AGRICULTURAL SCIENCE TECHNOLOGY AND INNOVATION SYSTEM CASE STUDY OF THE ZAMBIAN DAIRY INDUSTRY

BY

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EXECUTIVE SUMMARY

An ASTI system case study on the Zambian dairy sub-sector was conducted by the University of Zambia in collaboration with the Technical Centre for Agricultural and Rural Cooperation ACP-EU (CTA). The objective of the study was to assess the strengths and weaknesses of the Agricultural Science Technology and Innovation (ASTI) system in the dairy sub sector in Zambia. A desk review of the policies affecting the sub sector in the past 50 years was undertaken. The main actors in the sub-sector were indentified through a brainstorming session and validated by a stakeholders' workshop. A structured questionnaire was administered on the identified actors. The aim was to assess the application of science and technology in the dairy sector as well as to identify and map the linkages and the intensity of the collaboration among the various actors.

The policy review showed that the dairy sector was private-sector driven from the early 1920s to the mid 1960s. The government provided incentives and subsidies which benefitted producers. This was supported by an efficient marketing and distribution system and the country recorded a surplus of milk during that period. In the post independence era, the government support shifted to promoting increased consumption, and the production and marketing of milk were nationalized through the Dairy Produce Board. The dairy industry subsequently collapsed in the 1980s. This downward trend changed when the government liberalized the economy in 1991. An increase in the number of dairy producers and processors was recorded and the price of milk moved upward. However, milk production is low, farmers face challenges in accessing veterinary services which impact on quality of animals and processing plants are underutilized.

The study showed that government involvement and an enabling policy and regulatory framework remain critical as not all aspects of dairy industry can be handled by the private sector. The survey also revealed that there was limited interaction among the various actors. Most of the players seem to be working in isolation instead of complimenting each other. While a number of actors especially NGOs were identified as the main actors in the provision of livestock extension services; most public extension officers are more knowledgeable on crops. The role of the major actors involved in science and technology, research and training in supporting innovation and competitiveness in the industry is limited and key actors namely producers do not acknowledge their role in the sector.

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1. INTRODUCTION

Many of the countries in Africa, the Caribbean and the Pacific have lagged behind in terms of development due to low application of science and technology and limited innovation. This is contrary to countries with developed economies that are principally knowledge based. In order to foster development and uplift the standards of living of people in the third world, there is need for governments to embrace science, technology and innovation in the production of goods and services. Very few developing countries can boast of investing at least 1% of their national budgets in scientific research and technological development; 3% is the benchmark for industrialized nations. Most governments have simply failed to appreciate the role science, technology and innovation could play in resolving some of the problems faced by their citizens.

Scientists work in isolation to the exclusion of other stakeholders including policy makers, entrepreneurs and targeted end users of intended research outputs and new technology. Consequently research and development are not always linked to what is needed on the ground, especially with regard to what the end users are demanding. For effective application of science and technology for socio-economic development, there is need to facilitate networking, enhance learning and recognize the contribution of all stakeholders in development. The innovation systems approach provides a framework for analyzing how different actors create, exchange and apply knowledge to foster economic development through the production of goods and services within the environmental context.

To help build capacity to enhance the application of Science Technology and Innovations in the ACP countries, the Technical Centre for Agricultural and Rural Cooperation ACP-EU (CTA) launched a series of training programmes and case studies to help local experts understand and study the performance of local innovation systems. Because most economies in ACP countries are based on agriculture, all the planned programmes were aimed at building capacity in the agricultural sector, hence the focus on the Agricultural Science Technology and Innovation (ASTI) system. By 2008, the training programmes were designed in such a way that experts in selected countries would improve their knowledge on innovation systems and apply the knowledge gained to understanding the local system for specific agricultural industries. Thus, the training was followed by a case study where different national groups looked at a specific commodity or sub-sector within the agricultural sector to evaluate the strengths and weaknesses of the ASTI system that affect its overall performance. Studies also evaluated how various actors in the industry interact and link with each other to keep it moving. Where weaknesses are identified, the study seeks alternative courses of action in order to improve productivity within the system. Examples of past studies include floriculture, maize and rice industries in Kenya, Malawi and Papua New Guinea, respectively. It was in line with these studies that the University of Zambia (UNZA) initiated a case study of the Agriculture Science Technology and Innovation (ASTI) Systems in the Zambian dairy industry using the innovation systems approach.

1.1 General Objective

To examine the structure and performance of the Agricultural Science Technology and Innovation (ASTI) Systems in the Zambian dairy sub-sector sector.

Specific Objectives

1. To review policies affecting the ASTI system in the dairy sub-sector.
2. To identify the key actors in the ASTI system.
3. To determine the traditional habits and practices and competencies of the actors in the ASTI system with regard to learning, investment and linkages
4. To determine the key functions performed by actors and assess performance
5. To make policy recommendations.

2. METHODOLOGY

This section presents research methods used to analyze the performance of the dairy sector in Zambia. The method used was adapted from earlier case studies done by CTA such as the cases of the Kenyan floriculture industry and the Malawian maize industry. In order to get a full overview of the structure and performance of the Agricultural Science Technology and Innovation (ASTI) System in the Zambian dairy sector, combined qualitative and quantitative tools were used to collect primary and secondary data.

2.1 Review of the policy environment

The study began with a review of policies that affect the agricultural sector in general and ultimately the dairy sector. The review of the policy environment and policies in the Agriculture sector and the dairy sub-sector was done through a desk research. Policies and issues that may be hindering or enhancing the functions of the actors in the dairy sector were identified. These were mainly policies that directly or indirectly affect the agricultural sector in general such as the agricultural policies enacted over time, fiscal policies, among others, as well as those that directly or indirectly affect the performance of the dairy sector.

2.2 Inventory of Actors

An inventory of actors in the dairy sector was done and this was followed by a half day seminar for the actors to explain the concept of the national innovation systems and also identify other actors who were omitted during the desk review. A brainstorming workshop was first held with researchers and later on with key actors to come up with a general overview of actors in the dairy sector and their key roles. The process began by delineating the flow of dairy products from production to consumption. The chain actors who transact the dairy products as they move along the chain were identified, as well as the roles and inter relationships among them. These included service providers such as organizations that provide business or extension services to support the operations, innovation and competitiveness of the dairy sector. Actors were grouped according to the key roles played in the dairy sector namely, enterprises, market/demand, diffusion, infrastructure provision and development and research and training.

2.3 Population Selection

The inventory of actors was used to identify the population to analyze the structure and performance of the Agricultural Science Technology and Innovation (ASTI) Systems in the dairy subsector. The population was grouped into two; namely organizations and dairy farmers. Organizations were non dairy farmers but were involved either directly or indirectly in the dairy supply and value chains. On the part of the farmers, due to a large number of dairy farmers in the country and resource limitation, the study focused on the dairy farmers from the two provinces of Zambia namely Lusaka and Southern provinces.

2.4 Sampling Methodology

Sampling was different for farmers and organizations. A census of all organizations identified during the brainstorming workshop was done and a total of 55 organizations agreed to be surveyed from the 65 identified. Farmers were subdivided into two groups namely; small scale and large scale and different sampling methods were used for these two groups. A census of large scale dairy farmers was conducted in the two provinces as there were few of them in numbers.

The number of small scale farmers was relatively large and a sample of farmers was selected from the target districts in each of the two provinces. First, a population framework of small holder dairy farmers was prepared by developing a list of dairy farmers based on the records at the Milk Collection Centers in the selected districts namely Lusaka, Mazabuka, Monze, Choma, Chongwe and Kafue. This effort resulted in a population framework list of 1100 farmers, divided over the five sub-populations (five districts). With the aim of an overall sample-size of 140 small holder farmers, a sample size for each stratum (district) proportional to its size was estimated and interval sampling used to obtain a sub-sample for each of the five sub-populations. A total of 133 dairy farmers were interviewed in the year 2009. Four of these were large scale commercial farmers. After data cleaning, 127 small holder dairy farmers were considered for analysis.

2.5 Methods of Data Collection

Primary data was collected both quantitatively and qualitatively using a combination of methods, while secondary data was collected from reviewing various policy documents and reports.

A. Quantitative data was collected by using a structured questionnaire to elicit information on:

a) Demographic characteristics of households such as how many people are in the household and what are their relationships? How old is each family member and their marital status? What is their level of education? How long have they lived in that house in the past 12 months and how many months are they available for farm work? Farm characteristics in terms of size and products produced. For organizations, demographic information collected included number of years of operations, year of establishment, area of focus and type of business ownership.
b) Allocation of resources in form of time, personnel and money to various activities.
c) Manpower training and specialization existing and perceptions on the quality of training.
d) Sources of financing and changes over the years.
e) Collaborations and networks and the strength of relationships among stakeholders.
f) Performance of the dairy sector in terms of new information, technology, new markets and products.

2.6 Location

The Republic of Zambia is a land-locked country in southern Africa, surrounded by Tanzania, Democratic Republic of Congo, Angola, Malawi, Mozambique, Zimbabwe, Botswana and Namibia. With an estimated land area of 752,614 km^2, Zambia is divided

into nine provinces, namely Central, Copper belt, Eastern, Luapula, Lusaka, Northern, Northwestern, Southern and Western Provinces. Lusaka and Southern provinces were selected because they were known to be major dairy producing areas. Selection of Lusaka and Southern provinces and the study sites therein was done through extensive consultations with key informants and knowledgeable organizations. Lusaka particularly was surveyed to collect data on organizations because most of them were located in Lusaka. Districts purposely selected in these two provinces were Chongwe, Kafue, Mazabuka, Monze and Choma.

