GDFP on smallholder farms marketing milk in the formal and informal chains. According to the ministry of agriculture (MoA, 2004), the dairy sub sector suffers from lack of Good Dairy practices which have impacted negatively on competitiveness and quality of the products in the sector. Hence in its current strategy for revitalizing the sector, the ministry intends to integrate all actors to focus on approaches that will facilitate commercialization of dairy products from production to marketing continuum in order to improve access to domestic, regional and export markets (MoA, 2004). To realize this goal, the Kenya Dairy Board (KDB) has embarked on the process of accreditation of smallholder farmers who produce milk for sale, while the Kenya Agricultural Research institute (KARI), is expected to play a key role on research and development issues on animal health and production since it is the main implementing agency for the ministry. Therefore, evaluation of Good dairy Practices through this research study is an opportunity to contribute to this goal by building the capacity of farmers to manage quality.

1.2 Problem Statement

There is inadequate Good Dairy Farming Practices on smallholder farms which causes production of poor quality milk and limits access to current and potential markets.

Problem owner: Smallholder farmers and the Government of Kenya.

1.3 Justification of the study

The study area for this research, Kiambu district, has a well developed smallholder dairy system and about 77% of households keep dairy cows (Omore, 1999). Farmers in the district market milk through formal and informal channels to consumers in Nairobi which provides a ready market.

However, Milk produced by farmers in the informal chain has been shown to be of poor quality (Muruiki, 2003) while milk from the formal chain has also been reported to be rejected by some processors and, laboratory analysis show increasing incidence of mastitis (Muchirii, 2007). As a response in addressing concern on the quality of milk, the author produced an extension brochure for KARI on how to avoid milk farm spoilage (Omondi, 2008).

Inadequate Good dairy farming practices on smallholder farms therefore remains a problem that needs to be addressed due to its effect on the entire chain.

This research study aims to close the gap between theory and practice by comparing and identifying gaps in GDFP at farm level that need to be managed. This study is very important, and is based on the hypothesis that building the capacity of farmers on Good Practices will be a better strategy of improving Quality and safety of milk to enhance market access rather than the current practice of intensive testing of deliveries by numerous producers. This is because when poor quality milk is produced on the farm, it cannot be improved along the chain, irrespective of measures taken.

1.4 Research Objective

To compare and identify gaps on Good Dairy Farming Practices that need to be managed on smallholder farms in the formal and informal chains to improve quality of milk.

1.5 Main Research Questions and sub questions

1. What are the current management practices on small holder farms marketing milk in the formal and informal chains?

   Sub questions

   1.1 What measures are available on the farms for animal health management?
   1.2 How are medicines used, stored and disposed?
   1.3 What are the conditions in which dairy cattle are kept?
   1.4 What is the source /quality of animal feeds and water?
   1.5 What measures are available on the farm on milking hygiene?
   1.6 What measures are available on the farms for waste management?

2. What strategies are needed to enhance GDFP at farm level?

   Sub questions

   2.1 What are the factors (problems) influencing adoption of GDFP on smallholder farms?
   2.2 Which institutions can support small scale dairy farmers to enhance good practices?

3. How is the smallholder dairy chain organized?

   Sub questions

   3.1 What are the roles of actors, supporters and influencers (stakeholders)?
   3.2 What is the effect of inadequate GDFP in the chain?

1.6 Study Area

The study was conducted in Kiambu West district. It is one of the districts in Kenya located in the Central Province as shown in fig 1.1 (Map of Kiambu West district). The district borders the city of Nairobi to the west. It has three divisions namely Limuru, Kikuyu and Lari.

The district is in AEZ 2-4 Central Kenya highlands with altitude ranging from 1400m to 1800m above sea level, bimodal rainfall in March- May and October-November with annual rainfall above 1500mm. The temperatures range between 10-24 degrees, while Soils are red volcanic. The farming system is mixed crop/livestock (Mureithi, 1999). Smallholder Dairy of zero-grazing is widely practiced with average herd size of 1-3 animals. The average land holding is 1 acre (0.5 ha) which is diminishing due to high human population growth. The population density average 500 persons/km^2. Land tenure is private ownership where owners have certificate of registration. Main breeds kept include Friesians, Aryshires, Gurnseys, Jerseys or their crosses, with average milk production/cow being 7.5 kg/cow/day. Common roughages used include Napier grass, road side cut-and-carry grass and crop residues (District livestock office report, 2008).

Kiambu West district provides a good study area to evaluate the use of Good dairy farming practices among smallholder farms for two main reasons: First, the SDP project (1999-2005) an initiative between the Ministry of livestock development (MoLD), KARI and International Livestock Research Institute (ILRI) conducted its projects on

smallholder dairy development in the district and, secondly, about 77% of households keep dairy cows and market milk through the formal and informal chains. Hence the data collected can legitimately be generalized to other smallholder dairy regions in Kenya.

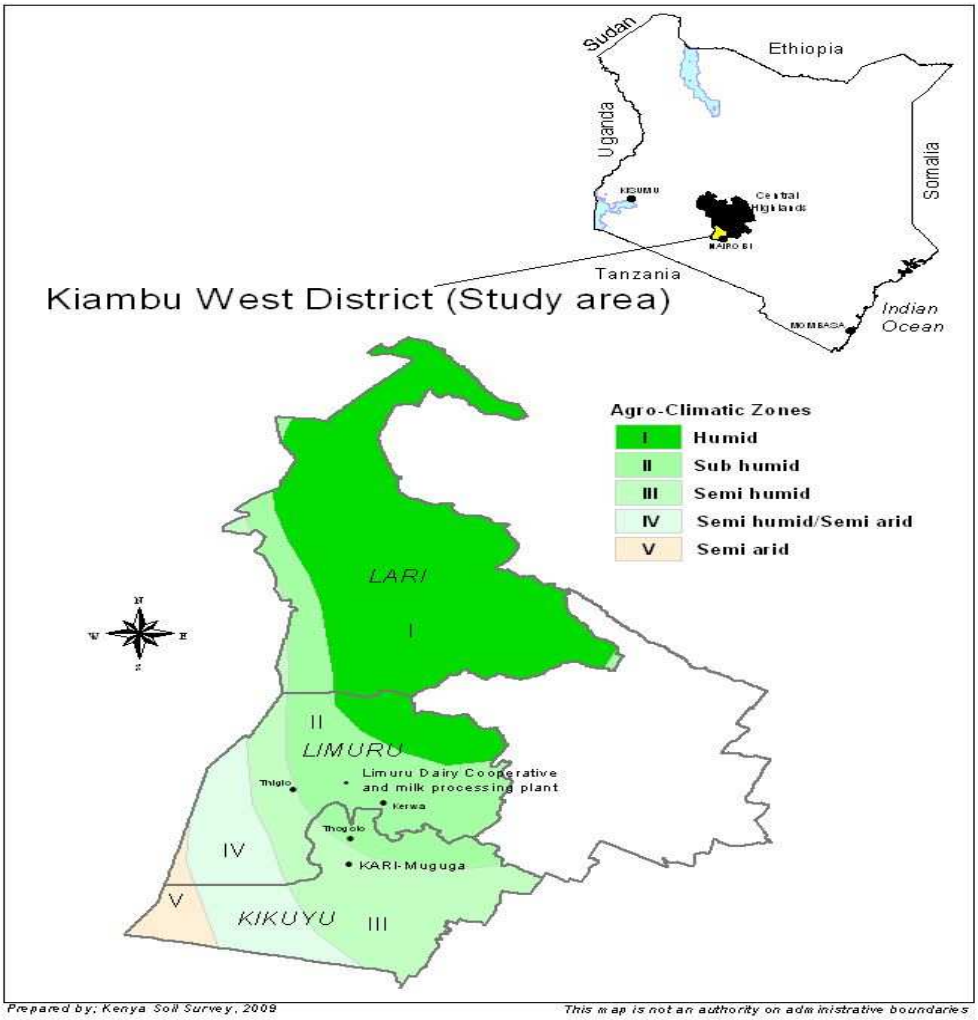

Fig 1.1: Map of Kenya showing study area

Table 1.1: study sites

Division	Zone	Study site
Limuru	rural	Thigio location
Limuru	Peri-urban	Kerwa location
Kikuyu	Peri-urban	Thogoto location

Table 1.2: Dairy production - Kiambu West district 2008 census

Division	Dairy cattle (adult)	Heifers	Milk Production (kg/yr)
Limuru	15805	11092	10,200,000
Kikuyu	10887	8251	2,800,000
Lari	16749	12910	370,000
Total	**43441**	**32252**	**13 370 000**

Source: DLPO, Kiambu West

Milk marketing in the district
Channels

1. Formal chain through cooperative/ processor
2. Cooperatives to traders or cooperatives direct to consumers
3. Farmer to traders
4. Farmer direct to consumers in Nairobi

Main constraints faced by dairy farmers in adopting GDFP
Low productivity and production of cows
Diminishing land sizes due to high population (average 0.5 ha)
High cost of inputs
Low milk price paid by the dairy cooperatives @ shs 23/kg (0.23 euro cents)
Poor Management practices - nutrition, diseases
Mismanagement of dairy cooperatives
Lack of access to credit
Poor quality of commercial feeds
Climate - frequent drought affects fodder production
(Source: district livestock office report, 2008)

1.7 Limitations of the study

The following limitations were experienced during the course of data collection:

- Subdivision of larger Kiambu district into new administrative areas - new districts which formerly used to be divisions e.g. Kiambu West.
  Hence data and Literature available and used in the study is mainly for the old Kiambu district.
- Selection of farmers marketing milk in the two types of chains used farmer organizations in the area. However due to inefficiency and low price in cooperatives most farmers market using both channels. However the researcher though facilitators managed to get enough farmers marketing milk only through the cooperatives.
- Severe drought in the study area at the time of data collection
- Serious Water shortage in the study area and the city of Nairobi

2.0 LITERATURE REVIEW

In this chapter, the selected concepts and theories which will be discussed consist of Good Dairy Farming Practices; Smallholder dairy production and development; and the Marketing of milk through the Formal and informal chains.

2.1 Good Dairy Farming Practices

Good dairy Farming practices (GDFP) is a practical tool recognized world wide in supporting farmers in the marketing of safe, quality-assured milk and dairy products (FAO, 2004). Dairy farmers are in the business of producing milk which is a perishable product hence, as primary producers in the supply chain, they must adopt farm-assurance schemes and best practices of production that satisfy the demands of processors and consumers. According to the International Dairy Federation (IDF) and FAO (2004), the overarching objective of GDFP is that on-farm practices should ensure that milk is produced by healthy animals under acceptable conditions for the animals and in balance with the local environment. The Good Practices toolbox consists of five areas that need to be managed namely: animal health and medicines; animal welfare, animal feeding and water; milking hygiene and environment (fig 2.1).

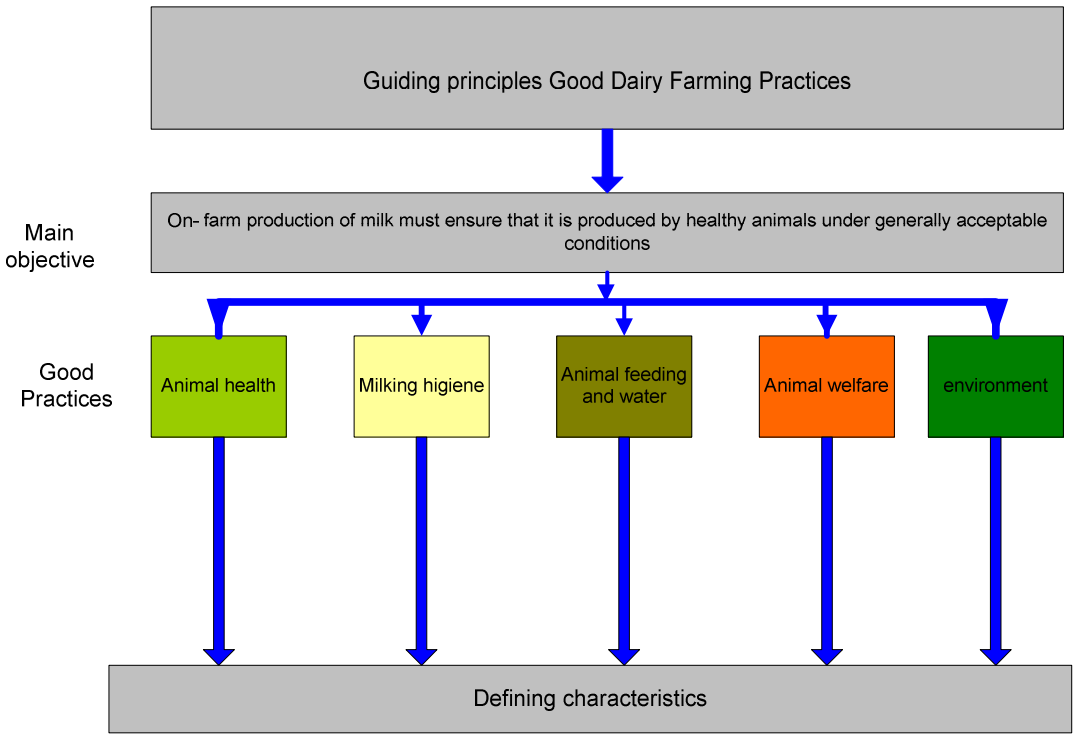

Fig 2.1: Schematic representation of good dairy farming practices
(Source: Adopted and modified by the author from FAO, 2004)

Table 2.1: Defining characteristics of good dairy farming practices

Key area	Main objective	Good practice	Specific measures
1. Animal health	Animals that produce milk need to be healthy and an effective health care programme should be in place.	1.1 Prevent entry of disease onto the farm 1.2 Have an effective herd management programme in place 1.3 Use all chemicals and veterinary medicines as prescribed 1.4 Train people appropriately	• Detect animal diseases early • Prevent spread of disease among animals • Prevent transmission of zoonosis • Ensure traceability • Prevent occurrence of chemical residues in milk • Follow correct procedures
2. Milking hygiene	Milk should be harvested and stored under hygienic conditions.	2.1 Milking routines do not injure cows or introduce contamination 2.2 Milking is carried out under hygienic conditions 2.3 Milk is handled properly after milking	• Use of suitable and well maintained equipment for milking and storage • Milk is harvested under hygienic conditions to prevent physical and microbiological contamination • Prevent occurrence of chemical residues
3. Animal feeding and water	Animals need to be fed and watered with products of suitable quality	3.1 Animal feed and water are of adequate quality 3.2 control storage conditions of feed 3.3 Traceability of feeds bought off farm	• Animals are fed on good quality feed • Water supplies and feeds are preserved from chemical contamination • No chemical or toxin or use of prohibited ingredients • Quality assurance of feed supplier
4. Animal welfare	Animals should be kept and allowed to exercise various freedoms	Animals should be kept free from hunger, discomfort, pain, fear and free to engage in patterns of normal behavior	Protection against extreme climatic conditions Appropriate feeding and watering Good sanitary conditions Safe environment
5. Environment	Milk production should be managed in balance with the local environment surrounding the farm.	Have an appropriate waste management system Dairy farming practices do not have adverse impact on the local environment	Limit the potential impact of dairy farming practices on the environment Present a positive image of milk production practices

Source: adopted from FAO, 2004.

These five defining characteristics for Good Practices are discussed below

2.2 Animal health and the use of veterinary medicine

Milk for human consumption should not contain residues. Residues in milk are undesirable because of their negative health effects on consumers. The recent contamination of milk with the chemical melamine in China resulted in sickness of more than 1200 babies and numerous deaths, causing serious safety concerns to consumers worldwide (Coghlan, 2008). Long-term exposure to antibiotic drug residues in milk can also give rise to bacterial resistance. This situation can create 'super bugs' that are immune to common, less expensive antibiotics. Antibiotic residues in milk also inhibit the starter culture bacteria which are important in the processing of milk products such as yoghurt and cheese (PTC+ manual, 2009). A survey by Omore (2005) in Kiambu district found out that there were no differences in the prevalence of antimicrobial residues in milk marketed in both the formal and informal chains in Kenya as all contained the prohibited substances. He concluded that these residues originated from farm level due to bad dairy practices when farmers fail to observe the specified milk withdrawal periods after treatment of cows.

Recent studies in Central Kenya and especially Kiambu district show increasing incidences of mastitis (Director of Veterinary service annual report, 2006) and the Kenya Dairy Board attributes the high level of bacteria load in milk due to poor hygiene at farm level (Muchirii, 2007; Mwangi, 2007).

These studies suggest that there is need to evaluate inadequate dairy farming practices especially on smallholder farms.