In terms of regional agricultural classification based mostly on the differentiation in climatic conditions principally rainfall patterns, farming systems, and to some extent temperature and soil types, these provinces comprise mostly agro ecological zone two (of the three) which constitutes the central plateaus with average annual rainfall of 800 to 1,000 mm. The soils in this region are mainly Haplic Lixisols (MACO 2008), Haplic Luvisols and Haplic Acrisols among others. These soils are more productive for cultivation of sorghum, maize, groundnuts, cow peas and a range of cash crops including tobacco, sunflower, irrigated wheat, soybean and horticultural crops. The region is also a livestock rearing area with mainly cattle and goats as the major livestock.

2.7 Individuals interviewed

Interviews were conducted with relevant representatives from each significant category of actors and these included:
(a) Small holder dairy farmers marketing at Milk collection centers
(b) Leaders of farmers' dairy cooperatives
(c) Milk Processors
(d) Research & Development Institutions
(e) Milk Vendors
(f) Managers of the relevant product section in the supermarket (e.g., Dairy products section)
(g) Suppliers of support services to producers, traders or processors (technical assistance, credit)
(h) Relevant governmental ministries
(i) Large scale farmers
(j) Training institutions
(k) Non- governmental Organizations

2.8 Survey instrument

Structured questionnaires adapted from earlier studies done by CTA were used in the survey of farmers and organizations. Questionnaires were adapted to the dairy sector and pretested prior to the surveys to seek clarity in questions, identify possible gaps and consistencies. Based on the pretest results, some modifications were made. Trained enumerators were used to collect data using structured questionnaires. They were trained on how to interview and fill in the questionnaires. Structured questionnaires were designed to capture information on a range of potential indicators of performance, innovations, habits, practices and linkages existing among key actors in the ASTI system of the dairy sub-sector. On the part of the farmers, an interview was conducted with

household heads, and in a few cases a knowledgeable family member if the household head was absent. In the case of organizations, heads of organizations or their representatives were interviewed and these represented the government, the private sector, and non-governmental organizations

The data collected do not constitute a statistically representative sample of all producers in the dairy sector in Zambia. They are, however, illustrative of the types of producers, and interactions that take place in the areas sampled in Zambia. In addition to primary data, secondary sources were used to verify data. Where possible, the findings were verified by triangulating the data and information with those from other sources. The primary data was used to map the linkages among actors and identify the strength of these linkages.

3. RESULTS AND DISCUSSION

This chapter presents and discusses the study findings. It begins by a presentation and discussion of policies affecting the performance of the dairy sub-sector. This is followed by a characterization of the actors in terms of their demographics and roles played in the in the dairy sub-sector. The mapping of the actors which consists of actors and their interlinked functions comes next, and it is followed by a section on the performance of the actors and how well the ASTI system is functioning.

3.1 Overview of the agricultural sector

Agriculture is one of the main economic activities in Zambia considering that more than 75% of the population depends on farming in one way or the other. Agriculture includes all economic activities in arable farming, livestock rearing, and forestry and fisheries production. By far, arable agriculture is the most popular and involves cultivation, processing and marketing of food and cash crops. In recent years, there has also been an increase in the cultivation of horticultural and ornamental crops, especially cut flowers for the export market. This has resulted in an industry whose products have come to be termed as Non Traditional Exports (NFE). Livestock production covers the keeping and marketing of animals including cattle, goats, sheep, pigs and poultry or their products. Currently, the contribution of forestry and fisheries to the country's agricultural industry is still limited. The importance of agriculture to the Zambian economy lies in the fact that in addition to being a source of employment for about 70% of the work force, it also contributes significantly to national food security and income generation. It is also a major source of raw materials for industrial processing and manufacturing of finished products (Zambian Review, 2006). It also contributes to foreign exchange earnings through export of raw and processed products like sugar, tobacco, cotton, horticultural and floricultural products. The Zambian agricultural sector contributes about 16% to the country's Gross Domestic Product (GDP). The sector is mostly made up of a large number of small scale producers (75%) and only a small number of large scale commercial farmers (25%). Small scale farmers are mostly engaged in subsistence farming with very few of their products reaching commercial market outlets. There is need to orient more small scale farmers towards commercial farming to increase productivity in the agricultural sector. The country has capacity to absorb more commercial farmers considering that out of 752 million hectares of land, the country only uses about 15% for arable farming. This is despite the country having a favorable climate that is characterized with annual rainfall of between 400 and 1400mm. The country is also host to about 45% of the water resources in the Southern Africa Development Community (SADC) region.

3.1.1 Review of The Zambian Dairy Sub-Sector

Like other forms of agriculture, the livestock sector consists of a large number of small scale farmers who keep their animals under traditional management systems and a small number of large scale farmers producing beef and dairy animals for the commercial market. The bulk of the livestock industry is based on cattle with most of the commercial farmers utilizing high producing exotic breeds from the western world. Despite low productivity, the contribution from traditional cattle keepers is quite substantial due to the large number of farmers who are scattered throughout traditional cattle farming areas of Western, Southern, Central and Eastern provinces. Most of the

animals entering official market outlets are distributed through established commercial meat processing companies including Zambeef, Keembe Real meat, Kachema and other large corporations. A considerable amount of meat products is also marketed through local abattoirs and butcheries scattered throughout the country. The most notable ones among these are those located in peri-urban areas like Kafue and Chongwe near Lusaka. Due to continued outbreak of animal diseases and limited supplies, there are no official export markets for meat and dairy products for Zambia. The dairy industry is actually still fragmented at the moment as it consists of only a small number of large scale white settler producers. Only a small number of indigenous Zambians are involved in dairy farming mostly as small or medium scale farmers. Commercial pork and poultry production activities are largely restricted to smallholder farming in and around large towns along the line of rail. These mostly use exotic breeds as indigenous ones are only found in rural areas under subsistence farming. The livestock industry also includes a number of commercial feed manufacturers, veterinary service providers, capital input suppliers, wholesalers and retail distributors of livestock products.

There is a lot of potential for increased production of livestock products from the traditional sector considering that, at present some of the processing companies such as Zambeef have opened abattoirs in rural areas to access animals for slaughter and processing from traditional cattle keepers. Sometimes meat corporations have to fatten animals bought from traditional farmers before slaughtering. This indicates that more needs to be done to improve productivity, quality and off take of animals from traditional areas through introduction of modern animal husbandry techniques. The current policy of the Zambian government is to try and improve productivity of traditional cattle through eradication of animal diseases and promotion of improved animal husbandry practices. To promote export of livestock products, the country is trying to demarcate and establish disease free zones, a move that has been seen as critical in meeting international meat quality standards for accessing export markets in Europe, America and the Middle East. Potential for increased production of small ruminants e.g.goats and sheep still remains to be exploited.

As highlighted in the foregoing discussion, the dairy industry in Zambia consists of only a small number of large scale commercial farmers who produce about 90% of the milk delivered to milk processing companies. These farmers number about 130 and produce about 60% of the 190 million litres of the country's annual marketed milk output. The rest is produced by medium and small scale farmers most of whom have settled in peri-urban areas to produce for the urban market. Some of the small scale farmers are also found in rural areas off the rail line where they keep dual purpose traditional cattle that only produce between 2 and 5 litres of milk per day (Mkumbuta and Schercand, 2006). Most of these farmers sell their milk directly to consumers in streets and local markets as either fresh or sour milk. The amount of milk produced by this group has not been properly documented due to lack of a proper milk recording system. A number of small scale farmers keep a few dairy crossbreed animals that they received through the recent livestock restocking programme spearheaded by the Zambian government through Heifer Project International (HPI), Land O' Lakes, Agriculture Support Programme (ASP), Livestock Development Trust (LDT) and Zambia Agricultural Technical Assistance Centre (ZATAC). Because of technical and financial support from cooperating partners, the sector has in recent years experienced considerable growth. This has also resulted in

increased consumption of milk and other dairy products as evidenced through the Zambia Dairy Processors Association (ZDPA).

However, despite good intentions and efforts from government and NGOs, the country is yet to have a viable dairy industry as the current gross domestic consumption of 15 litres falls far below the recommended 45 litres per capita per year (FAO, 1982). Even the current 190 million litres of milk produced each year falls far below the required 253 million litres. Actually, the documented 190 million litres per year is what is marketed through official channels to be processed into pasteurized milk, cheese, yoghurt, ice creams or fermented as sour milk. Current deficits in milk production are met by importation of powdered milk from New Zealand and the European Union. The country also imports Ultra High Temperature (UHT) treated milk from South Africa and Zimbabwe. Despite deficits in milk production, the country still exports limited amounts of dairy products to the Democratic Republic of Congo (DRC) and Malawi (Valeta *et al.*, 2004). Outlined below is an account of some of the government policies that have had an impact on the development of the dairy industry in Zambia.

3.2 Review of Policy Framework3.2.1 Review of Milk Production Policies

Pre-Independence Dairy Production Policies (1924 to 1964)

In Zambia, dairy farming dates back to the colonial era with the arrival of the white settlers in 1924 to the then Northern Rhodesia (Government Report, 1962). The settlers came with their own exotic dairy breeds including Holstein Friesians, Channel Islands and a few Aryshires (UNGAMI, 1975). As is still the case today, dairying activities during the colonial times were restricted to urban settlements along the rail line extending from Livingstone in Southern Province to towns on the Copper belt. The policy for the colonial government from the late 1920s to the early 1950s was for the country to be self sufficient in producing milk for the consuming communities. In the late 1950s, consumption of milk increased with the opening up of copper mines as people moved from rural areas to mines in search of jobs. During this time, there were about 120 commercial farmers in Zambia. The amount of milk produced was more than adequate to meet the needs of the consuming urban population. The surplus was processed into hard cheese by the Zambezi Cooperative Dairies based in Livingstone and the Cooperative Creameries of Northern Rhodesia (CCNR) based in Lusaka and the Copper belt. Estimated milk production and consumption levels between 1956 and 1963 are as shown in Table 1, which shows a marked increase in milk production in the late 1950s and early 1960s. The resulting increase in milk production was as a result of increased urbanization that was associated with the start of copper mining activities on the Copper belt. Most of the milk at the time was being produced in satellite dairy farms located in Chisamba, Broken hill (Kabwe), Lusaka and Mazabuka (UNGAMI, 1975).

The target for milk production for the then government was to produce about 10% above estimated milk demand for local consumption. To promote increased production of milk in the country, the Federal Government subsidized purchase of capital inputs while the Northern Rhodesian government provided up to 50% subsidies for importation of dairy breeding stock. The government also gave bonuses for good dairy farming

practices and guaranteed milk prices within allocated quarters to encourage farmers (Report of commission of inquiry, 1962). Thus, the policy of making the country self sufficient in fresh milk production was fulfilled through government support to producers. The government did not want to encourage increased production for the export market as it thought there were other territories within the British Empire namely New Zealand and South Africa that had better comparative advantage in producing milk for export.

Table 1: Estimated milk production levels and utilization in Northern Rhodesia between 1956 and 1963

Year	**Milk production (litres)**	**Form of Utilization (%)**		
		Fresh	**Butter**	**Cheese**
1956	9,000	77	4	19
1957	11,365	73	5	22
1958	13,368	78	5	17
1959	18,000	68	9	23
1960	18,000	65	14	21
1961	20,000	69	18	13
1962	21,000	77	14	9
1963	21,800	74	11	15

Source: Modified from the report of the Central Research Sub-committee on Animal Husbandry and Pasture Research, 1964.

Post Independence Dairy Production Policies (1964 to 1991)

After independence in 1964, the policy of the new Zambian government was to encourage more indigenous Zambians especially those in urban areas to consume more milk as a way of improving their nutrition and health status (Zambia Cattle Development Limited, 1970). This was accomplished by introducing a two-tier milk pricing system known as the Cheap Milk Scheme in July 1965. This made milk cheaper in low income than in high income residential areas. The policy made sense at the time as the country was producing surplus milk that most of the poor African population could not afford. The government also wanted local Zambians to get involved in commercial dairy farming as a way of empowering them while increasing milk production to keep pace with increased consumption as a result of rapid urbanization (Agric 636.08). However, the situation on the ground did not result in increased milk production as the uncertain political situation in the country and the controlled milk pricing system resulted in exodus of white settler farmers from either the country or dairy farming (UNGAMI, 1975). Gordon and Lines (1969) noted that between 1962 and 1970, the number of white dairy settler farmers in the country declined from about 140 to less than 100, while the number of milking cows reduced from 10,000 to 8,000 over the same period. Monthly milk production levels reduced from 1,208,000 litres (319,000 gallons) in 1963 to 1,082,000 litres (286,000 gallons) in 1966, which shifted milk supply levels from a surplus of 481,000 (127,000) to a deficit of 344,000 litres (91,000 gallons) per month (Table 2).

Table 2: Monthly supply and demand of milk under the two tier milk pricing systems in '000 Litres

Consumer category	**1963**	**1964**	**1965**	**1966**
Milk Production levels (Supply)	1450	1491	1491	1300
Sales at economic prices	873	868	882	886
Sales through cheap milk scheme	--	--	368	827
Surplus for processing	577	623	241	- 414

Source: Modified from Gordon and Lines*, 1969.*

Deficits in milk production continued well into the 1970s when the government decided to take new policy measures to revamp and sustain the industry. The policy changes undertaken by the Zambian government are summarized below:

1. Encourage more commercial farmers to remain in dairy farming by increasing and guaranteeing milk producer prices

This was in response to rampant exodus of white settler commercial farmers from dairy farming and lack of entry of new young farmers into the sector. The government responded by increasing milk prices and introducing guaranteed producer prices for a period of 18 months. Although the policy was not expected to completely stop the exodus of white farmers, it somehow slowed down the pace. The policy was reviewed after the guaranteed period that led to new price adjustments. Apparently, government control of milk prices remained a stumbling block to increased profitability in the dairy sector at the time.

2. Establishment of state run large scale commercial dairy ranches in urban centres

The main objective for establishing state run large scale commercial dairy ranches was to increase milk production for the growing urban population and to provide breeding stock to intending local dairy farmers. This programme resulted in the establishment of four huge dairy ranches in Chisamba, Ndola (Kafubu), Kabwe and Mazabuka. The Lusaka and Ndola ranches were actually established on farms that had previously been abandoned by white settler farmers. The established farms were equipped with modern dairy facilities and were stocked with pedigree pure exotic dairy breeds. The farms were supplying milk to urban consumers through the newly established Zambia Dairy Produce Board (DPB).

3. Establishment of Dairy Tenant Resettlement Schemes

This was part of the government policy for encouraging local Zambians to take up large scale commercial dairy farming as a business activity. This scheme was initiated in 1971 and was based on providing land and loan facilities to local Zambians to enable them to keep between 20 and 25 dairy animals on 400 acre farms (ca 160ha). The only

qualification for interested Zambians to become dairy farmers was to attend an 18 months compulsory course in dairy management on a government established dairy college. Graduating students were provided with all dairying inputs including equipment for animal handling, milk collection, feed production and processing. The scheme was managed through a central manager, who was also responsible for implementing Artificial Insemination services. Despite the good will and effort from the government, this scheme ended in failure due to lack of technical and managerial skills among participating farmers. Other limiting factors included lack of capacity for producing adequate amounts of fodder and grain for the high demanding exotic dairy breeds. There were also seasonal variations in milk solids not fat that somehow affected the quality of milk reaching the market.

4. Establishment of Rural Dairy Units

This was designed to promote increased milk production in provincial centres to supply milk in areas off the rail line. The programme was run through the Zambia Cattle Development Limited, where each provincial headquarter was made to establish a dairy farm to supply milk to the local population. The government supplied all inputs and individual farms were responsible for marketing milk to the general public through government owned retail shops like Zambia Consumers Buying Corporation (ZCBC), Mwaiseni Stores and National Import and Export Corporation (NIEC). In addition to supplying milk to the general public, the Rural Dairy Units were also responsible for providing breeding animals to local population to encourage mixed livestock production. The farms also served as demonstration centres for improved animal production especially in areas that were not traditional cattle rearing areas (Gordon and Lines, 1969).

5. Crossbreed Development Scheme

The scheme was part of the Rural Dairy Units although this was implemented at district level with the aim of encouraging increased production and consumption of milk among Zambians living off the line of rail. The scheme was designed to provide rural farmers with 4 to 6 dairy cows for milk production on 12 to 18 acres (4.8 to 7.2ha) of land. This scheme was based on the use of crossbreed cows to cater for expected poor management levels among rural small scale farmers. The idea was to promote livestock production and hundreds of farmers had received crossbreed cows by 1976 when the project closed. In terms of milk production, crossbreed cows were expected to yield between 4 and 5 litres per day instead of the expected 10 to15 litres from Holstein Friesians under Zambian conditions. The project lacked sustainability in terms of funding for continued supply of breeding cows to intending farmers. Recipient farmers also lacked managerial skills for successful management of animals to sustain increased milk production levels.

6. Improved supply of extension services to commercial farmers

At independence, there was a critical shortage of qualified personnel in dairy management and the government had to take measures to improve the situation. It is documented that at independence, there was only one dairy officer and a milk tester

servicing more than 100 farmers along the rail line. The government thus, embarked on training and recruitment of personnel in the Ministry. This resulted in the recruitment of dairy and livestock officers at national, provincial and district levels. The government also established agriculture training institutions to continuously train human resource.

The above policies were implemented and had limited success in achieving set goals and planned objectives as the country has never achieved the objective of meeting consumer demand in milk production since 1964. In order to improve profitability and promote national industrialization, the government decided to improve milk production in the country by involving privately run government controlled Para-statal companies. This saw the creation Zambia Agricultural Development Limited (ZADL), a large scale farming corporation under the Industrial Development Cooperation (INDECO) (Kaluba, 1963). INDECO took over the running of state ranches and set up more dairy ranches in provincial capitals to supply milk and provide dairy breeding stock to intending local farmers. Despite limited success in the early 1980s, the ranches failed to thrive during the economic depression of the late 1980s and were subsequently privatized after the new government took over and started implementing Structural Adjustments Programs (SAP) in 1991.

Liberalized Market Economy Production Policies (1991 to present)

In 1991, there was a shift in public policy with the coming of the second republic government that shifted from a state controlled economy to that of private sector led initiative. The dairy sector also had to undergo Structural Adjustments Programs (SAP). The SAP policies resulted in privatization of the dairy sector through market deregulation and reduction of financial and technical support from government. Thus, liberalization of the dairy industry exposed the sector to open market forces that removed inefficiencies. Privatization of the sector also saw entry of new players in the market who took part in re-organizing the dairy industry. Under the new initiative, the role of government was limited to creating an enabling environment and regulating participating private institutions. Roles that could not be taken up by the private sector were fulfilled by creation of privately run public institutions such as the Livestock Development Centre (LDC) under the Golden Valley Agricultural Research Trust (GART) in Choma, Livestock Development Trust (LDT) and Zambia Agriculture Technical Assistance Centre (ZATAC). The role of private-public partnership institutions was mainly to provide research, extension services and breeding stock to intending dairy farmers. A number of Non-Governmental Organizations also participated in promoting dairy production by providing breeding animals, technical assistance and extension services. The most notable NGOs include Land O' lakes, Heifer Project International (HPI), Agriculture Support Programme (ASP) and the Herd Book Society of Zambia. The main objective for the above NGOs was to empower rural populations through dairy farming. The overall impact of privatization to the dairy sector has been the replacement of Government support to producers in the form of subsidies and extension services by NGOs and public private sector alliances. The NGOs have also helped the dairy sector by organizing farmers into cooperatives and farmer group associations, building milk collecting centers installed with milk cooling and testing facilities. The NGOs have been instrumental in introducing and implementing new technologies and application of good dairy management practices.