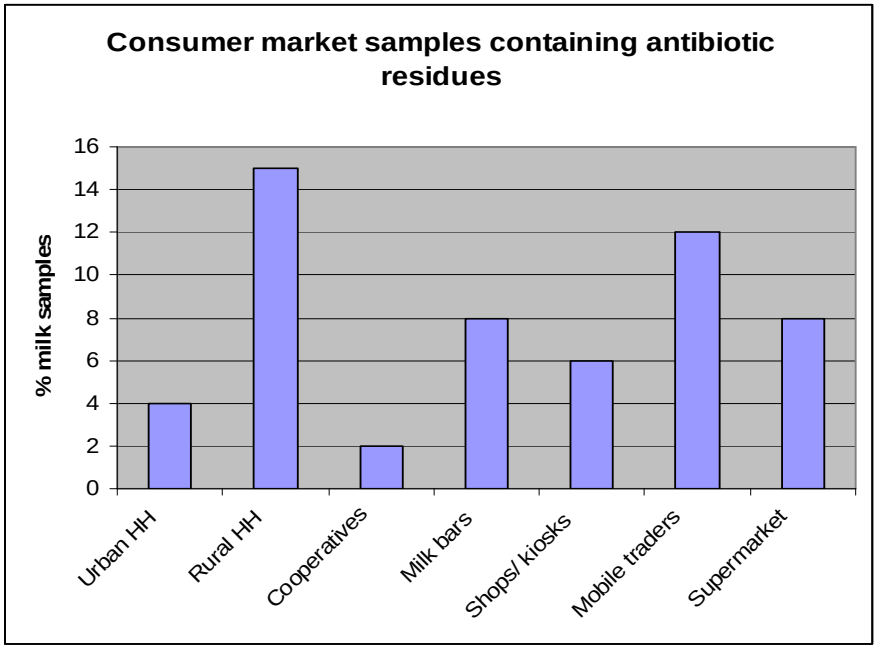

Fig 2.2: consumer milk samples containing antibiotic residues
(Source: adopted from Omore, 2005)

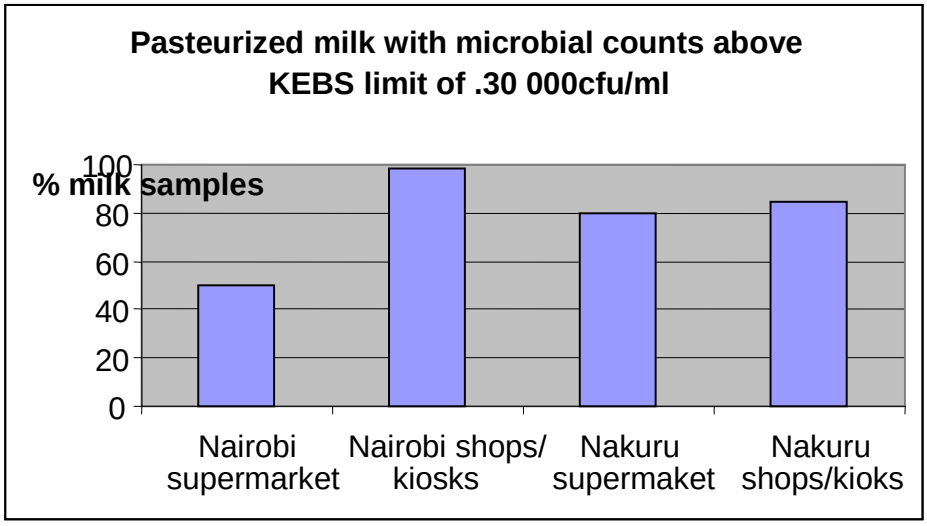

Fig 2.3: Pasteurized milk market samples containing high microbial counts
(Source: adopted from Omore, 2005)

2.3 animal feeding and water

Feeds used in Kenya have been reported to be of low quality and in some cases contaminated with aflatoxins which have been found in milk. A study by the university of Nairobi on the prevalence of contaminants in dairy feeds in Nairobi peri urban (Mwangi, 2007) concluded that 50% of commonly used feeds - maize germ, cotton seed meal, wheat bran were contaminated with aflatoxins and pose serious implications on livestock and human health.

2.4 Milking hygiene

Hygienic milk production at farm level is the starting point in quality assurance of milk in the dairy chain. Omore (2005) in his study on addressing public health and quality concerns of marketed milk in Kenya showed that there were unacceptable levels of the quality of milk and recommended training of dairy farmers in specific farm practices. Van Schaik et al (2005) in a recent study on smallholder dairy farms in Chile showed that lack of hygiene and inadequate milking conditions resulted in poor quality milk in the dairy chain.

2.5 Animal welfare

Animal welfare refers to freedom from hunger and thirst, malnutrition, discomfort, pain/ injury/disease and freedom to express normal behavior, fear/stress.
In developing countries, scarce resources are directed towards human rather than animal problems, resulting in poor welfare. Other factors such as cultural attitude towards animals, religious beliefs, poor stockmanship and economic considerations influence animal welfare standards (Hristov, 2008)

2.6 Environment

Dairy production leads to environmental pollution especially if waste and manure disposal is not managed. More than 50% of nitrogen may be lost when manure is not well preserved on the farm. In Kiambu district, due to diminishing land sizes, manure is

used to improve soils for crop production and crop residues are in turn used to feed livestock-nutrient cycling (Lekasi et al, 2001)

2.7 Use of GDFP in developed countries: Netherlands/EU/USA

In the Netherlands, the Qarant system is used on all dairy farms supplying milk to Friesland-Campina as an assurance for good dairy farming practices. Farms are inspected annually to ensure that they are compliant. A farm is expected to meet a GDFP score of >85% in all areas, otherwise the farm is given 12 weeks for improvement or face sanctions which include revoking license to supply milk (PTC+ manual, 2009).

Table 2.2: Quality parameters expected from GDFP in selected countries

Country standards	Bactoscan TBC/ml	Somatic cell count /ml	Residues	Other demands
Netherlands	< 100,000	<250,000	Nil	Payment based on quality : protein 3.4%,butter fat 4.0%
USA	< 100,000	< 500, 000	Nil	Milk must be stored at 7° and received at that temperature. Milk must be produced at grade A licensed farms
EU	<100,000	<300,000	Nil	Milk must be produced at farms that meet EU standards for sanitation and water quality

Source: Compiled by the author from PTC+ manual 2009

2.8 Use of GDFP in developing countries - Common market for Eastern and Southern Africa (COMESA)

The harmonized Standards for COMESA on somatic cell counts are

- 1st grade raw milk should have less than 200,000 cells/ml
- 2nd grade raw milk should have 200,000-1,000,000 cells /ml
- 3rd grade raw milk should have 1,000,000-2,000,000 cells /ml

2.9 Use of GDFP Kenya

The Kenya standard for good dairy farming practices is based on the "code of hygienic practice for production, handling and distribution of milk and milk products" (KeBS, 2000). According to this standard, the practices required for primary production of milk for sale include management of the following areas:

- Water: clean portable drinking water available on the farm to facilitate hygienic practices in the production of milk.

- Waste: removal of manure and other wastes from the milk sheds and disposal in a drain
- Animal health: The Kenya standard states that raw milk should originate from healthy dairy cows, free from zoonotic diseases such as brucellosis and tuberculosis as well as other diseases like mastitis.
- Animal holding areas: clean, spacious well ventilated housing with floor that facilitates drainage. Availability of separate milking area.
- Feeds: safe and free from residues, pesticides, toxins or any other agent that may present health risk
- Vermin: effective control of vermin such as rodents on the farm
- Veterinary drugs: Milk from animals treated with antibiotics shall not be used unless the withdrawal period has been achieved.
- Hygienic milking: The standard stipulates that milking should be carried out under hygienic conditions and the milker should be healthy and free from infectious diseases

In every respect the Kenya standards for Good dairy practices is adopted from the recommended FAO guidelines already discussed in the earlier sections in this chapter. Inspite of its existence, application at farm level has not been successful as evidenced by the findings of various studies indicated in this chapter (section 2.1, 2.2) which show the persistence of low quality milk produced at farm level. Moreover, payment of milk is based on quantity and not quality.

2.10 Smallholder dairy production and development

Studies by Bebe et al (2002) indicated that the smallholder dairy production in the Kenya Highlands is marked by declining farm size, upgrading into dairy breeds and an increasing reliance on purchased feeds, both concentrates and forage. In areas such as Kiambu district, purchased fodder has become very important in dairying and together with commercial feeds account for the largest cost (67%) of production as shown in fig 2.4. Zero-grazing technologies constitute an important strategy through which smallholders in the highlands intensify their farming systems, particularly as farm sizes decrease.

	breeding	Feeding	water	healthcare	labor	cowshed	margin	TOTAL
Share of Production costs %	2%	67%	5%	5%	6%	5%	10%	100%
K shs / litre (100 Kshs = 1 euro)	0.4	13.4	1	1	1.2	1	2	20

Fig 2.4: Farm level milk production costs

(Source: Modified by the author from IFC dairy sector value chain study, 2006)

2.11 Key characteristics of the industry

The dairy industry in Kenya is one of the largest in sub Saharan Africa. It accounts for 6% GDP and supports about I million smallholder dairy households. There are about 650,000 small scale farmers located mainly in the central highlands and Rift Valley. Out of the estimated national dairy herd of 3.5 million, smallholders own 3.3 million cattle and control over 80% production and over 80% of the marketed milk ((Muruiki, 2003).These farmers own 1-4 cattle and supply milk directly to consumers, traders or though cooperatives (Muruiki, 2003). There are approximately 2000 medium to large scale farms who deliver milk to small and large processors for sale to local and regional markets. Total production of milk is estimated by the Kenya Dairy Board (2008) to be 3.8 billion kg/year. Production dropped in 2008 due to post election violence.

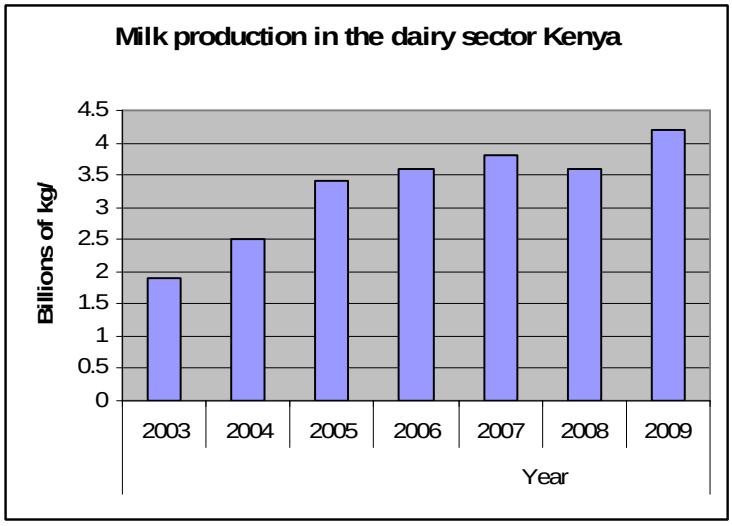

Fig 2.5: Trend in milk production dairy sector Kenya
(Source: Kenya Dairy Board records, 2009)

2.12 Trends in dairy development in Kenya

Before Kenya's independence in 1964, dairy development was carried out by white settlers on large scale farms using exotic dairy cattle breeds introduced in the Kenya highlands. After independence, African farmers were allowed to own land and cultivate crops and keep improved dairy cattle. Over time, Smallholder farmers have dominated dairy production, mainly due to two main catalysts: government and development partners supporting dairy production and marketing; and the advent of a liberalized economy (Omore, 1999).

2.13 Benchmarking Kenya with South Africa

Comparing the dairy sector in Kenya with South Africa, Kenya has low productivity of herd, informal marketing dominance, low processing and low revenue per litre of milk.

Table 2.3: Comparison of dairy sector in Kenya with South Africa

Sector attributes	Kenya	South Africa
Size of dairy herd	3,500 000	550 000
No of farmers	650,000	4555
Production/cow/year (litres)	1500	5000
Marketed raw milk billion litres	1.2 (32%)	2.3 (88%)
Fresh milk processed	293 m kg	1.4 billion
Total milk processed	327 M	2.3 billion
% marketed milk	55%	100%
Revenue/kg (formal chain)	US$ 0.73	US$ 1.41
Revenue/kg (informal chain)	US$ 0.43	US$ 1.41

Source: USAID Report, 2008

2.14 Dairy sector stakeholders: Actors, supporters and influencers

This section outlines the general organization in the dairy chain in Kenya.

Input supplying: supply of heifers, artificial insemination (AI) services, feeds, drugs, equipment.

Production: Activities on the farm to produce raw milk from cows. Production is carried out by 650000 smallholders and about 2000 medium /large scale farms countrywide.

Collection, Bulking and cooling: Bulking is carried out by about 350 farmer cooperatives/organizations. There are over 70 cooling plant though many are not operational.

Processing and packaging: Transformation of warm or cooled raw milk into pasteurized milk or dairy products. Carried out by 30 registered processors.

Transport and distribution: Transportation of milk between each step of the chain. Carried out by over 5000 informal and formal traders including producers, cooperatives and processors

Retailing: selling of raw or processed milk and milk products to consumers. Carried out by supermarkets, kiosks, milk bars, traders.

Actors in the dairy chain

Input suppliers*:* supply animal feeds, drugs, AI services and equipment to farmers. They also supply different types of equipment to other actors in the chain.

Producers: Keep dairy cattle, produce milk and sell to consumers.

Cooperatives*:* Collect bulk and sell milk to processors and sometimes to traders or directly to consumer. Sometimes they also process.

Processors*:* Process and add value to milk before selling to consumers through supermarkets and shops. The leading processors in the country are KCC, Brookside, Spin knit, Githunguri and Limuru dairies.

Traders and Retailers*:* Buy milk from farmers and supply to consumers. Retailers include milk bars, kiosks / shops and supermarkets.

Consumers*:* End users of the milk and milk products.

Other stakeholders in the dairy chain: Supporters /Influencers

Supporters and influencers facilitate actors at various levels of the chain.

Government: The ministry of livestock development is responsible for policy formulation and implementation; facilitate production, research and delivery of extension services through the departments of livestock production (DLP) and the department of veterinary

services (DVS), while the ministry of cooperatives is responsible for the management of dairy cooperatives. Government is the main influencer of the environment in which other actors operate.

Kenya Dairy Board: *R*esponsible for regulating the dairy sub sector though licensing, inspection, and certification. It also ensures quality control of milk and dairy products from production to marketing by training actors on milk handling practices and promotional activities.

Kenya Bureau of standards**:** Responsible for providing standards and code of practice for production and processing necessary for marketing of milk and dairy products in local and international markets

NGO's - Land O Lakes / International Livestock Research Institute

Trains mainly farmer organizations on feed conservation methods and coordinates various projects on the Kenya Dairy sector competitive programme (USAID, 2008). The goal is to identify opportunities for competitiveness of dairy farmers and other actors in the sector. ILRI is a leading research agency in the Livestock for livelihood theme.

Research & training

- ***KARI:*** KARI collaborates with the above chain supporters in ensuring that milk and dairy products are free from veterinary drugs, residues and disease causing organisms. KARI is also the government agency on research and development aspects of forages.
- ***Universities (Nairobi and Egerton)***: Train manpower in areas related to animal husbandry and health, feeds and milk processing

Donor agencies: They support various projects along the chain in collaboration with the government and service providers.

Financial institutions*:* These include banks, savings and credit societies, micro credit institutions. They support dairy actors by providing credit

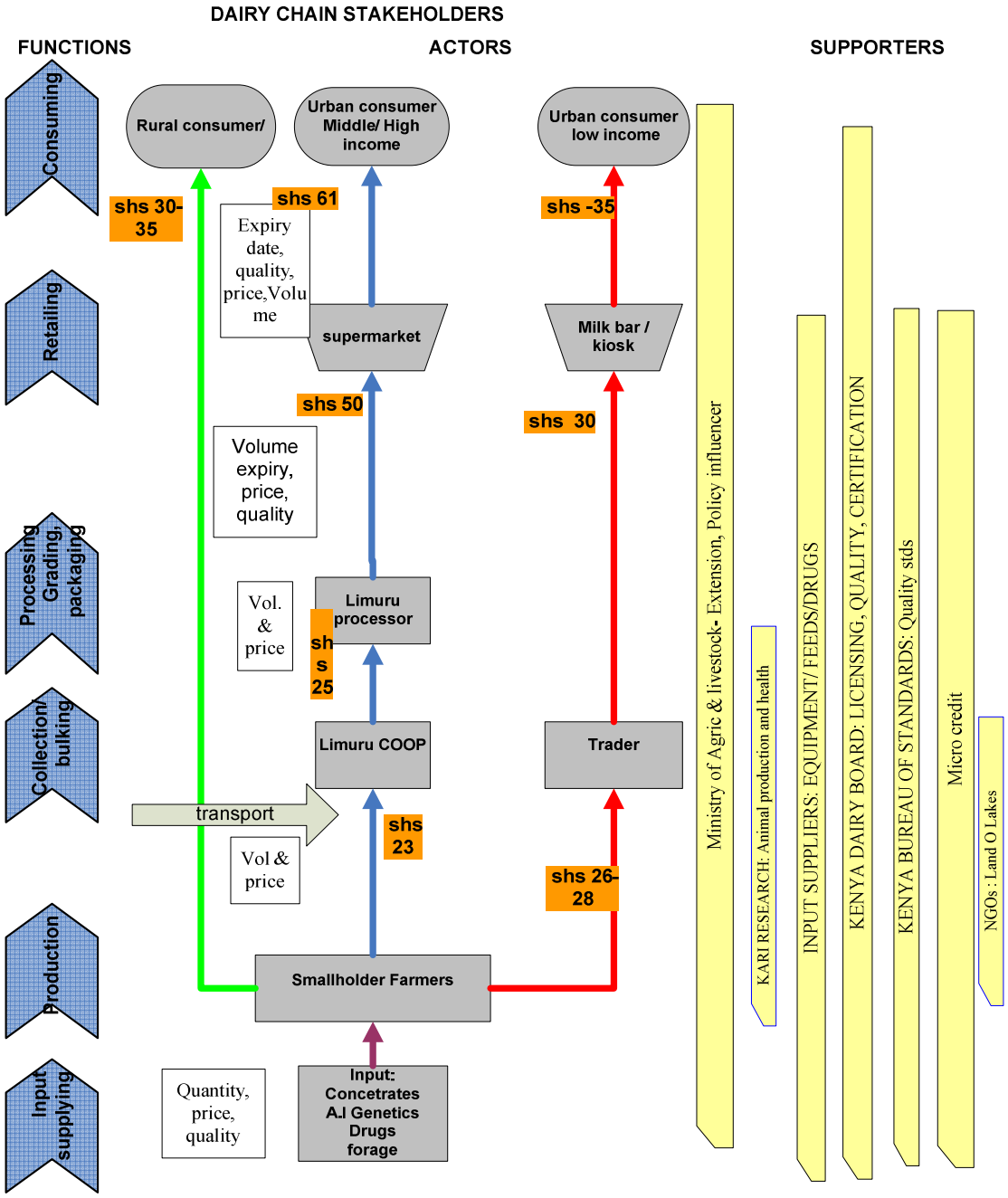

Fig 2.6 : Chain Map of smallholder dairy sector in Kiambu West district
(Source: compiled by the author. Shs 100 = 1 Euro)

2.15 Comparison of smallholder dairy in Kenya and Asia

This section analyses the role played by smallholder farmers in dairy development in Asia and compares the trend with Kenya.

India is the largest milk producing region of the world (Staal, 2001). Strong consumption trends in South Asia are due to growing population, rising incomes, urbanization, demographic changes, promotion of school milk programmes have contributed to the

growth of the dairy sector. Like in Kenya, 80% of animals are raised by smallholder farmers owning 2-5 cows. These producers account for 80% milk production.