Table 3 shows milk production levels for selected years under the liberalized economy (1998-2003). There has been a general increase in milk in these years except the year 2000.

Table 3: Milk production levels over the years under the liberalized economy

Year	Volume produced in Litre
1998	138,000,000
1999	141,000,000
2000	135,000,000
2001	147,000,000
2002	139,000,000
2003	190,000,000

Source: Valeta et al., 2004.

Despite these positive developments, there are still gaps in the sector. This is because the private sector has failed to play all the roles needed to facilitate increased production of milk in the country. There are areas within the industry that could not be taken up by the private sector as they were either deemed uneconomical or there was no comparative advantage. The government has also failed in fulfilling their role of monitoring and regulating the private sector. This failure has sometimes compromised the quality of goods and services delivered to general public by the private sector. Due to lack of funding and government support, the privately run public-private partnership institutions have also failed to provide research and extension services and as such even the government supported dairy restocking programme has failed to yield the expected results. As such the country is yet to have a sustainable dairy industry that can meet the needs and aspirations of the consuming public in terms of milk production.

3.2.2 Review of Milk Marketing Policies

Pre- Independence Milk Marketing Policies (1924 to 1964)

During the colonial period, milk produced in Northern Rhodesia was marketed by two government supported dairy cooperatives namely the Zambezi Cooperative Dairies Limited and the Cooperative Creameries of Northern Rhodesia (CCNR) (Government Report, 1962). Zambezi cooperative Dairies Limited was established in 1956 by 10 local producers to market their milk to the consuming white settler community in Livingstone city in southern Zambia where the company had a processing plant. The company was responsible for collecting and distributing milk produced by about 54 farmers in and around the area. The CCNR on the other hand was responsible for collection and distribution of milk in towns along the line of rail extending from Kalomo in Southern Province through the Midlands to the Copperbelt. The estimated amounts and prices of milk marketed by CCNR between 1954 and 1961 are given in Table 4. All the milk marketed by cooperatives was pasteurized before distributing to consumers with the surplus being processed into hard cheese or butter. CCNR was also responsible for importing processed dairy products into the country. It was the policy of the then government to assist the two cooperatives to process and market locally produced milk in an orderly and organized manner while ensuring product quality and safety. This

policy was accomplished by subsidizing capitalization of processing plants and by guaranteeing wholesale milk producer prices. To regulate the dairy industry, the colonial government enacted a Dairies and Dairy Produce Act that is still in force to date (Cap 217) although it has been repealed from time to time. The government also established regulations for public health and technical specifications for the production and distribution of quality and safe dairy products. To increase consumption of milk in the country, the Federal Government extended the distribution of milk to African compounds in Ndola and Lusaka in 1958. This however, was only for skimmed milk, a by-product from butter and cheese manufacturing.

In marketing milk during the colonial era, producers were obliged to pay for milk transportation to the nearest milk collecting depot from where the processing company took responsibility in meeting transportation costs to the processing plant. CCNR operated a number of milk collecting rounds between Southern and Copperbelt provinces and the government provided the company with a subsidy for milk transportation. This tended to favour distant producers as milk was uniformly priced regardless of the source. It must be appreciated that Copperbelt and the Midlands provided the principal market for milk produced in Northern Rhodesia and all officially marketed milk was distributed by CCNR (Table 4). To encourage production on the Copperbelt, the government offered a premium price of about 5d/gallon of milk produced on the Copperbelt. This, however, did not help very much as farmers did not respond to any significant extent. This may be due to the fact that there was a policy of fixed retail prices for each region and CCNR being a recipient of government subsidy was obliged to sell milk at agreed prices

Table 4: Milk Quantities and prices marketed through the Cooperative Creameries of Northern Rhodesia (1953-1960).

Period	**Marketed Milk ('000 litres)**		**Price (d) per pint**	
	Midlands	**Copper belt**	**Midlands**	**Copperbelt**
1953/4	508	53	6.5	7.5
1956/7	559	665	7.5	8.5
1957/8	649	948	7.5	8.5
1958/9	670	966	8.5	9.5
1959/60	673	1003	8.5	9.5
1960/1	669	983	8.5	9.5

On the Copperbelt, milk was delivered to surrounding towns using refrigerated vehicles, which delivered milk at pre-arranged points to be transferred to special two-wheeled carts for house to house deliveries (Table 5). The pasteurized milk distributed by CCNR was packaged in one *quarter, half and one pint* bottles and marketed in European residential areas of Lusaka and Copperbelt using a house to house delivery system. Sales were mostly based on cash except in a few cases where tokens were used in place of coins. Tokens were readily available from designated milk distribution centres. Distribution of milk in African compounds was through established retail stands and especially constructed two-wheeled carts. The carts were usually just left on the road sides after milk sales and only taken to milk distribution centres once or twice a week for cleaning. On the Copperbelt, milk was also packaged in 1 pint cartons, although the

cartons tended to leak sometimes . CCNR also marketed fortified fresh skimmed milk although this was later replaced by acidulated skimmed milk due to limited demand (Table 6). Suffice to say that skimmed milk was only marketed in African compounds and was cheaper than fresh milk. Prior to independence, the colonial government also operated a free milk scheme in European schools which was later abandoned during the Federation. The free milk scheme was replaced with whole and flavored milk that was cheaply made available to school children.

Table 5: Milk supplies and sales to CCNR collecting depots along the rail line for processing and distribution to the Midlands and the Copperbelt

Station	**Intake**	**Sales**	**Surplus**	**Total sales**
Mazabuka	1,521,247	21,999	1,499,275	20,425
Lusaka	1,073,649	496,805	876,844	275,803
Broken Hill	206,932	150,288	914,389	569,571
Totals	**2,801,828**	**669,092**	**2,467,608**	**865,799**

Source:

Table 6: Daily sales in gallons during selected months for fresh and acidulated skimmed milk in cartons by CCNR.

Selected Dates	**Fresh skimmed Milk**	**Acidulated Skimmed Milk**
March 1959	210	--
June 1959	430	97
February 1960	278	736
August 1960	--	514
September 1960	--	351
September 1961	--	383

Source: Federation Report, 1962.

In addition to the two cooperatives, milk was also marketed through a number of licensed private producer retailers, who are said to have been marketing about two thirds of the milk in Ndola, a third in Chingola and a sixth in Mufulira. It is also reported that prior to independence, half of the milk marketed in Broken hill (Kabwe) was through private producer-retailers. On average, producer-retailers marketed about 11% of the milk in areas covered by CCNR and about 37% in those outside its coverage. Producer-retailers usually delivered their milk to consumers even though some of the bigger consumers like the Asian community went to fetch raw milk from the farms. The reason for fetching milk from farms was that some consumers preferred raw to pasteurized milk. In terms of technological advancement, some of the producer-retailers were quite advanced and had even acquired automatic bottling machines although, others were still undeveloped and were simply decanting their milk in bottles, cans, cartons or even old whisky bottles. Producer-retailers have continued to market milk in areas not serviced by official milk distributing companies even up to the present day.

Post-independence Milk Marketing Policies (1964 to 1991)

After independence, milk marketing was a preserve of the Dairy Produce Board (DPB), which was a subsidiary of the Zambian government. Because of limited milk supplies,

DPB was not engaged in the manufacturing of any dairy products to a large extent and was only responsible for collecting and distributing milk along the line of rail. In 1965, the Zambian government adopted a two tier milk pricing policy under the Cheap Milk Scheme in order to make milk readily available to more Zambians (ZCDL, 1970). The purpose of this policy was to make milk cheaply available in high density residential areas while maintaining a higher price in low density or high income areas. The impact of the cheap milk scheme was that it more than doubled consumption of milk in the country within two years, which outstripped supply (Table7). This was against the background of reduced milk production levels as result of increased exodus of white settlers from dairy farming. This created a deficit in milk supply that had to be met by importation of powdered milk for reconstituting fresh milk. Thus, the DPB also got engaged in the importation of powdered milk to reconstitute fresh milk to meet milk supply deficits. The cost of reconstituted milk was estimated to be 25% cheaper than that of whole fresh milk. In 1970, the price differential under the cheap milk scheme was changed from that of economic zones to that of the product depending on whether it was fresh whole milk or reconstituted skimmed milk. The reconstituted milk was being produced at 8.7 million litres per year and accounted for about 40% of total milk demand in the country.

Table 7: Milk production and marketing during the post independence era between 1965 and 1969 ('000 litres per day) by the Zambia Dairy Produce Board.

	1966	**1967**	**1968**	**1969**
Sales of liquid milk	36.7	46.6	53.4	57.9
Purchases of fresh milk	43.9	37.5	39.7	34.4
Surplus (+) or Deficit (-)*	**+7.2**	**-9.1**	**-12.5**	**-23.5**

Source: Zambia Livestock Development Programme, 1970. * Deficits were met by importation of powdered skimmed milk for reconstitution.

To market milk, DPB was collecting about 34,000 gallons of milk per day produced along the rail line of which only 5700 litres was from the Copperbelt. Only Choma and Kalomo were found to be too far for DPB to collect and market milk from at a profit. Like in the colonial era, these places and those off the rail line were serviced by licensed producer-retailers. To enable DPB to distribute milk at a profit, the government provided subsidies to cover for the narrow difference between producer and wholesale prices. Like the colonial government, DPB also offered an extra 5ngwee(n) per gallon to the price of the milk produced on the Copperbelt to encourage local production. This was against the 3.50 to 4.00n required to transport a gallon of milk from the Southern Province to the Copperbelt. There are indications in literature of DPB setting up facilities to produce Ultra High Temperature treated (UHT) milk for distribution to consumers off the line of rail although implementation of this plan does not appear in any subsequent reports.

In areas off the line of rail, there were minimal activities for commercial marketing of milk in the country. Milk in most provincial capitals was produced and marketed by government run dairy farms under Rural Dairy Units (ZCDL, 1970). Outside provincial headquarters, there were no government efforts to supply milk to the consuming public. Most of the rural districts depended on milk supplied by traditional small scale farmers whose animals produced extra milk to supply to surrounding urban centres during the rainy season when there is ample supply of quality feeds their. Milk in these areas was

either marketed by farmers themselves or hawkers in streets and local markets. As stated above, supply of milk in these areas was rather seasonal and there is no reliable data to document amounts supplied and marketed from traditional local animals. There are still no established market networks for milk off the line of rail. Milk in some of the rural districts was supplied by local farmers on the government sponsored Crossbreed Development Scheme (CDS).

Milk Marketing Policies under the Liberalized Economy (1991 to present)

Privatization of the dairy industry in 1991 saw entry of new participants in the marketing and distribution of milk in the country. This resulted in improved marketing and introduction of new dairy products apart from just pasteurized whole milk and cheese marketed under DPB. The introduced dairy products include long shelf-life UHT milk, fruit flavored milk, butter, fresh cream, dairy fruit-juice blends, ice-cream and yoghurt. Privatization of the sector has also led to the development of a modern and formal dairy supply chain between consumers and producers. In addition to milk processing companies, major South African supermarket chains including Shoprite checkers, Mellisa, and SPAR entered the dairy market in 1996. These market chains did not only create a reliable and growing formal market for dairy products across the country, but also drastically increased the use of refrigeration facilities in milk retailing. The combined use of refrigeration facilities and manufacturing of UHT milk (which can be stored up to 12 months without refrigeration) drastically increased the distributional reach of milk and other dairy products. From one or two milk processing companies, the country saw entry of up to 19 new companies that started to compete in buying, processing and the distribution of milk from producers to consumers. At present, about 190 million litres of milk is currently being marketed through official channels every year. This, however, does not meet the national demand as there is still a shortage in fulfilling the 253 million litres required and importation of powdered milk has continued to balance up the deficit (Valeta, 2004).

Even under the liberalized market economy, most of the milk is still produced along the line of rail and is marketed through milk collecting centres that have been installed in various parts of the country with the assistance of donor agencies through NGOs. Farmers are usually responsible for delivering milk to collecting centres from where processing companies pick it to their plants. Depending on the arrangement, companies may charge a premium for milk transportation. Currently, there are about 19 milk processing companies with capacity to process milk into various products including pasteurized milk, yoghurt, ice creams and a wide range of milk based drinks and beverages. Deregulation and removal of price controls for inputs and products has allowed processors to establish a new quality-based raw milk pricing schedule. The price of milk is currently calculated using complex formulas based on bacterial count and butterfat content amongst others. The marketing of dairy products is currently regulated by the Zambia Dairy Processors Association, which is a lobbying NGO with interest to promote consumption of dairy products in the country.

Even under the liberalized market economy, there is still a considerable amount of milk that is marketed through unrecorded channels mostly as unprocessed or raw milk. The market for the raw or fermented milk is to satisfy customers with a special appeal for

raw milk and those who feel pasteurized milk to be too expensive. Suffice to say that raw milk is used in a number of traditional dairy foods.

3.2.3 Review of Policies Affecting Milk Processing

Milk Processing Policies Prior to Independence

Prior to the independence, processing of milk in the country was a preserve of the Zambezi Cooperative Dairies Limited and Cooperative Creameries of Northern Rhodesia that processed to market a bulk of the milk produced along the line of Rail. Zambezi Cooperative Dairies Limited was responsible for collecting and processing milk produced in and around Livingstone where as CCNR was mandated to collect and process milk from parts of Southern Province, the Midlands and the Copperbelt. Most of the milk collected by the cooperatives was processed by pasteurizing into fresh whole milk with the surplus being processed into hard cheese and to a lesser extent butter fat. To fulfill this mandate, the CCNR had milk processing and bottling facilities at various stations along the line of rail. CCNR also had a milk/stock sterilizing plant in Lusaka and cheese making and milk cooling factories in Mazabuka. On the Copperbelt, the company initially had a milk processing plant in Ndola, which was later moved to a more centrally located Kitwe and the Ndola plant converted to a mere distribution centre. All Copperbelt towns had established milk distribution centres. In 1958, an additional cheese making factory was opened in Kabwe, the then Broken hill in addition to ice cream making plants in Lusaka and Kitwe. The capacity for butter making was about 1800 kg of milk daily that gave a maximum output of *5,570* pounds and the cheese making capacity was *3,500* gallons that translated to *3,230* pounds of output per day. This shows that there was a lot of capacity to handle and process milk during the colonial era. The only problem in milk processing at the time was that most milk had to be transported more than 500km from Mazabuka to the Copperbelt, which proved to be too expensive. The company gave a premium price for production of milk on the Copperbelt to encourage local production although this did not work very well. There was also an element of double handling of milk from the midlands that also reflected in increased production costs. Ultimately, CCNR was liquidated just before independence to pave way for the formation of the Zambia Dairy Produce Board in 1964.

Table 8: Milk processing facilities and production capacities for various products in '000 gallons/day.

Milk Processing Activity	**Lusaka**	**Kitwe**	**Mazabuka**	**Kabwe***
Pasteurizing	600	800	1200	300
Bottle washing and filling	300	800	20	200
Carton milk packaging	-	450	--	--
Sterilizing Tower	650	--	--	--
Volumes handled				
Peak day receipts	3,700	3,800	4,600	680
Daily milk sales	1,400	2,820	65	440
Sterilized milk sales	12,600	--	--	--

Milk processing policies post independence (1964 to 1991)

After independence, the government nationalized all dairying activities in the country and the Zambia Dairy Produce Board (DPB) was established to control the buying, manufacturing, importation and marketing of all dairy products in the country (FAO, 1982). Thus, during the post independence era, DPB was responsible for the collection and packaging of milk for distribution to consumers. The main milk processing activities for DPB was the pasteurizing of milk collected from farmers along the line of rail in areas that were deemed economically feasible for the company. Because of milk shortages that were brought about by the Cheap Milk Scheme, DPB did not engage itself in processing milk into dairy products to any great extent. It was instead more involved in trying to balance up milk deficits by reconstituting imported powdered milk for consumers. Thus, the only additional milk processing activities carried out by DPB was fortification of imported milk powder into reconstituted milk, which accounted for about 40% of the total milk demand. Because of government controls and the fact that everyone was obliged to market their milk through DPB, there was limited investment in the dairy sector to warrant large scale processing of milk in the country.

Milk Processing Policies under the Liberalized Market Economy

In 1991, after the liberalization of the National Economy, there was free entry of participants to the dairy industry especially with regard to milk processing companies. Privatization of the Zambia Dairy Produce Board saw entry of new companies; Parmalat, Diamondale, Zambebeef and others, which had to compete to buy milk from farmers for processing into various products. The country now has more than 19 milk processing companies from just two that were available in 1991. Some of the major processing companies together with their processing capacity are shown in Table 9. There is also a number of producer-retailers, as mentioned above, who have installed milk processing facilities and are able to process milk into various products that they directly sell to consumers. Thus, current milk processing facilities in the country are far beyond their milk production capacity. This tends to have a negative effect on the pricing of milk to consumers. There is need for increased production of milk in the country to warrant efficient use of available milk processing facilities. This is particularly important considering that the current per capita milk consumption of 15l per year is way below the recommended 45l by the FAO (ref).

Table 9: Production capacity and location of major milk processing companies

Processing Company	**Installed capacity ('000l)**	**Operating Capacity**	**Location**
Parmalat Zambia limited	120,000	60,000	Lusaka/Kitwe
Finta Danish Dairies limited	120,000	50,000	Livingstone
Zammilk Products limited	20,000	15,000	Chisamba
Diamondale Dairy	12,000	12,000	Chisamba
Kaposhi Dairy Products	6,000	4,500	Chisamba
Maplehurst Dairy	1,000	1000	Kabwe
Eastern Dairies	16,000	800	Chipata
Greenveld Farm	4,000	2,000	Chipata

Source: Modified from Valeta, 2004.

3.2.4 Review of Policies Affecting Training and Technological Development

Certificate Training Programmes

At independence, the policy of the government was to introduce indigenous Zambians to dairy farming by offering training programmes for those who wanted to take up dairy farming as a business career. This saw the opening of a government dairy training college (Clifton Dairy Training College) in 1967 east of Lusaka, where aspiring dairy farmers were trained for two years for a certificate course. It is unclear if this college is part of the present day Palabana Dairy Training Institute (PDTI). After graduation trainees were provided with loan facilities and given land for dairy farming. In addition to the training of would be farmers, the government also wanted to train extension workers to assist with the development of the dairy industry in the country. The government also recruited dairy extension workers to help reduce production costs through improved efficiency to increase profitability in the industry. Palabana Dairy Training Institute is still the main centre for dairy management personnel in Zambia at certificate level.

The other training programme relevant to dairy management at certificate level was in Artificial Insemination (AI) that was offered by the National Artificial Insemination Services (NAIS) under the Department of Veterinary Services in the Ministry of Agriculture. NAIS was also established in 1967 and in addition to AI training was also responsible for importation and distribution of semen and liquid nitrogen to farmers. Suffice to say importation of liquid nitrogen is no longer necessary as it is locally available through commercial suppliers. Training in AI by NAIS was and is still done on a "do it yourself" basis whereby farmers or their employees are taught basic techniques for about 5 to 10 days so that they could implement it on their farms on their own. Initially, the training was only conducted in Mazabuka but this has since been extended to other parts of the country through mobile training sessions. Poor funding and lack of follow up check ups due to bad road network coupled with inferior success rates with AI as compared to natural mating has limited the extent and use of artificial insemination among dairy farmers. However, in recent years the technique has been gaining popularity due to shortage and high cost of pedigree breeding bulls. NGOs like HPI and Land O' lakes have also played a defining role in the promotion of AI among smallholder farmers by training farmers in AI techniques. NGOs contribute to AI training by sponsoring training programmes for small scale farmers.