2.16 Marketing of milk through the Formal and informal chains.

As stated before, marketing of milk in Kiambu reflect the general trend in the country. The accelerating collapse of Kenya Co-operative Creameries (KCC) from the early 1990s and the liberalization of the market in 1992 were catalytic events that changed the nature of milk marketing and processing Kenya. Milk marketing is carried out through either the formal or informal chains although four channels are evident as shown in fig. 2.7

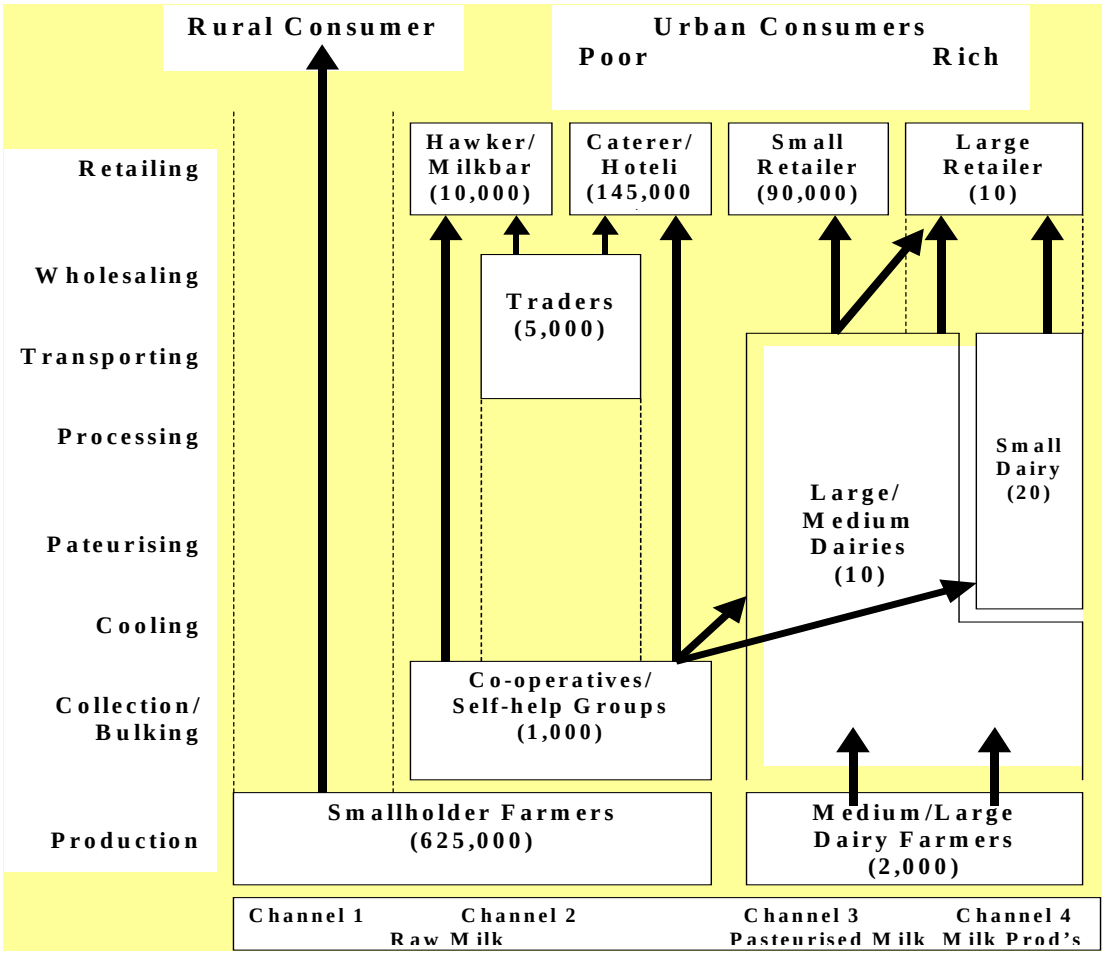

Fig 2.7: Actors in different milk marketing channels in Kenya
(Source: SDP, 2004c)

Channel One (Informal chain) - Raw milk direct from Farmer to Rural Consumer

In this channel, smallholders supply milk directly to consumers. About 42% of smallholders sell to neighbours in rural areas or urban centres as their main market. Prices paid by consumers are about shs 30 in Kiambu district. The directness of the channel with no intermediaries or transport/processing costs results in considerable cost savings to both parties.

This is a favored channel for smallholder farmers because of the simplicity and immediate payment relative to other channels. It is therefore likely to remain strong and continue to grow.

Channel Two (Informal chain) - Raw milk via intermediaries to urban consumers

This channel accounts for 30% of all marketed milk. Smallholder farmers supply milk to traders, co-operatives or self-help groups. Speed is essential, given the perishable nature of milk and time of day also seems to be critical, with the best prices and highest chance of selling early in the morning, with a second peak in early evening coinciding with consumers need for milk.

There are wide variations in the chain and the number of intermediaries used, but one example from Kiambu West-Nairobi illustrates the process.

i. Smallholder producers in Kiambu West milk at 4.30-5.00 a.m.
ii. Milk is collected by traders from homesteads or delivered to collection points from 6.00 a.m.
iii. Milk is transported to Nairobi, particularly slums and poorer areas, and is on sale from 6.30 a.m.
iv. Hawkers buy the milk and take it to individual households for purchase or it is delivered direct to 'milk bars' or hotels
v. Households use the milk immediately and can purchase again for evening consumption.

The channel appears to be very efficient at getting milk from rural producers to urban consumers. The consumer prices are between Ksh.30-35/litre. Many co-operatives and self-help groups have begun to take the milk in their own vehicles, park at a known place in a slum area and wholesale it to milk bars and hawkers.

The farmers in Kiambu get Ksh 23/litre from the co-operatives, whereas traders buy at between shs 26/litre – shs 28 /litre from the farmers. Selling to urban areas seems to give Co-operatives the best return per litre, despite the transport and associated costs. This is a relatively low paying channel, compared to other outlets, but there are other perceived advantages of supplying to the co-operatives as outlined later in this study.

Consumers prefer raw milk because it is tasty and cheap. This is in contrast to packaged milk from large processors. The issue of shelf life of raw versus pasteurized milk is of little relevance to consumers given that most milk appears to be consumed immediately in tea and with 98-100% awareness of the need to boil milk before consumption (Omore, 2005).

Overall, the swift delivery of raw milk from farm to (poorer) consumers in urban areas at relatively low prices appears to be highly efficient and this channel is rapidly growing.

Channel three (Formal chain): Pasteurized packaged milk to urban consumers

This is the smallest of the three liquid milk channels. There are 30 registered processors in the country. However, 80% is controlled by 5 processors: new KCC, Brookeside, Spin knit, Githunguri and Limuru. Large dairy farmers and co-operatives collect, bulk, and sometimes cool the milk before supplying to processors. About 85% of milk is sold as fresh milk either as short life pasteurized milk or long-life Ultra High Temperature (UHT) milk. This channel is distinguished from the other two channels since milk is pasteurized. Because these processors are in the formal sector, they also incur additional costs through cold chain facilities, payment of VAT and corporate taxes. The price paid by consumers buying milk though this channel is between shs 61- shs 64 /kg (0.61-0.64 euro cents)

	Farm level production	Transport	Bulking	Transport	Processing & packaging	Distribution	Retailing	TOTAL
Share of Revenue Ksh/lt	36%	5%	3%	3%	37%	8%	8%	100%
Formal chain (Ksh/lt)	22	3	2	2	22	5	5	61
Share of Revenue	74%	9%	-	-	-	6%	11%	100%
Informal Chain (Ksh/lt)	26	3	-	-	-	2	4	35

Fig 2.8: Share of revenue by marketing through the formal and informal chains
(Source: Modified by the author from IFC dairy sector value chain study, 2006)

Channel four (Formal chain) – Milk Products to Urban Consumers

This channel is the smallest in volume because the market for added value milk products is still very limited in Kenya.
It shares much of the infrastructure of channel three as the milk is supplied from larger farmers to medium/large processors or is supplied by co-operatives to small processors. The main products in this channel include: yoghurt, fermented milk, butter, cheese and milk powder (only produced by KCC). The products only appeal to a limited urban middle-income group and tourist hotels.
The prices are significantly higher than pasteurized milk, for instance yoghurt retails at prices Ksh160/litre (1.60 euros). The long-term prospects for this channel appear to be good, but its overall value to the dairy industry is limited at present.

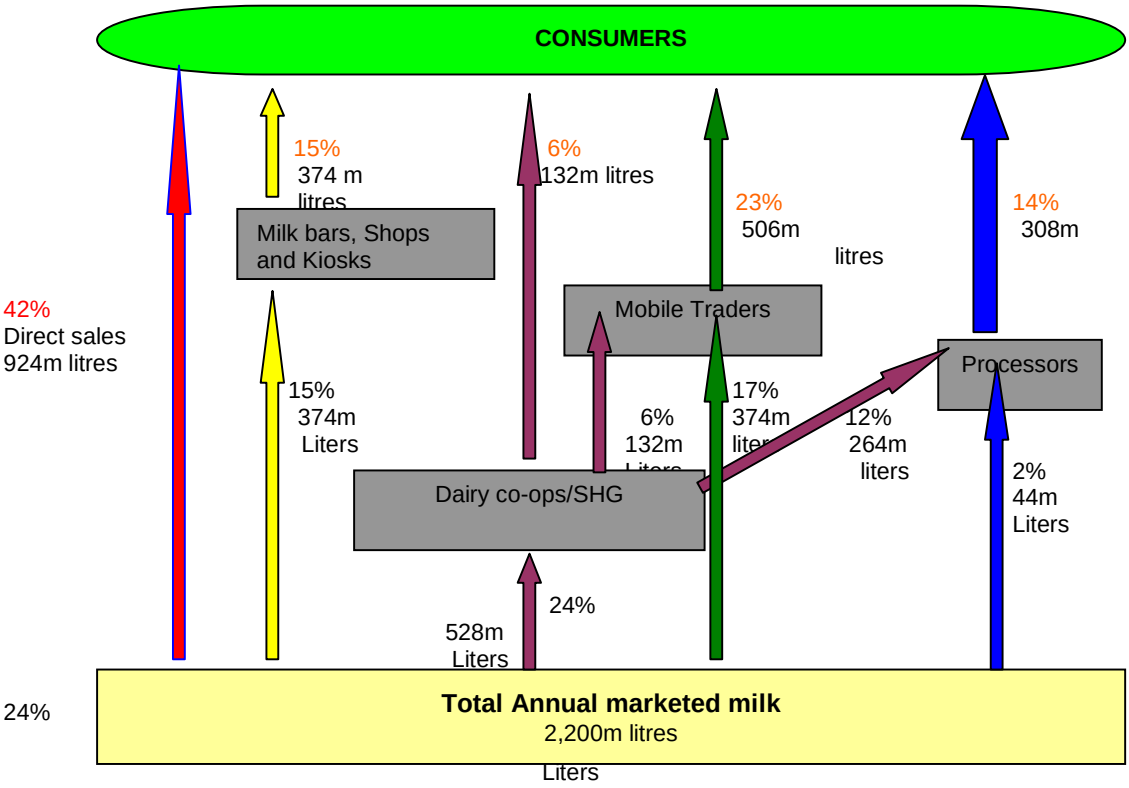

Fig 2.9: Quantity of milk marketed through the formal and informal chains
(Sources: Adopted from SDP Policy Brief # 4 SDP, 2004c: Percentage marketed flows are calculated on marketed milk, not on total production).

2.17 Comparison of Formal and informal markets in East Africa and Asia

While comparing milk production and marketing between East Africa and South Asia, Staal et al (2001) found that informal milk marketing has played a key role in both regions. In countries India, Pakistan, Uganda and Tanzania, informal markets control 80% of marketed milk. FAO (2005a) also estimates that over 80% of the milk consumed in developing countries annually is handled by informal traders. These suggest that the market dominance is not due to lack of investment in the formal chains or non enforcement of standards, but rather they are as a result of the continuing demand and services they offer.

Table 2.4: Formal and informal milk markets supplied by small scale producers

	Informal	cooperatives
Tanzania	96	4
Uganda	90	10
India	83	6
Sri lanka	40	7
Kenya	80	16
Nicaragua	84	4

Source: FAO, 2005

3.0 RESEARCH METHODOLOGY

3.1 Research Strategy

The aim of this research study was to compare and identify gaps on Good Dairy Farming Practices that needs to be managed on smallholder farms in the formal and informal chains to improve quality of milk. Hence the selected methodology (Desk study, survey and case study) was based on the premise that it would generate the type of knowledge which can be expected to satisfy these aims (Oliver, 2008). The study was based on a survey of 40 dairy farms spread across three farmer organizations in Limuru and Kikuyu divisions of Kiambu West district, and was carried out between July-August 2009. The reasons for choosing the study location included: a concentration of numerous smallholder dairy farmer groups marketing milk through the formal and informal chains due to proximity to the city of Nairobi; previous work by SDP project in the study area (Omore, 1999; Lekasi, 2001), collaboration with KARI during the National Agriculture Research Project (NARP) and, finally, the area is typical of other smallholder dairy milk sheds and hence the results obtained would be generalized to other farms in Kenya.

3.2 Design

A purposive sampling was used to select the surveyed farmer organizations. A checklist on GDFP parameters was used to guide and record observations on individual farms randomly selected i.e. 20 farms marketing milk through the formal chain and 20 farms in the informal chain. In addition, the study employed focus group discussions with farmers in both chains to obtain an insight into problems constraining farmers in adopting GDFP, and a case study involving Limuru co operative, milk traders, Limuru milk processor, Kenya Dairy Board and consumers to obtain an overall picture of the extent and effect of inadequate GDFP on milk quality and possible strategies for improvement.

3.3 Gaining access to study area

As a first step to carry out the study, the author discussed the research proposal and study design with the employer (KARI). KARI wrote introductory letters to the three farmer organizations and other stakeholders in the case study explaining the purpose and permission to carry out the study. The author approached the Coordinator of farmer groups (CBO) in the district who agreed to facilitate meetings with various groups. This approach was preferable than using the district livestock office because of good rapport and easy accessibility to respondents. Before collection of data, consultative /planning meetings were held with the three farmer groups for a de briefing on the aim of the study, selection of farms in each chain to be visited for observations on GDFP and date / venue for focus group discussion meetings. Similar planning meetings were also held with other stakeholders in the case study.

The employer also facilitated the researcher with funding, transport and the driver.

3.4 Sample Selection and size

The research population used in this study was smallholder dairy farms, owning 1-4 cattle. The criteria for inclusion were farms supplying milk through the formal chain only and those supplying through the informal chain only. Thus a stratified sample size of 40 (20+20) farms was chosen purposely due to logistical reasons and limitations of the short field study time. It was felt that the sample would be sufficient for the study and

address the research objective. The results of the study from this sample would provide an indication that can be generalized to the research population.

3.5 Data collection

Desk study

Secondary data was collected by going through relevant documents to collect literature on use of GDFP in assurance of milk quality and safety; current situation on the dairy sub sector; information on the quality of milk marketed by smallholder farmers in Kenya; formal and informal marketing channels in Kenya and Asia; as well as cases from other countries where Good practices are successfully used by dairy farmers.

3.6 Data collection instruments

i) A checklist to be used for farm observations was developed and pre tested in order to gather quantifiable data. The pre testing was to ensure that all items and questions were clear and that all the interviewees will understand them the same way and that the researcher would get the correct answers which can be analyzed.
A semi structured questionnaire with a checklist on GDFP (FAO, 2004; PTC+ manual, 2009) was used to collect data through interviews and personal observations on the two types of farms.
ii) Specific checklists were also developed to collect data from focus group discussions with farmers, cooperative, processor, Kenya dairy board, traders and consumers

3.7 Survey

40 farms were randomly selected and divided in two clusters of 20 each.

- 20 farms marketing milk through the formal chain (cooperative, processor)
- 20 farms marketing milk through the informal chain (direct to consumers, mobile traders, retailers).

Data collection was carried out by the researcher with the assistance of CBO coordinator and leaders of specific farmer organizations who introduced me to the farmers.
The specific areas observed included: animal health and use of veterinary medicines; animal welfare; feeds and water; milking hygiene and environment.

Table 3.1: Stratification of farms

	Thigio-limuru	Kerwa-Limuru	Thogoto-Kikuyu	Total
	(n)	(n)	(n)	(n)
Formal chain	7	7	6	20
Informal chain	7	7	6	20

3.8 Focus group discussions

Focus group discussions (Pretty *et al* 2002; Leeuwis, 2004) were conducted with farmers in the formal chains and also with those in the informal chain and were done in church compounds since these were centralized and provided serene atmosphere for discussions. The composition of the focus groups was mixed - male and female to ensure gender equity. Participants were selected from among those farms previously visited in the survey. The discussions were interactive and aimed at eliciting group experiences, perceptions and attitudes on GDFP (Kumar, 1993). The discussions focused on constraints faced by farmers in adopting the five elements of GDFP and their suggestions on strategies for improvement. To guide the discussions, a chairman to coordinate discussions and a secretary to write down the agreed issues were chosen from among the farmers. Flip charts were provided in which farmers indicated the constraints and solutions for improvement. Thereafter, the group secretaries presented the results in a plenary, as shown in table 4.2.

3.9 Case study

Case study involving key informant interviews with actors in the formal chain: Limuru dairy cooperative, Limuru milk processor and 2 actors in the informal chain: Traders, consumers and 1 chain supporter (KDB - quality regulatory body) was done to obtain overall picture / assess effect of inadequate GDFP on quality, how it affects marketing and strategies to enhance GDFP along the milk chain (triangulation). A checklist specific for each actor was used to collect data. Limuru dairy cooperative was included in the case study because farmers indicated facing problems of milk rejections.

Initially the researcher had planned a case study involving one trader. However, a decision was made following observations in the course of farm survey and when it also emerged during focus group discussions that the youth were not involved in primary production but in marketing of milk as will be discussed in the later chapters.

3.10 Data analysis

Quantitative data from the farm survey was analyzed using Descriptive statistics (SPSS). Since questions in the checklist were coded “yes” or “no” (nominal variable), the Pearson’s Chi-square test was used and, where the observed variables were ordinal, the Man Whitney test was chosen. These statistical tests were used to compare whether there is a difference between farms in the two chains in each of the GDFP variables at $p = 0.05$. If $P > 0.05$ it means there is no significant difference and therefore H0 is accepted whereas if $P<0.05$, there is a significant difference in the practices and H0 is rejected. In addition, the Spearman’s test was used to investigate two ordinal variables which are ranked i.e. to find out whether there is a correlation between level of education of farmers and the practices (variables) at $p=0.05$.