Also stationed in Mazabuka is the Zambia Institute of Animal Health (ZIAH) that specializes in a two-year training programme for animal health personnel, who upon graduating are employed as veterinary assistants in government institutions and private dairy farms. Also involved in the training of dairy personnel at certificate level are the two Zambia Colleges of Agriculture (ZCA) in Monze and Mpika. ZCA trains school leavers in general agriculture and students are given a choice of specializing in either crop or animal husbandry. Animal husbandry graduates may be employed as dairy extension officers after taking specialized additional short courses in dairy management. In the past, there were also a number of farm institutes scattered throughout the country that were involved in the training of local farmers in various fields of agriculture including dairying. Most of these institutes had beef and dairy animals, which enabled these institutes to be used as demonstration centres to local farmers. However, since the late

1980s, most of the farm institutes have been run down and currently do not have any animals or personnel and are rarely used as agricultural training centres. Perhaps the government should consider revamping these institutions if the country is to improve its agricultural out put. A number of NGOs including the church also facilitate training of local farmers and extension workers in dairy management by organizing training workshops in partnership with local institutions including GART, UNZA, ISTT, LDT and others. HPI and Land O' lakes have been instrumental in organizing such training sessions and these will mostly include animal feeding, forage and fodder production, business administration, milk handling, marketing and others (Valeta, 2004). There are also church based training centres such as Kasisi, Elias Mpundu and Kalulushi Agricultural Training Centres that are involved in teaching agricultural skills including dairy farming to local youths and established farmers.

Dairy Training at Diploma Level

Apart from the recently introduced training programme in dairy technology at Palabana, the country does not have any specialized dairy training at diploma level. The only training related to dairy at diploma level is in animal husbandry at the Natural Resources Development College (NRDC) in Lusaka. The college was established in 1969 and offers a three-year training programme in agriculture where students are given a choice of specializing in either crop or animal husbandry. Other specialization options offered by NRDC include education, fisheries and nutrition. Graduates from the animal husbandry quota are the ones who are employed as livestock extension officers or ranch managers by the government and private dairy farms, respectively. The diploma programme at NRDC is known for its practical application of learnt knowledge in the field. In addition to NRDC, some of the specialized training programmes in dairy at diploma level are obtained from outside the country including South Africa, United States of America, the Netherlands and others. The newly introduced diploma programme at PDTI is yet to be proved and is more tailored towards business management and dairy technology and is, therefore, targeted for the production of dairy managers and dairy technologists for the processing industry. The programme is designed to take three years for school leavers and two years for non school leavers who have Palabana dairy management certificates. The two Zambia Colleges of Agriculture (ZCA) in recent years introduced diploma programmes in their curriculum.

Dairy Training at Degree level and beyond

The University of Zambia's School of Agricultural Sciences is the principal training centre for degree holder dairy scientists in the country. The school offers a five-year training programme where students meant for the dairy industry are made to specialize in animal science from the second year. Thus, agriculture graduates from animal science quota are the ones who are employed as dairy managers or dairy extension officers by private and government institutions. Animal science graduates from UNZA have an advantage in that they are also trained in other fields of agriculture including animal health, crop production, soil science, economics and rural extension. They may however, not be very conversant with dairy technology including milk processing. Dairy technologists are currently produced under the recently introduced Food Science and Technology Department.

In recent years, degree programmes at the University have been faced with challenges in practical training of students due to the large number of students enrolled under limited resources and facilities. These challenges tend to hamper implementation of practical classes and field visits. The University of Zambia through the School of Veterinary medicine also produces veterinary surgeons who upon graduation are employed as animal health experts both in government and private firms. Some of the veterinarians from UNZA are actually employed as dairy managers and are thus, given duo responsibility of managing dairy farms while ensuring the health of animals on the farm. Suffice to say that the School of Veterinary Medicine was only opened in 1988 and before then, most of the training for veterinary personnel in the country was done in Kenya at Kabete Campus of the University of Nairobi.

A number of degree training programmes are also accessed from other countries through private, bilateral and multilateral scholarships given to Zambian citizens by foreign governments and private institutions. This is particularly true for postgraduate training for masters and doctorate degrees in specialized fields of animal agriculture including nutrition, reproductive physiology, breeding and dairy technology. It must be mentioned that the University of Zambia has in recent years established its own postgraduate programmes at masters and doctorate degree levels in various fields of agriculture including livestock production. The newly established government sponsored Mulungushi University in Kabwe is also likely to offer degree programmes in specialized fields of agriculture including dairying as they open up their new frontiers of education under the School of Agricultural Development. Although not directly related to dairy, the Copperbelt University offers degree programmes in agro-forestry that may find application in the dairy industry.

Research and Technology Development Policies affecting the Dairy Industry

Since independence, the Research Branch of the Ministry of Agriculture has been the principal organization responsible for the execution of research and development of technologies that may be related with the dairy industry. At present, the country has no private or public research institution that specifically deals with dairy. Most of the dairy related research activities in the Ministry have been concerned with nutrition of ruminants through improved production of pasture and fodder crops and development of strategies for dry season supplementation of cattle. The main research stations involved with livestock research included Mochipapa in Choma and the National Irrigation Research Station in Nanga. Research activities at Mochipapa were mostly concerned with dry season supplementation of animals for increased meat and milk production while in Nanga the emphasis was on improved pasture and fodder production. It is, however, important to note that before independence, Mazabuka Central Research Station was the main centre for animal production research in the country if not Africa. At the time, the main research activities at Mazabuka concentrated on evaluating the productive and reproductive capacity of indigenous cattle. Other research activities were aimed at improving milk production in the country by crossing indigenous cattle with exotic dairy breeds. It is the only centre that still boasts of a milk recording laboratory. Mazabuka has now expanded its mandate to genetic conservation of indigenous animals.

It must be appreciated that prior to independence, policy issues affecting the development of the dairy industry were enshrined in the Agricultural Act of the Federation of Rhodesia and Nyasaland. This Act was implemented through the Federation's Agriculture Research Council (ARC), whose mandate was to harness efficient exploitation of raw materials for the British Empire from all the colonies. The ARC was divided into three advisory and technical research Units including Agriculture, Forestry and Tsetse control. The ARC was transformed into the Agriculture Research Council of Central Africa (ARCCA) in 1963 after the dissolution of the Federation. Unfortunately, the ARCCA did not last long as it was changed into the Zambia Agricultural Research Council in 1964 after independence.

The Zambia Agriculture Research Council continued up to 1967 when the Act was repealed to establish the National Council for Scientific Research (NCSR). The NCSR was mandated by the government to coordinate and implement all research activities in the country. It must be noted that from the establishment of the Federation in 1953 to 1967 when NCSR was established, all research activities related to dairy production were conducted at the Animal Production Research Unit (APRU) in Chilanga. The name of APRU was later changed to Livestock and Pest Research Centre (LPRC) under NCSR. Livestock research activities at LPRC concentrated on quantifying and controlling constraints affecting livestock productivity in the country. These included disease diagnosis and control of disease transmitting vectors including tsetse flies, ticks and worms. NCSR has since been transformed into the National Institute for Scientific and Industrial Research (NISIR) and has various animal research programmes including tsetse ecology, nutrition, reproductive physiology and disease control. Through NCSR programmes a lot of livestock research has been conducted to improve productivity of animals in the Zambia but perhaps the real tragedy is that very few research findings have found application in the field. The main problem with livestock research in the country has been lack of coordination and liaison among participating institutions.

Other institutions dealing with animal production research in the country include the University of Zambia (UNZA) through its research efforts under the Department of Animal Science. The department has been conducting research in animal production including dairy nutrition for quite some time now. Most of the research efforts at UNZA have concentrated on nutrition of animals especially during the dry season when there is limited supply of feed and water. Current dairy research efforts at the UNZA are aimed at improving milk production by crossing local cattle with exotic dairy breeds and improved nutrition through increased utilization of locally produced feed resources. The School of Veterinary Medicine also conducts dairy related research through their efforts in animal disease control and eradication. Research in disease and vector control is also a responsibility of the Central Veterinary Research Institute (CVRI) in Balmoral. This clearly demonstrates that there have been a lot of research done in the country but the problem is that most research findings have not reached the end users.

To help improve the diffusion of research findings to end users and other stakeholders, the government has made some policy changes as to how the country coordinates and implements research and development programmes by enacting a new Science and Technology Act. The new Act mandates the Ministry of Science, Technology and Vocational Training (MSTVT) to coordinate and oversee the implementation of research

and development activities in the country. The Act seeks to improve the socio-economic wellbeing of Zambians through the application of science and technology in the development and production of goods and services. To this effect, the Ministry has established a number of institutions for successful implementation of science and technology initiatives (Table 10). The Ministry also coordinates the development of skills and entrepreneurship training through the Technical Education and Vocational Training Authority (TAVETA). It is a requirement that all private and public skills training institutions be registered with TAVETA for them to conduct any training programmes. TEVETA also facilitates development of infrastructure and capacity building in skills training institutions by putting up structures and training of personnel. A good example for infrastructure development has been the construction of dairy practical training unit at Palabana. TEVETA also works in collaboration with the Examination Council of Zambia (ECZ) in curriculum development and examination of candidates from registered institutions.

Table 10: Key research and development institutions in Zambia

Institution	**Function**
National Science and Technology Council	Coordination and funding of S&T research in Zambia
National Technology Business Centre	Piloting and up-scaling of developed technology
National Technology Information Centre	Assessing and promotion of developed technologies
Environmental Council of Zambia	Environmental safety and Public health
Zambia Bureau of Standards	Standard setting body
National Institute for Scientific and Industrial Research	
Zambia Agriculture Research Institute	Research
The University of Zambia	Research and Training

3.2.5 Existing Legislations Affecting the Dairy Sector

Poverty Reduction Strategy Programme

PRSP is a developmental programme initiated in 2002 by the Ministry of Finance and National Planning to plan for empowerment of citizens by adopting and focusing on measures required to achieve sustained economic growth. Through the PRSP, the country needs to develop an economy that creates jobs for citizens and generates tax revenues for the state to foster sustained economic growth and poverty reduction. In the PRSP, the aim is to have a broad based economy for promoting income generation, linkages and gender equity. It is important to note that agriculture has been given priority as an engine for economic development by virtue of abundant natural resources

in terms of land, human capital and favorable agro-ecological climate. Agriculture is also considered to be critical in the implementation of PSRP in that most of the poor people in Zambia are engaged in this sector in one way or the other.

Vision 2030

Vision 2030 is a long term planning instrument that reflects the aspirations and determination of the people of Zambia for the nation to be a prosperous middle income country by the year 2030. The vision sets a number of plausible courses of action to be taken towards achievement of long term goals and targets. These are divided into five-year national development plans that all together contribute towards reaching middle income status by 2030. In the process, the country is expected to significantly reduce hunger and poverty among citizens by fostering a competitive and outward oriented economy. The vision, therefore, emphasizes efficient use of locally available resources including land, agriculture, mining, energy and tourism in addressing problems of poverty among Zambians. The vision highlights possible scenarios in attaining targeted developmental options by the year 2030.

Fifth National Development Plan

The fifth National Development Plan is part of the long term developmental goal of Vision 2030 outlined above. The FNDP is aimed at broad based wealth and job creation through citizenry participation and technological advancement. The strategic focus of the FNDP is economic infrastructure and human resources development. In terms of agriculture, the focus for FNDP is to facilitate and support the development of a sustainable and competitive agricultural sector that should ensure food security and income generation to maximize the sector's contribution to the national Gross Domestic Product (GDP). The goal is to ensure improved agricultural productivity and competitiveness.

Millennium Development Goals

The Millennium Development Goals, popularly known as MDGs, are a set of 8 globally accepted human developmental targets set out by 147 Heads of State and governments in 2000.Considering that in most of the world poor people live in rural areas, agricultural development has been cited to be critical in the attainment of most of the MDGs. Even though all MDGs have a direct or indirect connection with agriculture, the first one, eradication of hunger and poverty is of greatest relevance to agriculture in general and dairy in particular.

The Standards Act (CAP 416)

The standards Act was enacted to control and regulate standards and quality of manufactured goods and products. This is implemented by the Zambia Bureau of Standards through the Standards Council of Zambia. The ZBS ensures that standards are set and adhered to by both producers and middlemen to protect consumers against exploitation and health hazards The standards for various milk products are highlighted elsewhere. Standards for various products in Zambia are set and regulated by various

technical committees including feeds, milk products. ZBS has powers to enforce the set standards and this may be implemented through prosecution or withdrawal of trading licenses. They also have powers to withdraw sub-standard products from the market or close premises producing such products. Standards are expected to be reviewed every five years, although this rarely happens. Sometimes there also problems of enforcement especially when the product in question borders on public health and consumers protection. In most cases, standards are enforced through the Quality Assurance Division.

The Public Health Act (CAP 295)

This act is implemented through the Ministry of Health and is meant to ensure that all commodities meant for sale to the general public are of good quality and in hygienic condition. It also sees to it that the people handling foods and the premises from where food is sold or consumed are according to established health and hygienic standard. The act also has the powers to declare people handling food to be medically fit and issues certificates to that effect. They also give registration certificates to all companies trading in dairy products upon inspection of their premises. The public Health Act is also mandated to declare people working on dairy farms or milk processing facilities are healthy and free of communicable diseases. They are also empowered to inspect any premises including animals that produce milk, dairy shops and milk transporting vehicles for human consumption. Public health regulations are enforced through health inspectors that may be employees of the Ministry of Health or local government authorities, popularly known and councils.

The Food and Drugs Act (CAP 303)

This act was enacted to ensure that all foods, drugs and medical devices sold in the country are safe to humans. The Act ensures that producers and other businessmen trading in food products including milk do not contaminate them with harmful or poisonous materials. The Act demands that all food products are properly packaged and labeled in terms of ingredients and any preservatives that may have been used in preparing such food products. The food and Drugs Act is more concerned with processed products unlike the public health Act that is more concerned with raw milk as it is produced and taken to the market for consumption or processing. Thus, the Food and Drugs Act is more concerned with processed dairy products including butter, cheese, yoghurt and other dairy foods. The Act is implemented through the Food and Drugs Board that advises the Minister responsible on what needs to be done.

The Weights and Measures Act (CAP 403)

This Act was enacted to ensure that machinery and equipment used for weighing and measuring products including milk and feeds are correct and accurate. The Act empowers officers to check the machines and equipment in question on a regular basis to ensure that they are in proper working order. The Act is administered and implemented through the Ministry of Commerce, Trade and Industry. The Act also prescribes and establishes minimum sizes and weights as trading standards for various

products including animal feeds and dairy products. This Act is usually implemented in liaison with the Standards Act and the two are under the same Ministry.

The Fertilizer and Feed Act (CAP 226)

The Act is sometimes known as the agriculture Act and is responsible for regulating the manufacture, processing and importation of fertilizers and animals feeds in the country. It provides for minimum purity standards for both fertilizers and feeds that can be sold in the country. The farm feed regulation is responsible for issuing registration certificates to feed manufacturers as they meet declared standards for purity and quality of feeds they produce. The Act also has powers to approve quality control laboratories for feed analysis. This Act is implemented through the Ministry of Agriculture and may in due course move to the newly established Ministry of Livestock and Fisheries. Thus, there is a possibility that this Act may in future be split into fertilizers and feeds Acts as a result of separating the Ministries for livestock and agriculture.

The Stock Diseases Act (CAP 252)

This Act provides legislation for the control and prevention of animal diseases in Zambia. The Act regulates importation and movement of animals in the country and has powers to quarantine stock under certain circumstances such as during a disease out break. The major diseases of concern governed by this Act include Foot and Mouth Disease (FMD), Lumpy Skin Disease, Contagious Bovine Pleuro-Pneumonia (CBPP) and other notifiable diseases affecting cattle. The Act empowers the Ministry to carry out disease surveillances and could declare disaster areas based on the disease situation in a given locality. The Act is also responsible for issuance of stock movement permits and for inspection of any stock for the purpose of ascertaining their health status.

The Veterinary Surgeons Act (CAP 243)

This act provides for the registration of veterinary professions and regulates the practice of veterinary Medicine in the country. The act regulates performance of any operation in giving, treating, diagnosis or any function that is performed or provided by veterinary surgeons. The Act empowers the Board of Veterinary Surgery to register all veterinarians in the country and issues them with certificates to allow them to practice veterinary medicine in Zambia. Thus, through this Act, only registered veterinarians are allowed to diagnose disease and treat animals on dairy farms. The effectiveness of the board remains to be seen as such meetings are rare and far between. The need to control quality in veterinary practice can never be over emphasized.

The Pharmacy and Poisons Act (CAP 299)

This legislation regulates the use and stocking of drugs in the country. It first maintains a register of pharmacists in the country and issues licenses for people and businesses dealing in drugs and poisons. The Act prohibits veterinarians from stocking drugs and can only prescribe medicine to clients for them to purchase them from established pharmacies. This has sometimes resulted in controversy especially with the introduction of private veterinary practices in 1994. What this Act entails is that a private veterinarian

cannot run a private clinic in the absence of a qualified pharmacist. It also reduces the effectiveness of practicing veterinary medicine, especially in rural areas if the veterinarian cannot stock drugs for immediate use on the farm. The above two acts still remain to be clarified as animal scientists are not allowed to treat animals despite their qualifications as animal production experts.

The Factories Act (CAP 441)

This act regulates the design and specifications of operating factories to ensure safety standards are maintained in milk processing factories. The Act is designed to protect workers in milk factories by ensuring safety rules are observed and followed. It also promotes hygienic production of quality dairy products from milk processing companies. The Act also includes large dairy farms as such farms are often regarded as factories.

The Environmental Protection and Pollution Control Act (CAP 204)

This Act provides regulation for the protection of the environment and control of pollution from established business entities. The Act is implemented through the establishment of the Environmental Council of Zambia under prescribed functions and mandates. The Council ensures that operations of dairy farmers and processors have a minimum impact on the environment by embarking on good agricultural practices. The council promotes effective and sustainable waste management disposal practices. The council also regulates proper use of agro-chemicals and animal manure by avoiding effluent going into rivers or places where they can be harmful to the environment. This Act works in tandem with the public health Act of the Ministry of Health.

The Water Act CAP 198

The water Act regulates the use of natural water bodies for the purpose of agriculture by issuing water rights to deserving business enterprises. Water rights empower individuals and companies to impound water from a river by building a dam. The Act is implemented by the Water Board that considers applications, makes surveys and investigates the impact of such rights to other interested parties. There can be no dairy business entity in the absence of water both at farm and factory level.

The Cooperative Societies Act (CAP 397)

This Act provides for the establishment, registration, inspection and supervision of cooperative societies to which members belong. Cooperatives belong to members and run for the benefit of members. The Act has enabled the establishment of many dairy cooperatives in different parts of the country. Through such societies, members are able to market their milk by joining forces and combining resources. They also have a combined voice to negotiate for better prices with milk processing companies and suppliers of dairy inputs.

The Agricultural Lands Act (CAP 187)

The Act provides for access to land by Zambian citizens for the purposes of agricultural utilization. It regulates the holding of land on leasehold either under customary or statutory land tenure. Under the Act, the Land Development Fund and the Lands Tribunal have been established to oversee land development programmes and settle disputes pertaining to land acquisition. The Act also provides for land acquisition for agricultural purposes including dairying. Deliberate efforts provided for in the Act enhance access to land by visible minorities such as women and other vulnerable groups. The Act is supportive to the establishment of medium and smallholder dairy schemes where farmers are given land to develop their dairy units.