Data collected from case studies was qualitative in nature and analyzed using themes and concepts. Both the qualitative and quantitative results were used to compare practices in the two chains and to determine gaps and identify opportunities for intervention.

PESTEC tool was used to analyze the institutional environment - political, economic, social, technological, environmental and cultural factors, and how these forces impact on the Smallholder farmers and their practices.

SWOT tool was used to analyze the internal strengths and weaknesses, and external opportunities and threats of the smallholder chain. Value chain analysis was used to analyze smallholder milk chain, functions of various stakeholders and to determine opportunities for a systems value chain development.

3.11 Ethical issues

All the respondents participating in the farm survey and case studies consented to take part in the study after they were made fully aware of the nature, purpose and their role in the study through the letter from the researcher's employer, KARI, and during planning meetings by the researcher himself. They were also informed about the importance of managing GDFP at farm level and how this would benefit farmers through increased quantity and quality of milk, reduce milk rejections by the cooperative and processor, increase farmers' bargaining power and trickle down benefits to other actors in the chain. In order to prepare the participants in one of the areas in GDFP, a copy of the KARI extension brochure developed by the researcher titled, "How to avoid farm milk spoilage" was distributed to all the participants.

Many of the respondents were concerned that previous studies in the area were merely theoretical aimed at providing data to researchers and that the present study be extended into a practical implementation phase so that they could see the benefits. This aspect became a rallying point almost in every meeting. The researcher took up this challenge which is addressed later in this thesis (chapter 5.10).

Another ethical issue that was considered was care of participants by limiting the time for individual farm observations/interviews to maximum of 45 minutes; holding focus group discussions for maximum of two hours mid morning after milking and feeding cattle; and at a venue convenient to all respondents. A snack was also provided to participants after the focus group discussions

3.12 Strengths and limitations of the methodology

Changes in the methodology: Initially, the researcher had planned to hold Focus group discussion with farmers in the formal and informal chains on different days. However, this was not possible and instead a decision was made to hold the discussions together, with each group making its presentations separately on a flip chart.

Limitations of chosen research perspective: The research used farmers in groupings; however they tend to adopt same management practices than those who do not belong to any organization. Perhaps a later approach could have yielded different scenario.

Sample size: The sample size used in the study was small (due to logistic reasons); perhaps a larger sample size of farmers would have provided a more accurate picture, hence it may be possible that the data and subsequent information generated may not be a proportionate representation of the whole population.

Strengths: By comparing GDFP in two chains across three groups provides a generalized overview on smallholder management practices.

FGD provided a good platform to get a deeper understanding of farmers' perspective on constraints / solutions with possibility of adoption.

Personal observations on individual farms was important in evaluating management conditions in which dairy cattle are kept and useful in identifying gaps and opportunities for intervention.

Finally, by employing a survey and case study (Verschuren and Doorewaard, 2005), both the breadth (quantitative) and depth (qualitative) in understanding critical issues in the research study were obtained.

4.0 RESULTS

In this chapter, data collected from farm survey, Focus group discussions and case studies is presented and analyzed. Several methods and tools such as charts, tables and themes are used in the analysis.

Household characteristics of respondents: age, gender and level of education

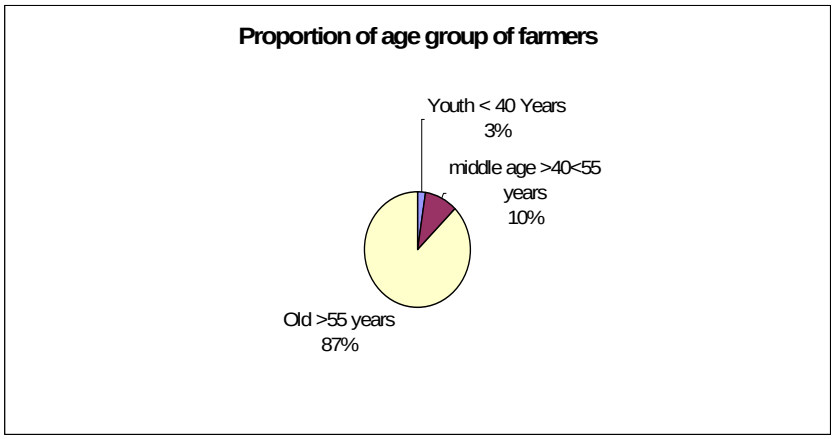

Fig 4.1: proportion of age categories of 40 farmers in study area.

Majority of respondents (87%) were more than 55 years old (retirement age in Kenya) while the youth accounted for only 3%. The mean age of the farmers was 57 years.

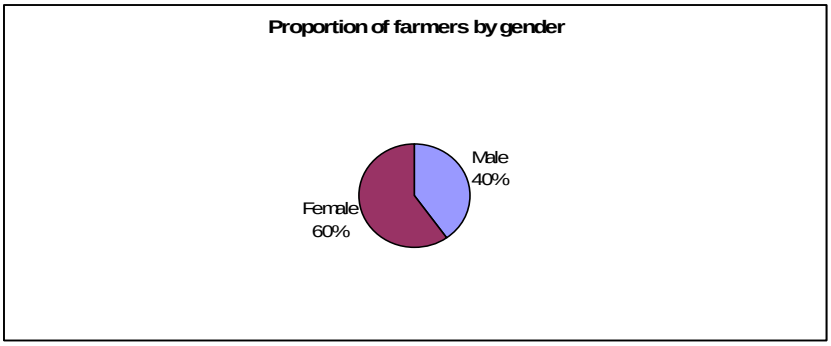

Fig 4.2: Proportion of dairy farmers by gender in study area

Most respondents (60%) were female while 40% were male.

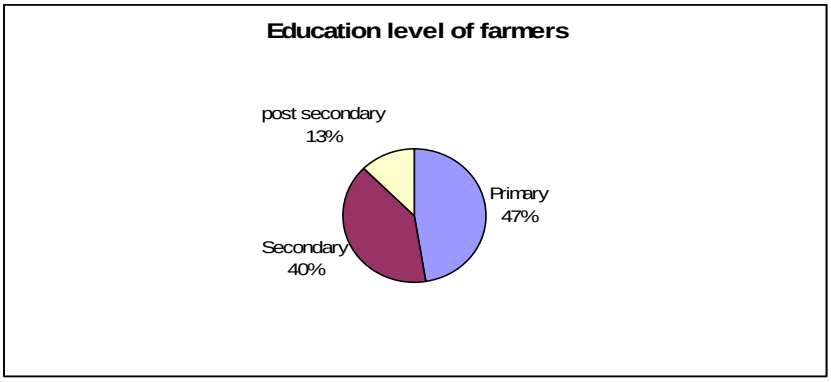

Fig 4.3: Educational level of farmers in study area

47% of respondents had primary level of education, 40% secondary, while only 13% had attained post secondary education.

a) Farm Survey results: Evaluation of GDFP

4.1 Current Status on Animal health: use of veterinary medicines

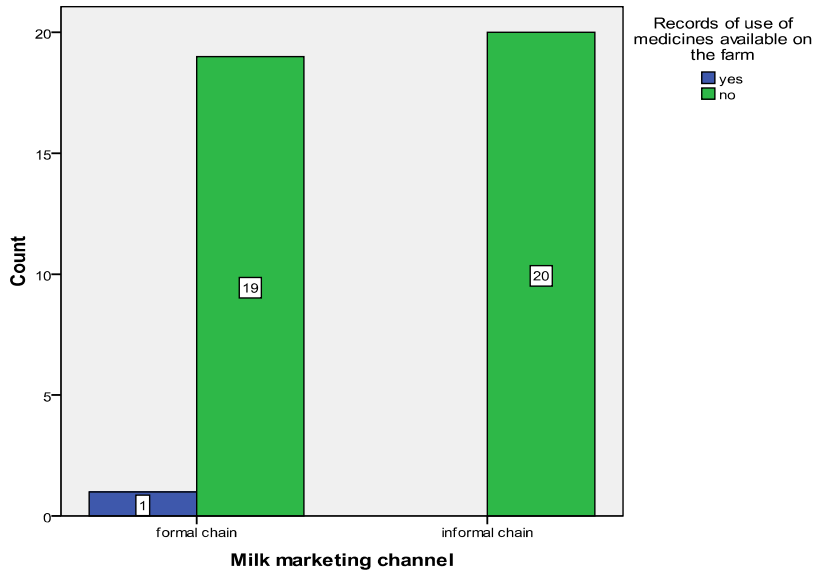

Figure 4.4: Records of use of medicines on farms in the formal and informal chains

The results show that all 20 farmers (100%) in the informal and 95% in the formal chains do not record use of medicines**.**

4.2 Current Status on Animal health: common diseases

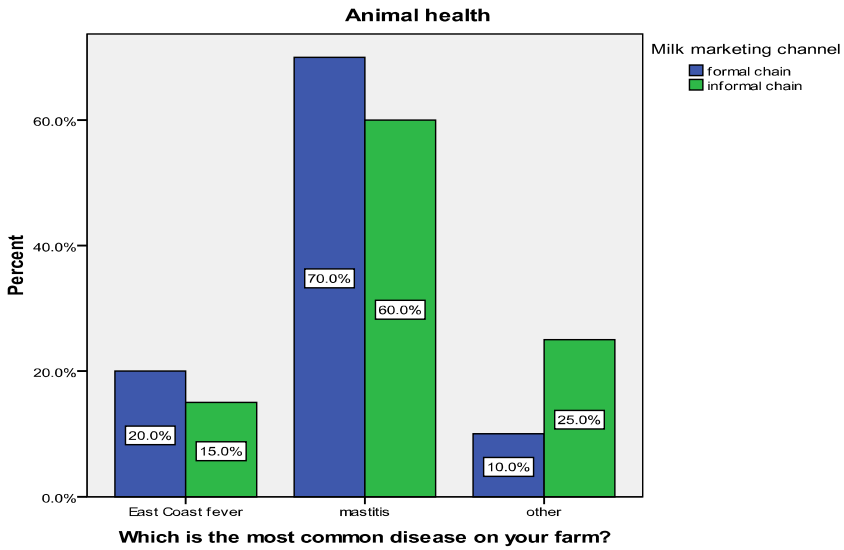

Figure 4.5: common diseases as perceived by farmers

The results show that mastitis is perceived by the majority of farmers in both the formal and informal chains as the most common disease.

4.3 Current Status on Animal welfare

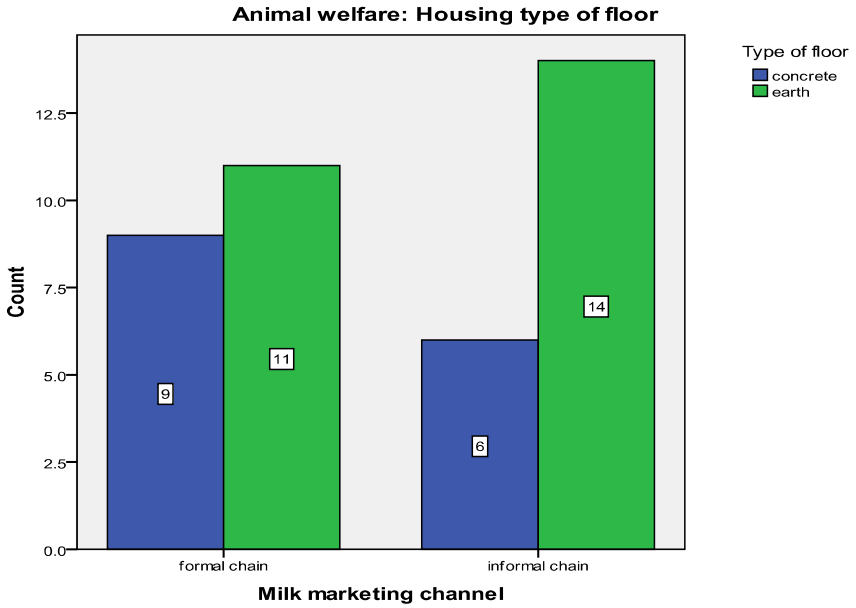

Figure 4.6: Cattle housing conditions

The results show 14 farms (70%) in the informal chain and 55% in the formal have earth floor houses for dairy cattle. However, there was no statistical difference at 5% level, (Chi square test, p=0.327) between the two types of farms. (Annex 1a)

4.4 Current Status on water sources

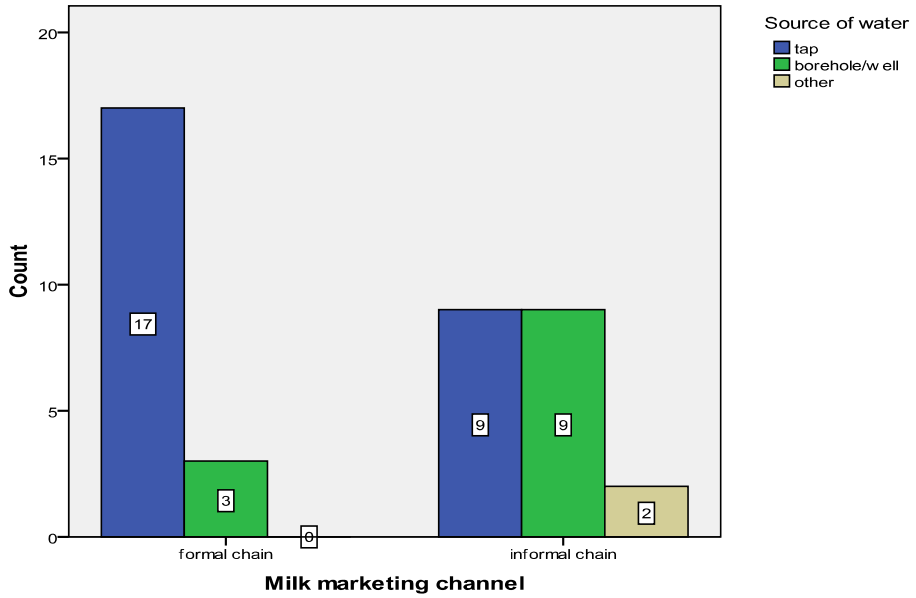

Figure 4.7: sources of water used by farmers

The results show 85% farms (n=17) in the formal chain and only 45% in the formal have tap water. There is a significant difference at 5% level, (Man Whitney test, p=0.007) between the two types of farms. (Annex 1b)

4.5: Current Status on Quantity of feeds

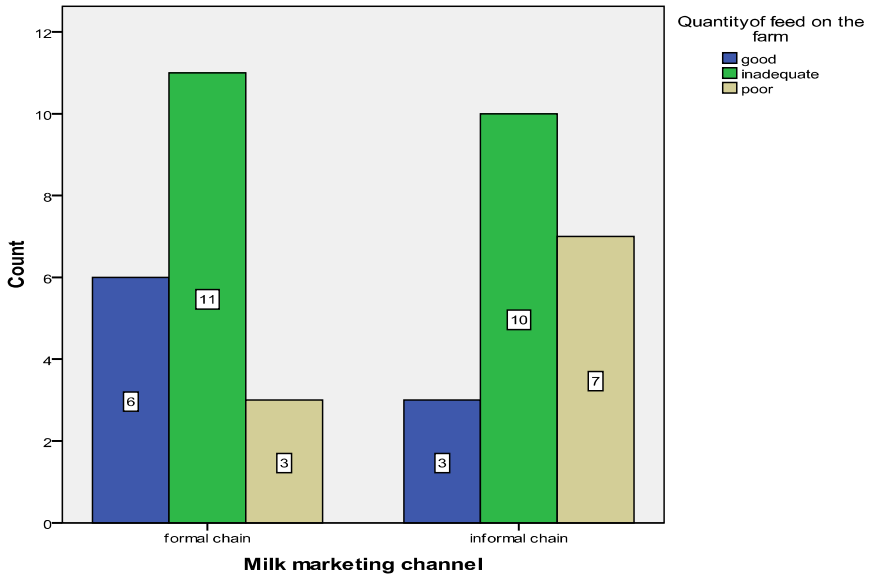

Figure 4.8: Quantity of fodder available at farm level

The results show 55% farms in the formal chain have inadequate quantity of forage while 30% feed good quantity. In the informal chain 50% have inadequate quantity while only 15% feed good quantity. Overall, there is no statistical difference at 5% level, (Man Whitney test, p=0.112) between the two types of farms. (Annex 1c)

4.6: Current Status on Quality of feeds

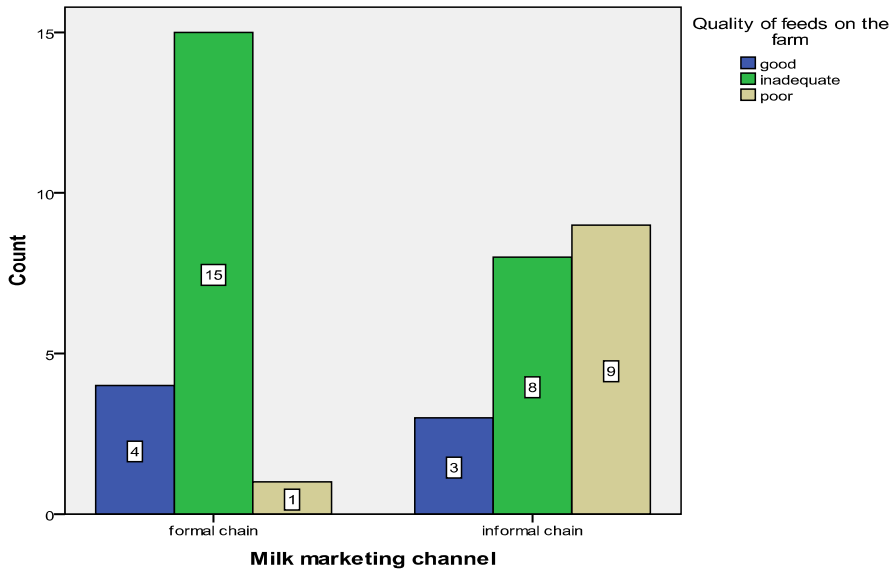

Figure 4.9: Quality of fodder available at farm level

The results show 75% farms in the formal chain (n= 20) feed inadequate quality of forage while only 20% feed good quality. In the informal chain 40% have inadequate quality while 45% use poor quality feed. Overall, there is a significant difference at 5% level, (Man Whitney test, p=0.025) between the two types of farms. (Annex 1d)

4.7: Current Status on Quality of commercial feeds

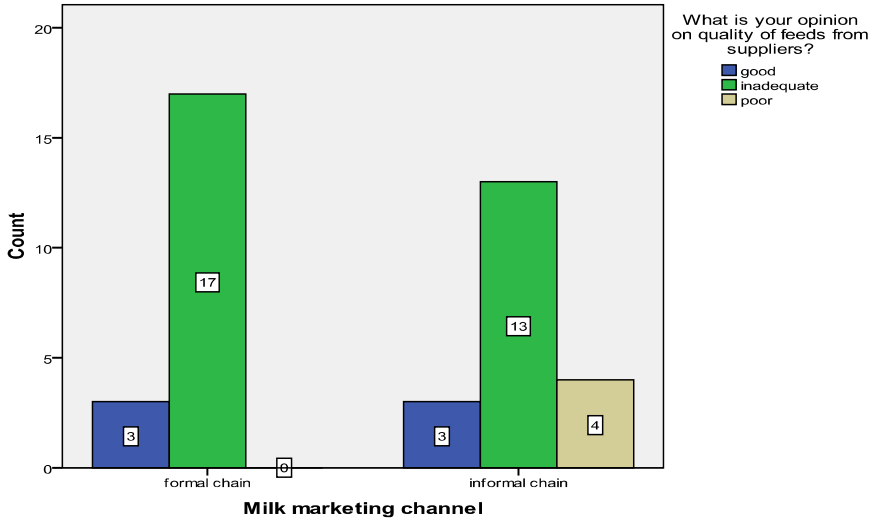

Figure 4.10: Farmer perceptions on quality of commercial feeds

The results show majority of farmers (85%) in the formal chain perceive commercial feeds are of inadequate quality whereas 15% feel it is good. In the informal chain 65% felt the quality was inadequate while only 15% felt it was good. However, there was no statistical difference at 5% level, (Man Whitney test, p=0.225) between the two types of farms. (Annex 1e)

4.8: Current Status on milking hygiene

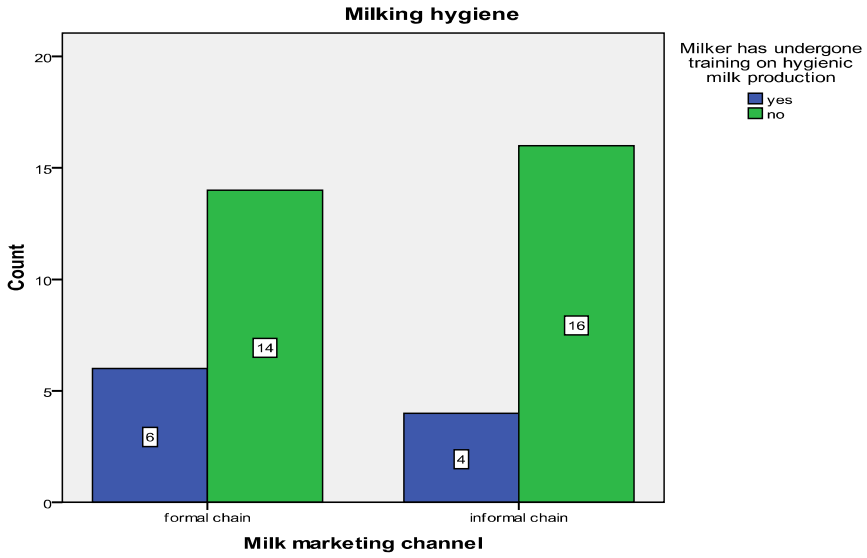

Figure 4.11: Training on hygienic milk production

The results show only 30% farmers in the formal chain have been trained in hygienic milk production while 70% have not. In the informal chain majority of farmers (80%) have not had any training in hygienic milk production. However, there is no statistical difference at 5% level, (chi square test, p=0.465) between farmers in the two types of chains. (Annex 1f)

4.9: Current Status on screening mastitis

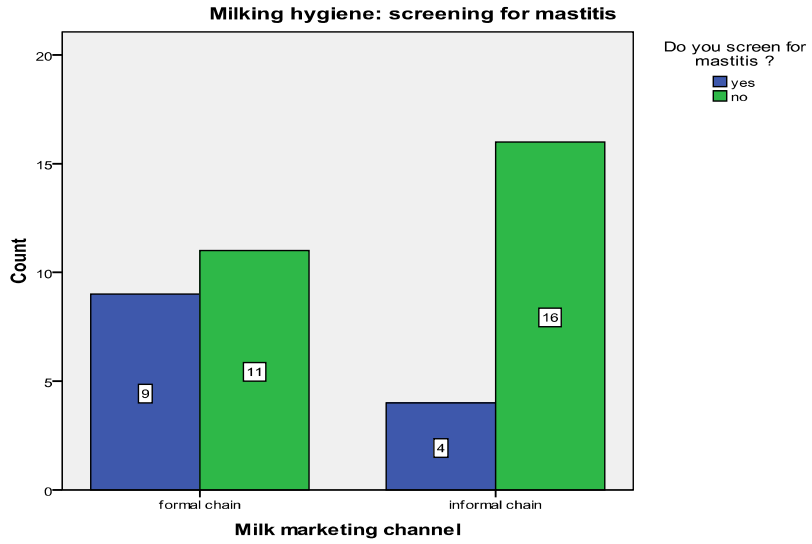

Figure 4.12: Screening for mastitis

The results show only 45% farmers in the formal chain check for mastitis before milking while 55% do not. In the informal chain only 20% check for mastitis while the majority of farmers (80%) do not. However, there is no statistical difference at 5% level, (chi square test, p=0.091) between farmers in the two types of chains. (Annex 1g)

4.10: Current Status on Environmental management

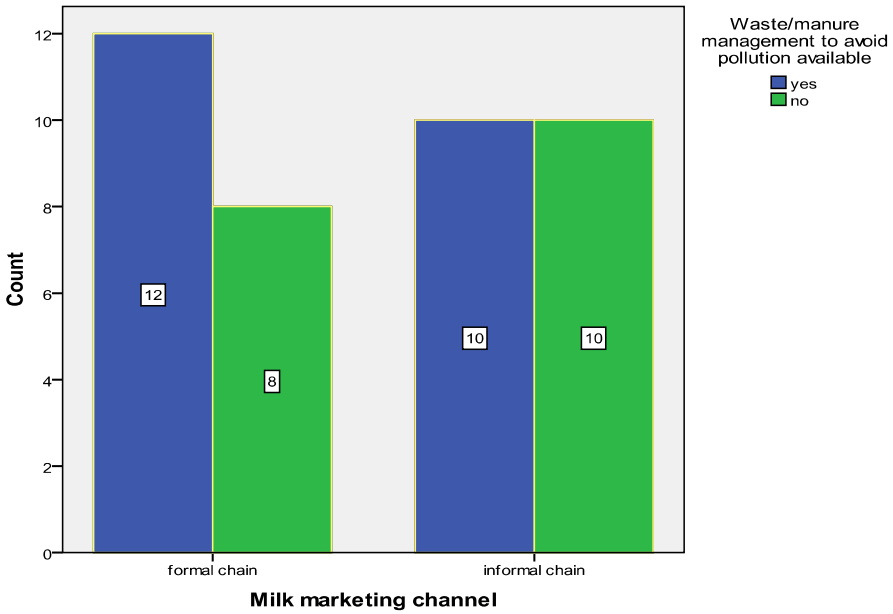

Figure 4.13: manure and waste management

The results show 60% farmers in the formal chain have good manure management whereas in the informal chain 50% manage manure properly. However, there is no statistical difference at 5% level, (chi square test, p=0.525) between farmers in the two types of chains. (Annex 1h)

4.11: Current Status on Documentation

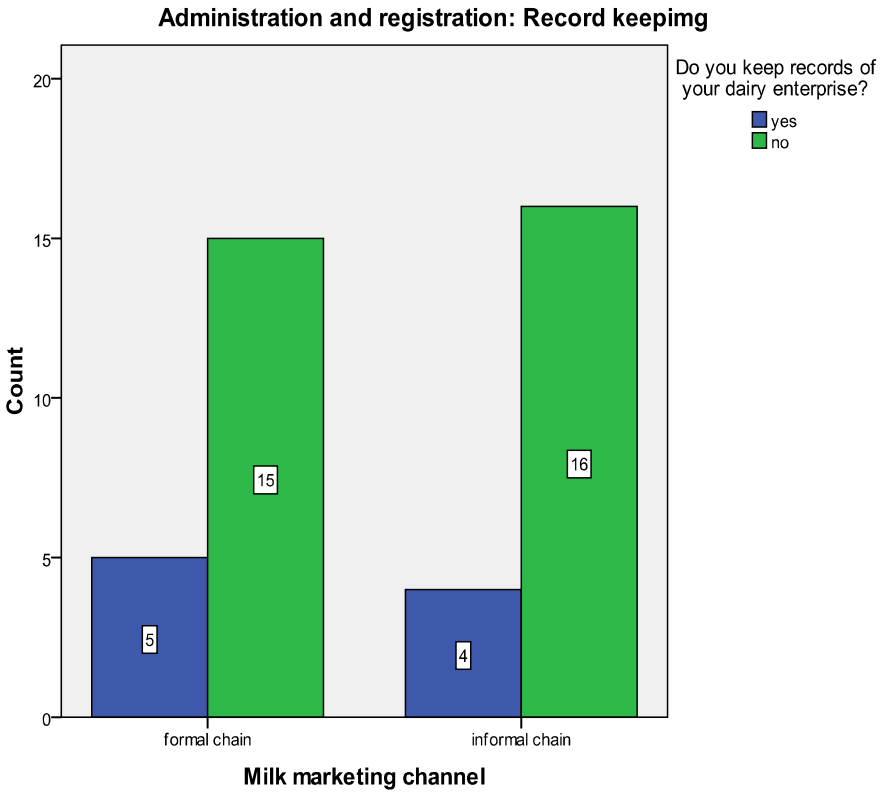

Figure 4.14: Record keeping
The results show 75% farmers in the formal chain and 80% in the informal chain do not keep farm records.

4.12 Summary of variables studied

Table 4.1: Data showing results of GDFP Variables

Variable	Formal chain				Informal chain				Overall		Statistical Test	p-value
	Yes (n)	%	No (n)	%	Yes (n)	%	No (n)	%	Yes %	No %	5%	
1. Animal health												
1.1 Biosecurity measures present	11	55	9	45	13	65	7	35	60	40	X^2	0.519
1.2 Occurrence of common diseases on farm												
• ECF	4	20			3	15			17.5	82.5	X^2	
• Mastitis	14	70			12	60			65	35	Not reliable	-
• Other	2	10			5	25			17.5	82.5		
1.3 Records use of veterinary medicine	1	5			-	-			2.5	97.5	X^2 Not reliable	-
2. Animal welfare												
Housing: type of floor												
• Concrete	9	45	11	55	6	30	14	70	37.5	62.5	X^2	0.327
• Earth	11	55	9	45	14	70	6	30	62.5	37.5		
3. Animal feeding/water												
3.1 Source of water												
Tap	17	85			9	45			65	35	MW	0.007
Borehole	3	15			9	45			30	70		
Other	0	-			2	10			5	95		
3.2 Quantity of feed												
• Good	6	30			3	15			22.5		MW	0.112
• Inadequate	11	55			10	50			52.5			
• Poor	3	15			7	35			25			
3.3 Quality of feed*											rho	0.029*
• Good	4	20			3	15			17.5			
• Inadequate	15	75			8	40			57.5		MW	0.025
• Poor	1	5			9	45			25			
3.4 Quality assurance of commercial feeds												
• Good	3	15			3	15			15			
• Inadequate	17	85			13	65			75		MW	0.225
• Poor	0	0			4	20			10			
4. Milking hygiene:												
4.1 Milker has undergone training	6	30	14	70	4	20	16	80	25	75	X^2	0.465
4.2 screening for mastitis before milking	9	45	11	55	4	20	16	80	32.5	67.5	X^2	0.091
5. Waste/manure management available	12	60	8	40	10	50	10	50	55	45	X^2	0.525
6. Farmer keeps farm records	5	25	15	75	4	20	16	80	22.5	77.5	X^2 Not reliable	-

Legend: X^2 = Chi square test
MW = Man Whitney test
* rho = Spearman's rho

The survey results in table 4.1 from Chi square and Man Whitney tests indicate that except for quality of feeds (P<0.05) and source of water (P<0.05), there was no statistical difference in other variables between farms in both chains as the p value was more than 0.05. Spearman's rho test shows there is a significant correlation (P< 0.05) between level of education and quality of feeds used on the farm.

4.13 Focus Group Discussions with farmers

Table 4.2: Constraints that prevent farmers from adopting GDFP and proposed solutions

GDFP	CONSTRAINT	PROPOSED SOLUTION
1. Animal health/Use of veterinary medicines	Lack of skills in diagnosing diseases e.g. mastitis, East coast fever; pneumonia Use of less qualified health providers who use medicines not according to prescriptions but on commercial basis. Inadequate extension services. Expensive drugs.	Farmer trainings /seminars by KARI. Laboratory facility for diagnostic research services.
2. Animal welfare (Housing)	Lack of knowledge on effect of proper animal housing on cow welfare/production. inadequate incomes from dairy hence not able to invest in building cow shed.	Farmer training/provision of standard housing plan by MOLD, KARI. Linkages to micro credit institutions.
3.0 Animal feeding/water	Expensive / Insufficient water services in the area.	Improved water supply by local government.
3.1 water	Lack of water storage facilities. Frequent drought.	Drilling of more boreholes with clean water. Training on Water harvesting technology by NGO/private sector. Micro credit to buy storage tanks. Forage conservation skills
3.2 feeds (roughage)	Zero-grazing on small plots not sufficient for forage cultivation hence underfeeding. Lack of knowledge on better forage species such as Napier grass. Poor preservation of forage. Lack of knowledge/skills on how to feed dairy cows.	Advisory services On Farm trainings/ supply of good quality seeds, forage species, legumes Home made ration technology GMP policy for feed manufacturers. Inspection for quality assurance
3.3 Feeds (commercial)	Frequent drought causing insufficient forage. High cost of feeds compared to milk price Poor quality (sub standard) feeds. Different brands of feeds confusing farmers	Feed analysis laboratory to assist farmers verify quality

4. Milking hygiene:	No separate milking area Not aware of sub clinical mastitis. Lack of cow side testing kit Use of one towel for udder cleaning Improper milk utensils/ cleaning procedures	Farmer trainings on hygienic milk production. Cow side test for detection of sub clinical mastitis by KARI.
5.Waste/ manure management	Lack of knowledge on manure use /storage /disposal. Distant transport of manure to hired plots	Training on use of manure for biogas production for domestic use by Private sector. Micro credit to buy donkeys/carts to transport manure and forage.
6. Record keeping	Lack of knowledge on types and importance of farm records	Seminars /workshops on record keeping, farm management.

Other issues:

1. Channel choice: Advantages and disadvantages of formal and informal marketing channels as perceived by farmers

Channel	Advantages	Disadvantages	PROPOSED SOLUTION
Formal marketing through cooperative	• Consolidated payment • Access to inputs such as feeds, extension • Farmers are more organized for collective action	• Low price to farmers while cooperative sell to traders at very high price • Corruption/ mismanagement • Political interference • Delayed payments • Walk long distances to collection centres Milk rejections	• Price increase • Regular payments • Training on quality/ good dairy practices • Payment of quality premiums on milk
Informal marketing through traders	• High price. • Cash payment. • Collect milk from homesteads. • Employment opportunities for youth.	• Opportunistic behavior - lack of price stability. • Risk- Traders sometimes disappear without payment- lack of trust • Low quality - adulteration/ mixing of evening and morning milk	• Farmer organizations-trader cooperation. • Traders seminar on marketing, hygiene milk handling

2. Reasons why the youth are not involved in dairy farming	**Proposed solutions**
Lack of interest.	Workshops /seminars targeting youths.
Negative attitude towards dairy as dirty work.	High price of milk will act as incentive.
Lack of capital to start dairy farm.	Parents to motivate the youth.
No land of their own.	Access to credit - youth entrepreneurship fund for dairy farming.
Failure of parents to pay them when they work on the farm.	Parents to be educated on the need for farm succession planning. / management
Low incomes from milk enterprise.	
Some youth generally lazy.	

b) RESULTS OF CASE STUDIES

These section summaries the results of the case studies on GDFP among selected actors in the formal and informal chains

Table 4.3: ***Effect of inadequate GDFP on the formal and informal chain actors***

ACTOR	INTEREST	COMMON PROBLEMS WITH MILK FROM FARMS	WHAT NEEDS TO BE DONE	BY WHOM? (STAKEHOLDER)
Limuru Dairy Farmers Co operative	Is one of the oldest dairy cooperatives in Kenya. Has 9000 members majority of whom are smallholders, but only 4000 are active. Collects milk from 31 milk collection centres (MCC) and supply to limuru processor. Has capacity of 45 000 litres but receives only 25000 litres per day from MCC. Pays shs 23 per/litre. Payment system based on quantity	Physical dirt; mastitis incidence of about 60%; chemical residues; Milk rejections per day: 100 litres dry season, 1000 litres wet season; inadequate quantity from smallholder farms	Farmer training: i. hygienic milk production ii. nutrition- fodder technology at farm level iii. general management iv. agri business other interventions v. feed analysis or start own feed manufacture vi. cold chain at MCC: it takes 3-5hours to collect and deliver milk to processor vii. Mastitis lab for SCC monitoring, pathogens, drug residues, pen side test viii. Stocking of Cooperative shop ix. Policy issues; standard of feeds, coop Act - political interference in elections x. Breed improvement Partnership: extension activities by coop constrained due to problems that need multidisciplinary approach at farm level and lack of finances / facilities.	i. Cooperative in partnership with other stakeholders ii. Cooperative, resource organizations iii. Farmers, coop iv. financial institutions, v. Universities, KEBs vi. Coop, stakeholders, dev partners vii. KARI, DVS, COOP, viii. Coop/ private sector ix. Coop, MOLD, KDB, KEBS, AKEFEMA x. Coop to arrange with financial institution to source cows for members to repay through milk
Limuru Milk processor	Is the fifth largest processor in Kenya with capacity of 60000/day but receives only 25000 litres. Produces and Supplies pasteurized fresh milk, fermented milk, yoghurt	Inadequate quantity; Presence of residues, high acidity, and long incubation periods for dairy products: yoghurt, fermented milk; rejects about 1000 litres of milk during rainy season.	i. Improve quality of milk at farm level. ii. Quality assurance of commercial feeds. iii. Payment on quality – review old policy which based payment on quantity iv. Traceability of milk through farmer	i. Partnership between coop/stakeholders. ii. Coop, MOLD, KDB, KEBS, AKEFEMA iii. stakeholders in dairy sector iv. KDB, Coop

			accreditation	
Milk traders	Milk marketing is done by the youth registered by KDB. Source milk from smallholders and supply to consumers / retailers in Nairobi. Quantity purchased per day 100 litres. It takes 45 minutes by motor bike or 2 - 3 hours to deliver milk to consumers.	Traders use lactometers to test milk and usually find adulteration, clotting, physical dirt, mixing of evening and morning milk. Post harvest loses when milk is not sold.	i. Milk preservation technology at farm level ii. Farmer training Other interventions • Priority for youth to improve quality: Cool boxes • Transport upgrade from bicycles to motor cycle	I & ii. Stakeholders /KARI linkages to private sector
Consumer	Buy milk from trader for consumption – in tea or for children nutrition. Interest in buying quality milk and are prepared to pay higher price but less than that in the supermarkets	Consumer tests milk through visual inspection and boiling and sometimes find adulteration	Training farmers / traders	
Kenya Dairy Board (KDB)	Regulatory; certification, licensing, capacity building and market promotion. Inspection of farms - challenge is numerous smallholder producers. Quantity of milk produced at national level 40 billion kg (2007),	• High bacterial count of raw milk • Lack of cold chain when milk leaves farm such that even if milk is pasteurized, final product still has high bacterial counts • Rejection, loses at national level • Nationally Post harvest loses 95milliom kg/yr • Low competitiveness of milk • Limited knowledge & skills on GDFP	Training at farm level Policy and regulation to reform the dairy Act Improve quality of commercial feeds Enforcement of regulations Motivation of farmers through price increase and payment of quality premium	MOLD/KDB/KARI/processors Stakeholders Government, KEBS, AKEFEMA code of practice. KDB inspection of farms Stakeholders in dairy sector

5.0 DISCUSSION

The main objective of this study was to compare and identify gaps on Good Dairy Farming Practices (GDFP) among smallholder farms marketing milk through the formal and informal chains in order to improve the quality of milk.

This chapter gives a general discussion on GDFP themes covered in this study; constraints and factors influencing adoption; effect on the dairy chain; and feasibility for implementation of a proposed intervention plan.

5.1 Evaluation of Household characteristics / Farming system on GDFP

The vast majority of farmers (87%) in this study were more than forty years old with a mean age of 57 years (fig 4.1). Incidentally, the retirement age for the labor force in Kenya is 55 years. The results seem to indicate that primary production is mainly carried out by elderly people as the youth are rarely visible. This observation raised the curiosity of the researcher to probe the reasons for this situation. It emerged during the focus group discussions with the farmers that reasons why the youth lack interest in dairy farming include: attitude towards farming as dirty work, low income from dairy enterprise, lack of start-up capital, no land ownership and failure by parents to pay them when they work on the farm. Indeed, during the case study with mobile traders (all of them youth), it was evident young people are involved in the next level of the chain i.e. marketing of milk. This scenario raises two fundamental issues: first, implications of the generational gap at farm level in terms of succession and efficiency, given that all farms practice zero-grazing system in which fodder (Napier grass, crop residues) comes from outside the farm and manure from cattle used to fertilize this forage has also to be transported. Secondly, the results suggest that the target group for farm level interventions, especially capacity building of farmers, may rightfully focus on older people. This scenario is also similar to major dairy producing countries such as the Netherlands, very few youth are involved in dairy production (Personal experience) and the reasons are similar to the Kenyan case.

The fact that there were more female (60%) than male farmers (40%) corroborated previous studies which have shown that women are involved more in farm activities such as feeding, milking (Mullins, 2005). Again, it is argued here that targeting of GDFP interventions especially on feeding and milking hygiene could focus on mainly women.

Slightly more than half of the respondents (53%) had at least secondary and post-secondary level education. The level of education had no influence on channel choice, but was significantly ($P<0.05$) correlated to the quality of feeds (table 4.1). This finding indicates that channel choice is determined by fundamentals indicated by farmers during the discussions as shown in table 4.2, while farmers with higher level of education recognize the important role of quality of feeds.

5.2 Evaluation of Animal health management and use of veterinary medicines

Mastitis was the most common disease cited by 65% of farmers (n=40) in both chains (table 4.1). This may be due to the poor housing conditions observed during the survey as majority of animal sheds had no concrete floor. Indeed from the case study, the limuru dairy cooperative extension office reported a mastitis prevalence rate of 60% on smallholder farms supplying milk to the cooperative (table 4.3). Mastitis is a problem in zero-grazed dairy herds in Kenya (Shitandi *et al*, 2004; Muchirii, 2007) and especially in Kiambu district (Omore, 1996; DVS annual report, 2006). The type of mastitis reported by both the farmers and extension office is the clinical type which has obvious signs such as abnormal milk, udder swelling or tenderness. However, they are not aware of

sub clinical mastitis which has no obvious signs. Several studies have reported a high prevalence rate of sub clinical mastitis on smallholder farms (Kivaria, 2006; Dego, 2003). The effect of mastitis on the dairy chain in Kenya is enormous: high bacterial counts in milk samples as recently reported by Omore (2005), effect on processed dairy products - yoghurt, cheese, fermented milk as indicated by Limuru processor, non competitiveness of Kenya's dairy products as indicated by KDB in this study (table 4.3). There is therefore need to train farmers on detection and control of sub clinical mastitis. This aspect is addressed in an implementation plan later in this chapter (5.10a).

On the use of veterinary medicine, all farmers (100%) in the informal and 95% in the formal chains did not record use of medicines on their farms. This may be due to the fact that most farmers rely on private animal health providers for veterinary care and hence see no need of maintaining records. As discussed before in this study (chapter 1 and 2), the presence of antibiotic residues in marketed milk poses serious safety concerns (Omore, 2005; Muruiki, 2003). Non availability of records on use of medicines means that milk containing residues cannot be traced to the farm of origin. Safety, quality and traceability issues have become important in global markets and food supply chains (Reuben et al 2007). Overall, there is no statistical difference (p=0.291) in animal health management between farmers in the two chains. The findings in this study suggest that there is need to train smallholder farmers in both the formal and informal chains on animal health management and proper records on use of medicines.

5.3 Evaluation of Animal welfare: housing conditions for dairy cattle

The results of this study suggest that there is no statistical difference (p=0.327) in housing conditions for dairy cattle between the two types of farms. Only 45% of the farms in the formal chain and 30% in the informal chain have concrete floor while 70% and 55% have earth floor houses in the informal and formal chains respectively. These findings differ from Kivaria (2006) who reported that 76% of farms had concrete floor in Dar es Salaam region. The good practice on animal welfare is that animals producing milk should be kept free from discomfort and in good sanitary conditions (FAO, 2004). Observations revealed that on most farms, animals sleep on muddy floors and in the rainy season the situation may get worse. Dirty cow environment is not only an infringement on cow welfare; it has ramifications throughout the chain due to the inevitable physical and microbiological contamination of milk. The large quantities of milk rejections by the co operative and processing plant reported in this study (table 4.3) imply that smallholder farmers are losing cash income as a result of poor animal housing.

During the focus group discussions, farmers indicated two constraints: lack of knowledge on effect of housing on milk quality and inadequate incomes to re invest in building proper cow shed (Table 4.2). I would agree with the former since even in some of the affluent households dairy cattle were kept in unsanitary conditions, reflecting both lack of knowledge and cultural attitude towards animals.

These findings indicate that housing is one of the most important gaps on smallholder farms, and there is need to train and supply farmers with proper designs for dairy cattle sheds and link them to micro credit since with meager resources priority is directed towards human rather than animal welfare.

5.4 Evaluation of Milking hygiene practices

In this area, two aspects investigated included whether the milker has undergone training on hygienic milk production; and secondly, whether screening for mastitis is done before milking. The study found that in only 30% of farms in formal channel and 20% in the informal, milkers had received training on milk production. Statistically, there

was no difference in the two types of farms (P =0.465) as shown in table 4. 1. These results suggest that majority of farms (75%, n=40), may be having poor milking hygiene practices due to lack of training. This is likely to affect efficiency in other aspects of GDFP as already discussed. One of the mandates of KDB is capacity building and certification of dairy farms with the objective of improving the quality and ensuring traceability of milk. None of the farms in this study is accredited. The large number of smallholder farmers in the country (more than 625 000) far out strips the capacity of KDB (see table 4.3). However, organized farmer groups, as in this study, can be able to access specific training from service providers on hygienic milk production through the training-of-trainers (TOT) approach (Pretty et al 2002).

As regards screening for mastitis, 45% of the farmers in the formal and only 20% in the informal chain check for mastitis before milking, though statistically there were no significant difference (p=0.091). Overall, 67.5% of the farms failed to check for mastitis. These findings confirm the complaints from the cooperative, processor and other stakeholders as indicated before in this chapter (5.2). Kivaria (2006) reported similar results (71%) from smallholder farmers in the Dares salaam region. From these findings, there is urgent need to have a mastitis control program on smallholder dairy farms. This aspect is addressed later in this study in an implementation plan (5.10a).

5.5 Evaluation of Animal Feeds and water

a) Source of water for dairy cattle

The study revealed that majority of farmers (85%) in the formal chain use tap water compared to 45% in the informal chain. There was a significant difference (p= 0.007) between the two types of farms. This differences may be due to the fact that in the formal chain milk is tested for quality at the Collection centres (MCC) whereas in the informal, quality checks are rarely done. From the discussions (table 4.2), farmers mentioned lack of water storage facilities, insufficient water supply by the local council, electricity interruptions and frequent drought (such as one experienced during this study) as affecting water supply for dairy cattle.

b) Quantity of forage available on the farms and fed to dairy cattle

From the study, the quantity of forage fed to dairy cows by farms in both chains was inadequate (55% formal and 50 informal), though there was no significant difference between the farms (p=0.112). This finding agrees with previous work carried out in Kiambu district by Mbugua (2006) and Omore (1994), and on smallholder farms in Nakuru district of Kenya by Lanyasunya (2006). The average land holding in the study area is 0.5 ha and this is hardly adequate to sustain crop and forage production to satisfy both human and livestock needs. Forage, which consists of cut-and-carry Napier grass and crop residues, is cultivated off-farm on mostly rented plots. Frequent drought further diminishes the quantity of feed available for dairy cattle. Underfeeding therefore leads to the small quantities of milk produced -average 7.5 kg/cow/day (Omore at al 1996b; District livestock office, 2008). There is need to address inadequate quantity of roughage on smallholder farms by training farmers on fodder preservation technologies such as silage making (Chamberlain and Wilkinson, 2002), and alternative forage species like fodder trees such as *caliandra* and *leucaena* which do not require much land.

c) Quality of forage available on the farms and fed to dairy cattle

The study also revealed that there was a significant difference p<0.05) in the quality of feeds (forage) used between farms in the formal and in the informal chains, although overall, on 57.5% of the farms (n=40) the quality was inadequate. Similar results have been reported in the area by Mbugua (2006) and Omore (1994). The quality of available fodder such as crop residues e.g. maize stovers, could be improved through treatment

with molasses and cultivation of tubers such as sweet potato vines which is rich in energy nutrients like starch and sugar (Ruminant Nutrition manual, larenstein)

d) ***Quality of feeds from commercial suppliers***

75% of farmers from both chains (n=40) perceived the quality of commercial feeds as inadequate (p=0.225). During the discussions farmers described most feeds purchased from agro veterinary stores as sub standard. Farmers are further confused by the many different brands available in the market. Similar observations were made by other stakeholders including the Limuru dairy cooperative (which has had many complaints with manufacturers) and the Kenya Dairy board.

As already discussed, a recent study carried out by the Kenya Agricultural Research Institute (KARI), Nairobi University and the ministry of livestock found that 50% of commonly used feeds for dairy cattle - maize germ, cotton seed meal, wheat bran were contaminated with aflatoxins. These contaminants have been demonstrated in milk samples collected from actors in both the formal and informal chains including supermarkets and pose serious health implications on livestock and human health (Mwangi, 2007; www.thecattlesite.com/news). Since the era of liberalization in 1990s, many private millers emerged in Kenya and there is need for quality assurance, surveillance and monitoring of feeds available in the market by industry stakeholders. Availability of laboratories where farmers can take feeds for analysis could help enhance the quality of feeds fed to dairy cattle. That way, only feeds from Good Manufacturing Practice (GMP) certified millers would guarantee the standards of safety, quality and traceability required in GDFP (FAO, 2004, PTC+ training manual, 2009)

5.6 Evaluation of Environment: waste and manure management

The study found no significant difference (p=0.525) between farms on manure and waste management. Overall, 55% of the farms (n=40) had a system available for manure collection and storage. It was observed that on most farms manure is used to fertilize plots for crop and fodder production, as also reported by Lekasi (2001). Another useful approach in ensuring that dairy farming is environmental friendly would be to harness manure for biogas production to generate fuel for cooking and lighting thereby saving on power costs and time spent by women searching for fuel. Indeed, this aspect was raised during the focus group discussions (table 4.2).

5.7 Evaluation of Record keeping

The results obtained in this study showed that majority of farmers (78%, n=40) did not keep records of their dairy enterprises. This is inspite of the fact that 53% had secondary and post secondary level of education (section 5.1 above and fig 4.3). These results are similar to those obtained by Bebe et al (2003), but in contrast to that of Kivaria (2006) who found that 76% of smallholder farms in Dar es Salaam kept farm records. During the discussions farmers acknowledged that they lacked skills and knowledge on importance of keeping farm records. From my observations, smallholder farmers did not seem to take dairy farming as a business activity, but rather as one of the farm enterprises for subsistence and provision of immediate household cash needs. Good record keeping is not only essential for traceability in supply chains for GDFP (KIT et al 2006), but a useful decision-support tool for monitoring and evaluation of farm enterprises.

5.8 Constraints / Factors influencing adoption of GDFP

a) PESTEC (G)- These are political, economic, social, technological, environmental, cultural and global factors in the general environment, which are supportive, or non

supportive and present constraints or opportunities to the smallholder's dairy farming. PESTEC tool is used here to analyze how these factors impact on smallholder farms.

Political factors

Government policy influence through a pro poor dairy development approach in which programmes in the dairy sector focus on food security; increasing productivity; employment creation both on farm and along milk marketing channel. Following liberalization in the 1990s, the informal chain emerged as well as many private players in the formal chain. Thus in "a free for all" market, it became impossible to monitor quality or emphasize GDFP, inspite of the existence of KEBS standards and code of practice for production of milk. The control of cooperatives under the cooperative development Act, under which all cooperatives fall has not allowed sufficient farmer control. Inefficiencies and mismanagement have led most farmers to look for alternative outlets for their milk.

Agriculture is said to be the mainstay of the country's economy (26% GDP) yet public financing (budgetary allocations) has been declining over the years.

Economic factors

A liberalized free market is the driver for smallholder sector. Farm gate price per litre of milk is low and has remained stagnant compared to the ever rising cost of inputs such as feeds. Thus farmers are unable to reinvest the meager earnings on the farm.

Milk payment system in Kenya is based on quantity; hence there is no incentive to produce quality milk. Access to credit is another factor influencing GDFP

Social factors

Decreasing land sizes and land ownership in smallholder systems. Growth in urban populations and low incomes among consumers who demand low price.

Generational gap - old people, not keen on adopting modern technologies, are involved in production on the farm while most youth seek alternative employment.

Technical factors

Lack of technical, general management practices in animal health and production due to inefficient / weak extension services and also over emphasis on breed improvement.

Lack of entrepreneur skills limits farmers from commercialization.

High cost of investment: inputs such as feeds, breeds, compared to low production of cows hence revenue not sufficient to re invest.

Most smallholders are merely actors in supply chains and therefore lack market information.

Lack of quality control and assurance systems among the dairy sector actors and service providers such as Good Veterinary Practice (GVP), GDFP, GMP, Good Distribution Practice (GDP), Good Consumer Practice (GCP) (Luning at el, 2006). Both KDB and KEBS have limited capacity to enforce quality through monitoring and inspection.

Environmental factors

Frequent drought- affects water supplies, forage production and is a determinant of the seasonality of milk production.

Cultural factors

Attitude and behavior towards cattle influences prevailing animal welfare standards as discussed in this study. In most households, it is women who milk and feed dairy cattle, yet capacity building focus on men. Men also control incomes and make decisions on dairy farms. Most smallholder do not view dairy farming as a business

Global factors

The increasingly integrated global markets under the World Trade Organization (WTO) are creating opportunities for exporting dairy products (World Bank, 2008). However, stringent food safety and quality standards i.e. Sanitary and Phytosanitary (SPS), present a challenge to smallholders' participation in these lucrative markets. Recently,

EAC/COMESA defined Standards and quality certification required for trade in milk and dairy products in the region. Smallholder farmers can take advantage of this window of opportunity.

b) SWOT of Smallholder dairy sector

This is a strategic planning tool used to evaluate strengths, weaknesses, opportunities and threats

Table 5.1: SWOT analysis of smallholder dairy farms

Internal aspects	**External aspects**
Strengths	*Opportunities*
• Dominate production and control 80% of marketed milk • Provides nutrition and employment opportunities to may families along the chain • Gender empowerment; many women involved in the small scale sector • Supports many service provider enterprises	• Demand for milk that exceeds supply • Consumer preference for cheap raw milk • Support from Government and development agencies - transformation of agricultural sector from subsistence to commercialization. • Potential for regional markets in neighboring countries • Milk deficit in other areas of the country beyond milk producing regions • Rising human population demand for food
Weaknesses	*Threats*
• Quality control and management practices is limited • Lack of traceability of milk • Chain coordination and governance absent • Milk production follows seasonal fluctuation due to scarcity of fodder hence uuncertainties regarding quantities; quality; delivery conditions; prices • Dependence on producing and marketing raw milk alone instead of value addition • Low production of cows • Uneconomical smallholder units due to small land sizes	• Policy – Many obsolete pieces of legislation such as informal chain not recognized by Dairy Act • GDFP limits export market due to poor quality • High cost of inputs • Risk of Disease out breaks • Frequent drought • High media promotion of other beverages

5.9 Effect of inadequate GDFP on the dairy chain

As we have discussed before, the effects of inadequate GDFP on the dairy chain are enormous. Three areas can be distinguished:

Household / farm level

Reduced cattle productivity and production due to animal health problems and inadequate feeding which results to loss of incomes.

Post harvest loses as a result of milk rejections.

Farmers have no bargaining power either in the formal or informal chains.

National level

Safety, quality and traceability concerns.

High bacterial count and residues in milk affects processing of dairy products.

Rejection leading to loses at national level. KDB estimates Post harvest loses at national level to be 95 million kg/yr (Table 4.3). At the present price of shs 23/kg, the annual loses are about shs 2 billion (2 Million Euros).

International
Low competitiveness in regional and international markets due to low quality dairy products.

5.10 Feasibility for implementation of proposed intervention plan

The results obtained from the survey and case study suggest that the testing of milk by cooperatives, processor as well as traders has not helped to improve the quality of milk from smallholder farms in Kiambu West. It is argued here that building the capacity of smallholders to manage GDFP is a better strategy of improving quality.
This section therefore proposes an implementation plan reflecting on the results of this study. The concepts, theories and models which will be used include chain empowerment, value chain development; 3 Ps i.e. People, Profit, Planet and Project Cycle Management (KIT, 2008; KIT 2006; and GTZ, 2006).
During the course of this field research, stakeholders interviewed expressed their concern about frequent farm visits and interviews by different organizations curious only to obtain data, whereas their interest was practical solutions to problems and especially on how to access markets. Indeed for a long time, smallholder farmers have been passive participants in numerous donor funded projects without much impact. Why rising poverty levels and low agricultural production inspite of highly educated agricultural professionals in Sub Saharan Africa? There could be many reasons but one important explanation is lack of a shared vision with farmers in a Systems innovation (KIT, 2008, Senge, 1990).
The close interactive discussions with farmers in this study were an eye opener to me in the way stakeholders perceive outsiders, including KARI. Nevertheless, they were interested in the outcome of this study and one of them, the Limuru dairy cooperative, has already invited KARI to partner in building the capacity of farmers on GDFP (Annex 3a). This proposed plan is a response to the invitation.

5.10 a) Integrated GDFP approach through a holistic mastitis control program

As we have already discussed, animal welfare; feeding and milking hygiene are the most important gaps observed on farms in both chains. Targeting of this intervention will involve identification of domains where the probability of adoption is high and where promotional strategies can most effectively be focused. Impact is created when the intervention solves existing significant constraints faced by an actor(s) or creates opportunities along a specific chain.
For effective targeting of this intervention, four key questions require to be answered:

- Is there demand for the intervention in the area?
- Can the intervention work in this area?
- What is the likelihood of adoption?
- If the intervention is adopted, what impact will be achieved?

In addition, if the intervention is to develop a value chain, (Value chain development) the model needs to address critical issues of What, Why, How, Who and when? (Value links GTZ, 2006).
What? : After considering several options, selection and targeting of a holistic mastitis control program seems to be the most feasible alternative, and is based on the fact that it will entail an integrated approach in the management of all the other GDFP aspects.
Why a holistic mastitis control program?

- At farm level farmers lose income through milk rejections by cooperative and processor.

- The cost of treatment for clinical mastitis is estimated to be shs 4000 (40 euros) (Muchirii, 2007; Omore, 1996) per cow which is equivalent to 174 litres of milk. In addition, there is loss of revenue associated with discarded milk during the withdrawal period as well as extra labor.
- The Limuru dairy cooperative will benefit from increased volumes delivered and improved quality.
- The processor will benefit by producing and guarantee of good quality products to consumers.
- It is a strategic tool box consisting of seven tools that will enhance GDFP

How? : The Vision and Strategy is to empower farmers in the formal and informal chains to improve quality by implementing GDFP

Table 5.2: Proposed Tool Box (Intervention Plan)

How? Vision and strategy	***Who? Implementing actors / roles***	***When? Timeframe***
Objective: Empower farmers to control mastitis thereby improving quality	To start with 3 farmer groups (n=40) used in this research followed by a scaling up using trained group members as TOTs & exchange visits.	24 months
Planning meeting with stakeholders in the formal chain: Farmer groups, cooperative, processor and supporters i.e. KARI, MOLD, KDB and micro credit institution to discuss, build consensus and agree on the shared vision, roles and responsibilities.	Facilitator: NGO "Land O lakes"	I month
Specific activities using the toolbox: a)**Tool 1: Capacity building of farmers to recognize, detect and control mastitis -** (Theory, active experimentation, concrete experience, reflection)	Farmer groups /KARI / co operative.	1 week
• **Modules – Knowledge**: Theoretical learning including causes, risk factors, effect on production / supply chain.	Farmer groups /KARI / co operative	2 weeks
• **Skills, attitude and competency learning**: On-farm Practical experimentation through a learning-by-doing approach to include recognition and control of clinical mastitis, detection of sub clinical mastitis via CMT/ reagent strips and its control. Dry cow period. Taking samples for laboratory analysis and research.	Farmer groups, co operative, Processor, KARI,KDB, input suppliers	monthly
• b**) Monitoring, evaluation and reporting**: Monthly participatory M&E monitoring will be done by inspection of each farm and taking samples for analysis of somatic cell counts. A reporting system between farmers, their coordinators and stakeholders will be used to share information and take remedial action on problem areas.	Farmer groups, co operative, Equity Bank	6 months
C) **addressing cross-cutting themes**: • **Tool 2: Animal welfare housing -** the farmer groups will be linked to micro credit institution through the cooperative to access credit for building a standard cow-shed with concrete floor. Repayment will be through milk sales. Proper housing will enhance mastitis control.	Farmer groups /KARI / co operative Farmer groups /KARI / co	

• **Tool 3: Milking hygiene -** milking persons will be trained on hygienic milk production including critical control points (CCPs) important in mastitis control and quality assurance.	operative / KDB	1 week
• **Tool 4: Feeding & water -** fodder - In view of the small plots and high cost of feeds, the intervention is to train farmers on fodder conservation and to plant fodder trees e.g. *caliandra* which have better nutritive value than crop residues. Proper nutrition for dairy cattle will reduce susceptibility to mastitis. Partnership with private sector to purchase water storage tanks	Forestry Research Institute (KEFRI), Land O Lakes, Private sector	6 months
• **Tool 5: Animal health and use of medicines -** training on herd health management and proper use, record, storage and disposal of medicines in order to avoid drug residues in milk	Farmer groups /KARI/ MOLD/ private sector	1 week
• **Tool 6: Manure management -** With concrete floor, the drainage and collection of manure will be enhanced to reduce chances of mastitis infection from environmental pathogens.	Farmer groups	1 week
• **Tool 7: Record keeping -** Training on keeping of production, reproduction, health and feeds records will be done to support decision making and also ensure traceability.	Farmer groups /KARI	1 week
d) Learning and innovation: Learning from the situation and changing strategy to support **"farmer business school"**	Farmer groups, co operative, Processor, KARI, MOLD, KEFRI	continuous

5.10 b) Value chain development

GTZ (2006) outlines the sequence in value chain development as: first, selection of a specific chain for promotion; conducting a value chain analysis to determine strategy; third, to build Public-Private Partnerships; and finally, monitoring impact. Five key strategies then form the basis for upgrading: empowerment of producers with skills and knowledge for decision making; quality improvement; value-addition and information management; cost reduction; and scaling up to increase volumes. MDF/HP consultancy (2008) presents five VCD models for designing interventions for smallholders as: Facilitating value chain development; supply chain development with smallholder inclusion; contract farming to include non entrepreneurial farmers; leading farming organizations and Do it yourself. The proposed intervention plan outlined in the foregoing section falls under the category of supply chain development with smallholder inclusion. This approach is more feasible than the rest of the VCD models, because the farmers in this study are organized and belong to a cooperative which supplies milk to the processor. However, the processor is not able to improve his position in the market due to low quality of milk. The approach has high likelihood of adoption since it is demand-driven, empowers farmers to manage GDFP by themselves, creates ownership, and sustainability because of the TOT approach. The position of farmers is improved from mere actors in Supply chain to chain partners through horizontal integration (KIT, 2006). In addition the bargaining power of farmer is very much improved due to management of quality standards. Furthermore this intervention creates an opportunity such that if not rewarded for quality, farmers can start a new chain of their own by engaging in small scale processing of low input value-added products like fermented milk, yoghurt, for local / domestic markets (annex 2b). The impact of this plan is a win-win situation for all chain actors, including KARI, which has revised its research approach to strengthen smallholder dairy competitiveness by mainstreaming the concept of Agricultural production value chains (KARI Strategic Plan, 2009-2014).

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This research study was aimed at evaluating good dairy farming practices (GDFP) by comparing and identifying gaps that need to be managed on smallholder farms marketing milk in the formal and informal chains in Kiambu West district. Specifically, the study sought to assess current measures available on the farms for animal health management; the use, storage and disposal of medicines; housing conditions for dairy cattle; milking hygiene; source of water and quantity/ quality of feeds; and waste management. Further, the research sought to find out constraints that prevent farmers from adoption; the effect of inadequate GDFP on the chain; and strategies needed to enhance GDFP at farm level.

The results obtained in this study have shown that the current practice of screening and testing milk delivered from farms done by dairy cooperatives, processors and traders does not help to improve quality. The findings further suggest that smallholder dairy development projects have had little impact in improving the quantity, quality and management practices at farm level. This is because in terms of comparison, there are no significant differences in management practices between farms marketing milk through the formal and those in the informal chains since all p values are more than 0.05, except for two variables: the source of water ($p<0.05$) and quality of feeds ($P<0.05$) where farms in the formal chain mostly use tap water, and appear to use better quality feeds than those in the informal chain. In the formal sector, numerous programs on trainings and input supply to farmers have had little impact since there is no difference in practices with the informal sector. A shift in approach by KDB to regularize the informal sector by licensing small scale milk traders and retailers through investing in milk testing equipment and containers has not helped either in improving quality at farm level. All these programs, though well intentioned, have failed to target the most important part of the chain in improving milk quality - the producers.

Thus the findings obtained in this study suggest that building the capacity of dairy farmers on GDFP is a better strategy of improving quality rather than the testing of numerous deliveries currently done by co operatives, processors and traders.

On the major gaps, the study has revealed that the status of good practices on smallholder farms in Kiambu West district is unsatisfactory. Mastitis is emerging as the most common disease with a reported prevalence rate of 65% mainly due to the poor housing conditions since about 62.5% of the farms have cattle sheds without concrete floor. Moreover, most farms (67.5%) do not screen for mastitis during milking, while few farmers (25%) have undergone training in hygienic milk production. It was revealed during farm surveys and focus group discussions that farmers only know about clinical mastitis but were un aware of sub clinical type which has no obvious signs and has been shown to be a major cause of bacterial contamination and high somatic cell counts in milk on smallholder farms.

The study has shown that the majority of farmers do not keep records of the dairy enterprise as well as on the use of veterinary medicine which is an indication of lack of training on importance of records. Most farmers rely on private animal health providers for veterinary care most of whom may not be accredited for Good Veterinary Practice (GVP) and also do not keep records of treatments on these farms. Non availability of records on use of medicines means that milk containing residues cannot be traced to the farm of origin. This raises concerns on the safety, quality and traceability of milk from smallholder farms, which are now important issues in global markets.

On whether dairy farming is carried out in balance with the environment, the results from this study show that on about half of the farms manure is well managed and is used to improve soil fertility. Alternative uses of manure such as training farmers in biogas production for fuel and lighting are needed to further enhance environmental conservation.

The study reveals that fodder is a limiting factor on many farms in both quantity and quality due to diminishing land sizes and lack of forage conservation skills, hence underfeeding of dairy cattle is common resulting into low milk production per cow. The feed situation on smallholder farms in the Central highlands, particularly during the dry season, has remained disappointing, inspite of many years of investment by dairy development projects. The average quantity of milk produced per cow remains low at 7.5kg/cow/day with about 2000 kg / 280 days lactation (District livestock office, 2008). There is a need to re think and come up with innovations on feed resources which will be sustainable. In addition, more focus should now turn to addressing dairy cow management rather than over emphasis on breed improvement which has become a major preoccupation of many dairy programs. Indeed during the FGD farmers acknowledged a good cow which produces 30 kg milk/day in a well managed farm transferred to a smallholder farmer in the study area will not possibly maintain the same production.
Interviews with both farmers and stakeholders also revealed that the quality of commercial feeds available in the market is questionable owing to lack of GMP standards for manufacturers; weak monitoring and inspection capacity of the industry regulators; and apparent lack of laboratories where farmers can take feed samples for quality analysis.

Thus this study has shown that inadequate GDFP has negative impact on the dairy chain from production to marketing continuum with major effects at three levels: reduced cattle productivity, post harvest losses as a result of milk rejections and lack of bargaining power at farm level. At the national level, it leads to high bacterial counts and residues affecting processing of dairy products; while at the regional / international level; dairy products from smallholder farms are less competitive due to low quality.

Adoption of GDFP may be influenced by a generational gap in which smallholder farmers are mainly elderly people while the youth are involved in marketing or off farm activities. The current low farm-gate price of milk contrasts sharply with the ever rising cost of feeds and, together with a national milk payment system which is based on quantity rather than quality further impedes adoption of GDFP. The low price of milk is a major issue that needs to be addressed through a broader forum involving policy makers and industry stakeholders.

The study has demonstrated that though they dominate national milk production and marketing, smallholder farmers are not yet ready to play in the big league which includes regional and international markets. First, they would need to become national champions. To achieve this goal, a holistic multi stakeholder approach to empower farmers in managing GDFP is of utmost importance. Such as an approach should focus on improving the position of farmers from mere actors to chain partners through horizontal integration and vertical coordination brokered by a lead actor such as a processor.

Finally, smallholder farmers are key players in the dairy sector in Kenya. Opportunities exist, through a shared vision, a Systems innovation and Thinking, which can transform them into entrepreneurs to take dairy farming as a business. That way, the smallholder sector will address GDFP effectively, while at the same time incorporating the central issues of today in agricultural production chains, the 3 Ps: People, Profit and Planet.

6.2 Recommendations

For smallholders to be efficient and effective in managing GDFP to improve the quality of milk in a competitive and sustainable dairy production chain, the following strategies need to be implemented. In addition to the strategic tool box already outlined in the improvement plan (table 5.2), specific strategies, on different aspects are necessary to optimize good practices.

Feed management

Inadequate quantity of fodder is a limiting factor in milk production. Income from selling 3-5 liters of milk per day is too low to provide cash needed for investment on GDFP. In addition this income is normally used to cover daily expenses and is not invested in dairy production. Feed costs for dairy cattle account for the highest proportion of variable costs of production (fig 2.4). Therefore technologies which would help reduce this cost may be easily adopted by farmers because lack of sufficient cash for farm activities was indicated as a constraint to adoption of GDFP. One such technology is the use of fodder trees such as *caliandra*. Mureithi (1999) evaluated the impact of *caliandra* and found that it was much better than maize stovers or banana stems, which farmers use in the absence of Napier grass. *Caliandra* does not compete for land use since trees can be established along fences. The Kenya Forestry Research Institute (KEFRI) can supply seedlings and train farmers on how to establish their own nurseries either individually or as groups.

Fodder conservation: Smallholders are very much exposed to seasonality (table 4.2, item 3.2). The dry season is a regular feature not only in the study area but also other parts of Kenya. Some of the seasonality could be removed by instituting good feed planning practices where forage is bought at a low price when it is abundant, conserved and used during the dry season when its price is high and pasture is not available. The endorsement of such practices requires an attitude change on behalf of smallholders. In other words, they need to start viewing dairy farming as an agribusiness that needs to be managed on annual basis, rather than as a speculative or daily activity. KARI and Land O lakes can train farmer groups in fodder conservation technologies including silage making.

Quality assurance for commercial feeds: This study has shown that most stakeholders are concerned about the unsatisfactory quality of commercial feeds. In order to improve and guarantee the quality of feeds, which is an important requirement in ensuring GDFP, GMP policy for feed manufacturers needs to be put in place and only those millers who are compliant should supply feeds to retailers. Regular inspection and monitoring, including availability of laboratories where farmers can take feeds for analysis is crucial. These measures should be addressed through a multi institutional forum to include KEBS, AKEFEMA, KDB and the University of Nairobi.

Manure management

Manure from small holders represents an efficient system that helps reduce use of chemical fertilizers since it maintains soil fertility and supports crop and fodder production. Another way of ensuring that dairy farming does not harm the environment would be to train farmers on use of manure for biogas production. Biogas is a well-established fuel for cooking and lighting in a number of countries. It is a gas mixture comprising methane and carbon dioxide that is formed when organic materials, such as dung or vegetable matter are broken down by microbiological activity in a digester under an aerobic conditions. Farmers in this study indicated their interest in this technology. Small scale biogas production would provide lighting and cooking fuel. Women, who are mainly involved in feeding and milking cows, would be the main beneficiaries through saving on power costs and time spent searching for fuel. The Kenya Renewable Energy Program, the ministry of livestock development and the private sector can train farmer organizations in this technology and therefore contribute to enhancing GDFP.

Milk payment system

Finally, milk purchases are currently driven only by volume and not quality. Reward for quality should be a priority in the dairy chain if Kenya's products have to be competitive in regional and international markets. The price paid per liter of milk needs to recover the cost of production. A broader forum consisting of policy makers and industry stakeholders need to address this important issue. However, lead actors such as processors can set precedence by paying premiums for quality, as this will encourage investment in GDFP needed to ensure the quality of milk. This will create strong market institutions and capture value through quality differentiation.

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APPENDICES

SPSS OUTPUT: ANNEX 1

1a)

Milk marketing channel * Type of floor Crosstabulation

			Type of floor		
			concrete	earth	Total
Milk marketing channel	formal chain	Count	9	11	20
		Expected Count	7.5	12.5	20.0
	informal chain	Count	6	14	20
		Expected Count	7.5	12.5	20.0
Total		Count	15	25	40
		Expected Count	15.0	25.0	40.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.960[a]	1	.327		
Continuity Correction[b]	.427	1	.514		
Likelihood Ratio	.965	1	.326		
Fisher's Exact Test				.514	.257
Linear-by-Linear Association	.936	1	.333		
N of Valid Cases	40				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.50.

b. Computed only for a 2x2 table

1b)

Test Statistics[b] : Source of water

	Source of water
Mann-Whitney U	117.000
Wilcoxon W	327.000
Z	-2.686
Asymp. Sig. (2-tailed)	.007
Exact Sig. [2*(1-tailed Sig.)]	.024[a]

a. Not corrected for ties.

b. Grouping Variable: Milk marketing channel

1c)

Test Statistics[b] : Quantity of feed

	Quantityof feed on the farm
Mann-Whitney U	146.500
Wilcoxon W	356.500
Z	-1.590
Asymp. Sig. (2-tailed)	.112
Exact Sig. [2*(1-tailed Sig.)]	.149[a]

a. Not corrected for ties.

b. Grouping Variable: Milk marketing channel

1d)

Test Statistics[b] : Quality of feeds

	Quality of feeds on the farm
Mann-Whitney U	126.500
Wilcoxon W	336.500
Z	-2.238
Asymp. Sig. (2-tailed)	.025
Exact Sig. [2*(1-tailed Sig.)]	.046[a]

a. Not corrected for ties.

b. Grouping Variable: Milk marketing channel

1e)

Test Statistics[b] : opinion on quality of commercial feeds

	What is your opinion on quality of feeds from suppliers?
Mann-Whitney U	166.000
Wilcoxon W	376.000
Z	-1.214
Asymp. Sig. (2-tailed)	.225
Exact Sig. [2*(1-tailed Sig.)]	.369[a]

a. Not corrected for ties.

b. Grouping Variable: Milk marketing channel

1f)

Milk marketing channel * Do you screen for mastitis? Cross tabulation

			Do you screen for mastitis?		
			yes	no	Total
Milk marketing channel	formal chain	Count	9	11	20
		Expected Count	6.5	13.5	20.0
	informal chain	Count	4	16	20
		Expected Count	6.5	13.5	20.0
Total		Count	13	27	40
		Expected Count	13.0	27.0	40.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	2.849[a]	1	.091		
Continuity Correction[b]	1.823	1	.177		
Likelihood Ratio	2.905	1	.088		
Fisher's Exact Test				.176	.088
Linear-by-Linear Association	2.778	1	.096		
N of Valid Cases	40				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.50.

b. Computed only for a 2x2 table

1g) Milker has undergone training on hygienic milk production * Milk marketing channel Cross tabulation

			Milk marketing channel		
			formal chain	informal chain	Total
Milker has undergone training on hygienic milk production	yes	Count	6	4	10
		Expected Count	5.0	5.0	10.0
		% within Milk marketing channel	30.0%	20.0%	25.0%
	no	Count	14	16	30
		Expected Count	15.0	15.0	30.0
		% within Milk marketing channel	70.0%	80.0%	75.0%
		% within Milk marketing channel	100.0%	100.0%	100.0 %

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.533[a]	1	.465		
Continuity Correction[b]	.133	1	.715		
Likelihood Ratio	.536	1	.464		
Fisher's Exact Test				.716	.358
Linear-by-Linear Association	.520	1	.471		
N of Valid Cases	40				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.00.

b. Computed only for a 2x2 table

1h)

Milk marketing channel * Waste/manure management to avoid pollution available Cross tabulation

			Waste/manure management to avoid pollution available		
			yes	no	Total
Milk marketing channel	formal chain	Count	12	8	20
		Expected Count	11.0	9.0	20.0
	informal chain	Count	10	10	20
		Expected Count	11.0	9.0	20.0
Total		Count	22	18	40
		Expected Count	22.0	18.0	40.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.404[a]	1	.525		
Continuity Correction[b]	.101	1	.751		
Likelihood Ratio	.405	1	.525		
Fisher's Exact Test				.751	.376
Linear-by-Linear Association	.394	1	.530		
N of Valid Cases	40				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 9.00.

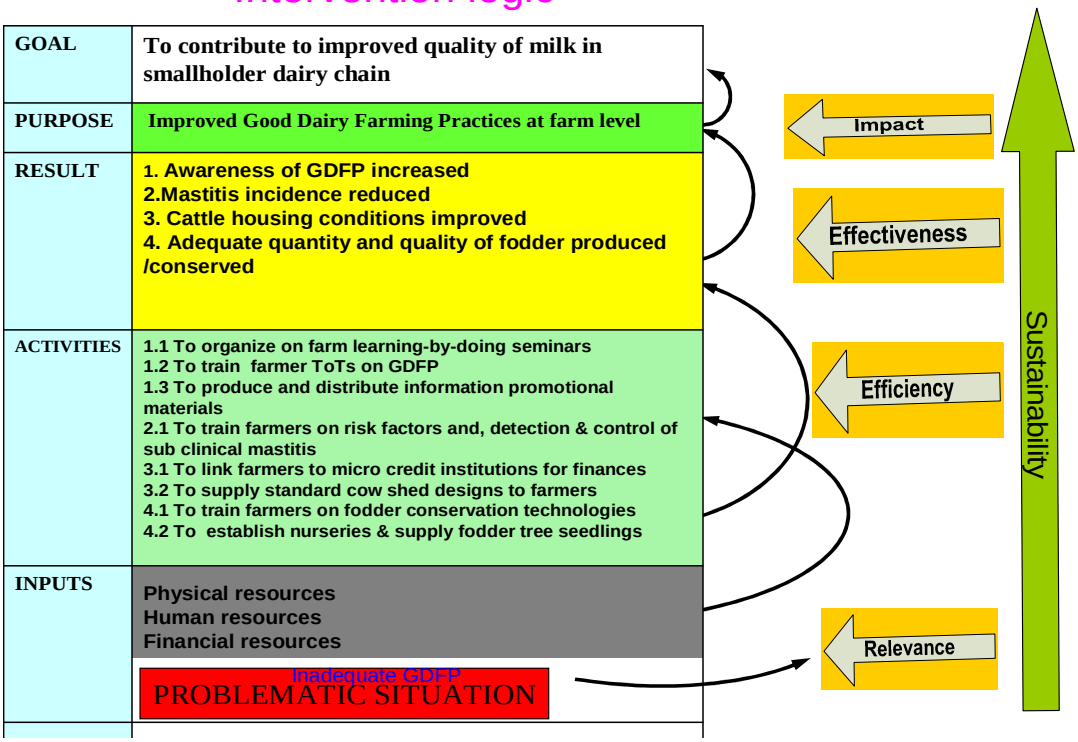
1i) correlation: level of education Vs Quality of feeds

			What is the level of your education?	Quality of feeds on the farm
Spearman's rho	What is the level of your education?	Correlation Coefficient	1.000	.345*
		Sig. (2-tailed)	.	.029
		N	40	40
	Quality of feeds on the farm	Correlation Coefficient	.345*	1.000
		Sig. (2-tailed)	.029	.

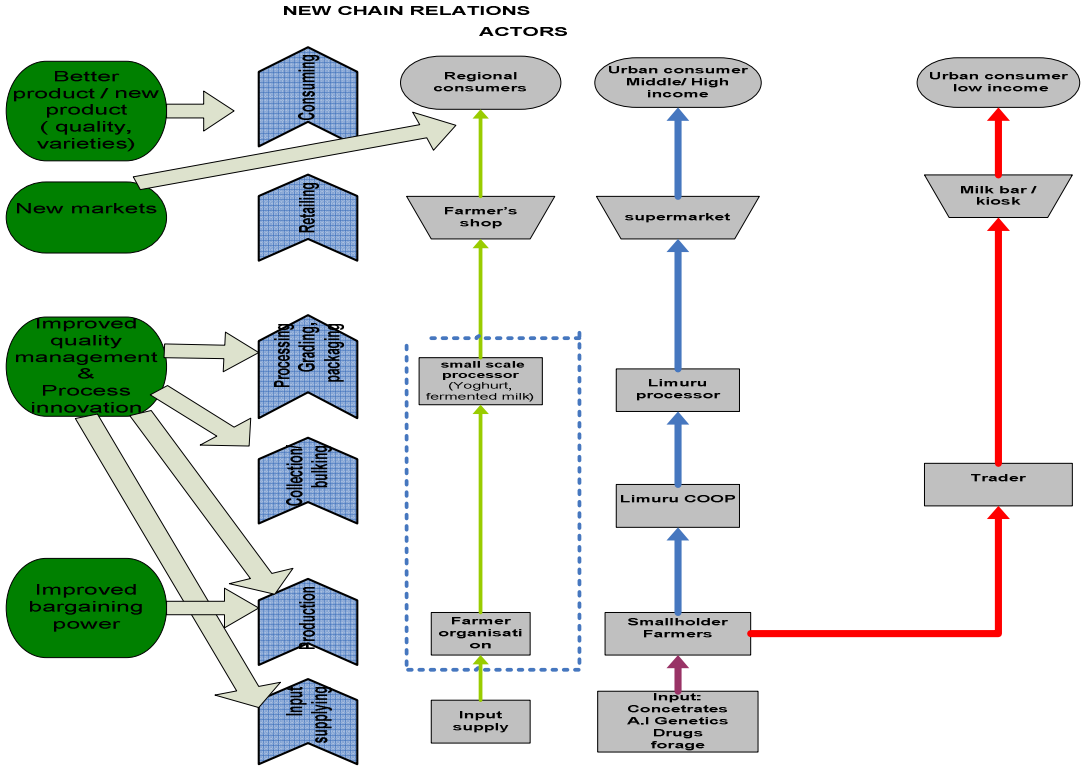
*. Correlation is significant at the 0.05 level (2-tailed).

ANNEX 2a): Intervention ToolBox

Intervention logic



ANNEX 2b): New chain relations



ANNEX 3a: Letter of invitation for partnership

LIMURU DAIRY FARMERS CO-OPERATIVE SOCIETY LTD.

P.O. Box 8-00217
LIMURU

Tel: 020-2010611/0
Fax: 020-2010611
Cell: 0713-833814
E-mail: limurudairy@gmail.com

Our Ref No. .....

Your Ref No. .....

August 3, 2009

THE DIRECTOR
KENYA AGRICULTURAL RESEARCH INSTITUTE
P.O. BOX 32,
KIKUYU.

Dear Sir,

RE: REQUEST FOR PARTNERSHIP IN CAPACITY BUILDING

We appreciate the role of your renowned research institute. We have received funding from Coop-Africa Challenge fund to support a feed processing plant in Limuru.

In our proposal, we have indicated KARI as a partner in the project in the areas of: capacity building of farmers in animal health - detection of subclinical mastitis, good dairy practices and forage improvement at farm level.

We shall greatly appreciate your kind confirmation to this subject by 3rd August 2009.

Yours faithfully

For and on behalf of Limuru dairy farmers cooperative society Limited.

STEPHEN N. KIBATHA
MANAGER.

ANNEX 3b: KARI Letter on partnership for proposed intervention

KENYA AGRICULTURAL RESEARCH INSTITUTE
NATIONAL VETERINARY RESEARCH CENTRE MUGUGA
P.O. BOX 32 - 00902, KIKUYU, KENYA
TELEPHONE: 020-2519769, 2524616, 2020512
E MAIL: vrckari @yahoo.com / karinvrc@kari.org, Webpage: www.kari.org

When replying please quote

OUR Ref: RES/SCH/59 **Date**: 3rd August, 2009.
ALL REPLIES TO BE ADDRESSED
TO THE CENTRE DIRECTOR

Cooperative Challenge Africa,
P. O. Box 9212,
DAR ES SALAAM,
TANZANIA.

REF: LETTER OF INTENT TO PARTNER WITH LIMURU DAIRY FARMERS COOPERATIVE.

We have received an invitation from Limuru Dairy Cooperative for partnership to build the capacity of farmers in animal health – detection and control of sub clinical mastitis, good dairy practices and forage improvement.

The purpose of this letter is to confirm our willingness for partnership as this will contribute to improvement of the safety and quality of milk in the dairy value chain.

We shall be grateful to formalize the terms of partnership (roles/responsibilities) once Limuru Dairy secures funding.

J.M. Mugambi,
CENTRE DIRECTOR,
VRC – MUGUGA NORTH.

c.c. (Attn: Stephen N. Kibatha,)
Limuru Dairy Farmers
Cooperative Society Ltd,
P. O. Box 8 – 00217,
LIMURU.
Email: limurudairy@gmail.com

Assistant Director,
Animal Health,
Kenya Agricultural Research Institute,
P. O. Box 57811 – 00200,
City Square,
NAIROBI.

ANNEX 4: Questionnaire and checklist

Evaluation of Good Dairy Practices on smallholder farms marketing milk in the Formal and informal chains in Kenya
Farmers Questionnaire / checklist

Section 1: General Household characteristics

Name of respondent ……Gender (1) Male……(2) Female…….
Age----------
Division----------Location…….
House hold head level of education
(1) Primary (2) secondary (3) tertiary
Farm size (acres)----------
How many cattle do you have on your farm? ----------
How many kg of milk are produced by your farm per day----------
How much is sold---------- home consumption---------- calves----------
Through which channel do you sell your milk?
(1) Formal (cooperative / processor) (2) informal (trader, direct to consumer)

SECTION 1: ANIMAL HEALTH & VETERINARY MEDICINE

1. Farm has unique registration number for animals kept and transferred
(1) Yes (2) No
2. Farm has bio security measures to prevent entry of disease on the farm
(1) Yes (2) No
3. Common diseases on the farm
(1) ECF (2) Mastitis (3) other, specify----------
4. Who treats animals on the farm?
(1) veterinarian---------- (2) Animal health assistant ---------- (3) other (specify) ----------
5. Records of all chemicals and use of Medicines available on the farm
(1) Yes (2) No

SECTION 2: ANIMAL WELFARE

6. Animal house: Floor type
(1) Concrete (2) Earth
7. Beddings available
(1) Yes (2) No
8. Sleeping area
(1) Same as feeding (2) separate

SECTION 3: ANIMAL FEEDING & WATER

9. Source of water
(1) Tap (2) borehole / well (3) other source----------
10. Quantity of feed (roughage) for cattle on the farm
(1) Good (2) Inadequate (3) poor
11. Quality of feeds (roughage) for cattle on the farm
(1) Good (2) Inadequate (3) poor
12. Storage conditions of feed to avoid contamination

(1) Good (2) poor
13. What is your opinion on the quality of feeds from suppliers?
1) Good (2) Inadequate (3) poor
14. Traceability of feedstuffs: Where do you buy your feeds (concentrate)?
(1) Agro veterinary stores 2) cooperative 3) other source (specify) ----------

SECTION 4: MILKING HYGIENE/ CLEANING PROCEDURES

Objective: milk should be free from microbiological, chemical & physical contamination
15. Milker has undergone training on hygiene milk production.
(1) Yes (2) No
16. When preparing the udder what do you use?
(1) Single towel (2) separate towels (3) None
17. Do you Screen for mastitis during milking?
(1) Yes (2) No
18. Do you sieve milk before bulking?
(1) Yes (2) No
19. Do you cool milk or deliver it 2 hours after collection?
(1) Yes (2) No

SECTION 5: ENVIRONMENT

20. Do you have a system to manage waste and disposal of manure?
(1) Yes (2) No

SECTION 6: ADMINISTRATION AND REGISTRATION

21. Do you keep records of your dairy farm?
(1) Yes (2) No
If yes, state which ones----------

CHECKLIST FOR FARMERS' FOCUS GROUP DISCUSSIONS

Issues:
1. What are the problems / constraints which prevent you from adopting Good dairy Practices on your farm?
2. In your opinion what needs to be done, and by who, to strengthen Good dairy Practices?

CASE STUDY

CHECKLIST FOR COOPERATIVE

1. Registered number of milk suppliers ----------
2. Active number of milk suppliers----------
3. Number of collection centres----------
4. Average distance of collection centres from cooperative----------
5. Quantity of milk received per day----------
6. What tests do you use for screening milk? ----------
7. What problems do you commonly find with the milk?
(1) Microbiological (2) physical (3) chemical
8. What action do you take when you find problems with milk?
1) reject_ 2) put penalty – if persist 3. other action (specify) ----------
9. Quantity of milk rejected per day-----100 litres dry season-/10000 wet period--------- or per month----------
10. What effect does inadequate Good dairy Practices have on milk?
11. What is the role of your organization in addressing Good dairy Practices?

12. In your opinion what needs to be done, and by who, to strengthen Good dairy Practices at farm level and quality issues in the dairy chain?

CHECKLIST FOR PROCESSOR

1. capacity of processing plant----------
2. Average kg milk received per day----------
3. source of milk----------
4. What problems do you commonly find with the milk?
   (1) Microbiological (2) physical (3) chemical
5. What tests do you use for screening milk? ----------
6. Quantity of milk rejected per day---------- or per month----------
7. What effect does inadequate Good dairy Practices have on your products?
8. What is the role of your organization in addressing Good dairy Practices?
9. In your opinion what needs to be done, and by who, to strengthen Good dairy Practices at farm level and quality issues in the dairy chain?

CHECKLIST FOR KENYA DAIRY BOARD

1. Role of KDB in implementing Good dairy Practices at farm level
2. Number of farmers registered (accredited) to produce milk for sale
   National level----------
   Kiambu district----------
3. Problems faced by farmers in adopting Good dairy Practices in the district
4. Effect of inadequate Good dairy Practices on domestic and export market
5. In your opinion what needs to be done, and by who, to strengthen Good dairy Practices at farm level and quality issues in the district and in the dairy chain?
6. Quantity of milk produced at national level (annually)----------
7. Amount exported----------
8. Standards for milk quality

a) Domestic market----------
b) Export market

CHECKLIST FOR TRADER

1. Source of milk ----------
2. How many kg of milk do you buy per day?
3. How long does it take to deliver milk to your customers?
4. What problems do you commonly find with the milk?
5. What action do you take when you find problems with milk?
   1) reject 2) put penalty 3.other action (specify)----------
6. How do you test milk for its quality?

CHECKLIST FOR CONSUMER

1. What problems do you commonly find with the milk purchased from farmer or trader?
2. How do you screen raw milk purchased from farmer or trader?
3. Would you prefer good quality milk?
   1) yes 2) No
4. If yes, would you be willing to pay for the good quality
   1) yes 2) No