The Investment Act (CAP 385)

The Act provides legal framework for starting up business activities in Zambia. The Act is administered through the investment Board and implemented through the Zambia Investment Centre, which was recently converted in to the Zambia Development Agency. The Act aims to provide an enabling environment for people wishing to start businesses in Zambia by providing facilities for easy access to information and registration of business entities. The Act also provides for incentives, special services and guarantees and issues investment licenses. The Act is supportive to the establishment of large scale dairy farming and milk processing plants for the manufacture of various dairy products.

The Companies Act (CAP 388)

The Act is closely related with the investment Act as it provides for the formation, management and registration of companies in Zambia. This Act provides a legal framework for private and public companies wishing to undertake commercial dairy farming or milk processing. This particularly facilitates registration of established international companies to start doing business in Zambia.

The Trades Licensing Act (CAP 393)

This Act empowers business and individuals to trade in goods and services they are licensed to. Through the Act, a number of trade licenses are issued to various business entities to allow them to trade in such businesses. This Act facilitates orderly and safe marketing of milk to processors and other consumers. This Act is mostly enforced through local councils that issue trading licenses. It is however restrictive to milk vendors or hawkers that frequently buy milk from farms for sale to the general public in streets and local markets.

The Dairies and Dairy Produce Act (CAP 230)

The Act was enacted for the control and registration of dairies and dairy produce in the country. The Act was established as a regulatory arm of the Zambia Dairy Produce Board with the sole purpose of ensuring production of quality dairy products in the country. Under the current scenario, most functions of this act have been taken over by that of the public health act. The Dairies and Dairy Produce Act worked hand in hand with the Dairy Produce Board Act (CAP 235), that enacted the establishment of the

government controlled Zambia Dairy Produce Board that was responsible for the production and marketing of milk during the first and second republics. The marketing of milk at the time was regulated by another act called the Dairy Produce marketing and levy Act (CAP 234), which is currently irrelevant under the private sector controlled economy that the country has been implementing since 1991.

3.3 Key Actors in the ASTI System of the Dairy Industry

The Zambian dairy industry is run by a wide range of stakeholders that play various functional roles to contribute to the overall performance of the industry. Some actors may have a single defined role while others play multiple functions and may interact with many other stakeholders. The various actors are divided into five main categories including enterprises, market and demand, research and training, diffusion and information transmission and policy and infrastructure development. Discussed below are the main players in selected cluster groups and the role they play according to the ASTI system. The clustering of various actors was adapted from the CTA methodological framework (2005).

3.3.1 Enterprises

The main actors under the cluster of enterprises include milk producers, the dairy farmers who produce milk, animal breeders who supply milk animals to farmers and milk processors who procure milk from farmers to turn into various dairy products. The enterprise cluster also includes a number of public and private institutions that provide goods and services to the industry.

Dairy Producers

The main milk producers in Zambia are generally divided into three main categories consisting of large scale commercial producers, medium and small scale producers. The division into various categories is based on the number of animals owned and the amount of milk produced by individual farmers each day. Large scale producers are those who mostly own more than 100 pure breed dairy animals and produce more than 1000 liters of milk per day. Most of the established large scale dairy farms run in families. Notable among large scale commercial dairy farms are Moomba, Kushiya, Cedrics, and Mupplehurst. Examples of dairy farms under selected categories are shown in Table 11. There are large scale commercial farms that are run as established corporate business organizations and keep dairy animals to produce milk for processing in their own factories or sell to other processing companies. Good examples of such companies are Kalundu dairy farm in Chisamba for ZAMBEEF, Diamondale in Ngwerere and Eastern Dairies in Chipata. Other large scale farms for dairying include those owned by government institutions such as Palabana dairy for LDT andBatoka Dairy for Livestock

Development Centre under GART. These institutions keep animals for other purposes but also produce milk that they sell to processing companies.

Medium scale dairy producers include farmers who own between 20 and 100 dairy animals and usually produce less than 1000 litres of milk per day. Most of the medium scale dairy farmers are located near urban centres and nearly all the milk produced is sold in towns to individual consumers or processing companies. The milk is usually delivered to the processing company every day or the company comes to collect milk from the farm on scheduled dates. The medium scale dairy producers mostly consist of retired employees who have taken up dairy farming as a business career. Some of the farmers are still employees of public and private firms in towns and run their dairy farms on part time basis. The dairy animals owned by this group of farmers are either pure or crossbreeds producing between 5 and 10 litres per day. A number of government institutions including training colleges that own cattle fall in this category. It is from this group of farmers that the potential for expanding the dairy industry lies. The industry is likely to grow as more of the emerging medium scale farmers graduate into large scale commercial farmers. As of 1999 (table 11), a majority of animals were owned by small-scale producers who mostly keep local breeds. However the largest quantities of milk produced came from the large-scale farmers who keep exotic dairy breeds and contributed about 40 percent of total milk produced in the country.

Table 11: Characterization of Zambian dairy farmers (1999)

Farm Characteristics	**Large Scale**	**Medium Scale**	**Small Scale**
Number of animals	37,877	4,778	1,519,967
Type of animals	Pure exotic	Dairy crosses	Pure local
Milk production/day (l)	25-30	8-15	2-5
Estimated Milk contribution (%)	40.2	12.4	43.3
Number of Farmers	68	164	30,390

Source: Land O' lakes, 1999.

The last category of milk producers are the small scale producers who may own from one up to 20 milk animals and produce milk that is either sold locally on the farm or delivered to the milk collecting centre for delivery to the processing company. This category also includes traditional farmers who keep local animals that they milk once daily to produce milk for home consumption or sell to neighbours and the milk collecting centre (Valeta, 2004). Their animals only produce limited amounts of milk each day ranging from as low as one litre to about five litres each day. It must be noted that a number of small scale farmers have received pure breed exotic dairy animals through the government sponsored livestock restocking programme, but these animals do not produce to expected capacity due to limited management capabilities of the owners. Because of large numbers, the small scale farmers have capacity to revolutionize the

dairy industry if organized properly through delivery of dairy inputs and marketing of milk. The current challenge with small scale producers is to produce milk of uniform quality from each collection centre.

Table 12: Main dairy producers in Zambia under various production categories

Component: Enterprise			
Dairy Producers	Commercial	**Name of Dairy Producer**	**Location**
		Kalundu Dairy, Diamondale/ Galaun, Sunrise, Zammilk, Kalwa	Lusaka
		Cedrics	Kitwe
		Mayana	Chipata
		Chisoba, Kushiya	Mazabuka
		Moomba Farms	
		Ndola Dairy Farm	Ndola
	Medium	Rosedale Farms	Lusaka
	Small Scale/ Emergent e.g. co-operatives and farmer associations across the country	**Name of Co-operation/ Farmer Association**	**Location**
		Mapepe	Chilanga
		Magoye	Mazabuka
		Mbala	Mbala
		Mpika	Mpika
		Chinjala	Chipata
		Mpima	Kabwe
		Zimba	Zimba
		Twikatane	Chingola
	Training/ Public Institutions	**Name**	**Location**
		Natural Resources Development College (N. R. D. C)	Lusaka
		Zambia College of Agriculture (ZCA)	Monze and Mpika
		Palabana Dairy Training Institute	Chongwe
		Kasisi Agricultural Training Center (KATC)	Lusaka
		Twin Fountain	Kalomo
		GART	Chisamba

Source: Survey data: Zambia 2009

Dairy Breeders and Semen dealers

Animal breeders provide milk animals through sale of replacement heifers and breeding bulls. There are no established dairy breeders in Zambia that sell pedigree milk animals to the dairy farming community. Most of the dairy animals offered on the market are from dairy farmers themselves who either offer excess replacement heifers or culled

milking animals. Others raise bull calves for sale as breeding bulls from their herds. There are also a number of firms that sell semen for Artificial Insemination to dairy farmers. For the supply of semen to farmers, Semex a joint venture between Kushiya Farms in Mazabuka and a Canadian breeding company, is the most notable one. Apart from Semex, there are very few established dairy breeders in Zambia and most of the breeding activities are done on-farm by farmers using their own bulls or by importing semen from other countries. In olden days, the government was responsible for importing semen in the country for supply to the dairying community. Most of the AI services at present are provided through private initiatives with the assistance of NGOs to farmer cooperatives. The main semen suppliers for dairy animals include Agro-vet limited, Livestock Services Cooperative Society and World wide Sires limited. The supply of semen through such private initiatives has proved to be too expensive. At the moment, NGOs like Land O' lakes and Heifer Project International facilitate importation of semen for dairy cooperatives and farmer associations, especially those who benefited through the government mediated restocking programme. The use of AI services in Zambia is still limited despite the technique having been introduced into the country way back in 1940s. There have been renewed interests in AI due to expanded dairying activities and the shortage of milk animals in the country. The ranch at Batoka in Choma has continued to supply dairy crosses to intended dairy farmers in the country. The only drawback is the limited supply and the fact the project lacks continuity as farmers still need to get back to Batoka for more crossbreed dairy animals. There is need to have a grading up of offspring from crossbred dairy animals using AI techniques.

Table 13: Breeders and breeding service providers

Name	Location	Type of Service	Products
Batoka Ranch	Choma	Crossbreeding	Dairy Crosses
NAIS	Mazabuka	AI Training	AI Technicians
Seemex	Mazabuka	Breeding	Semen and Bulls
Livestock services	Lusaka	Trading in semen	AI supplies
Agro-vet limited	Lusaka		Semen
World wide Sires	Lusaka		Semen

Dairy processors

The dairy Processors are categorized into two main groups based on the number of litres of milk they are able to process each day. The dairy processors procure milk from producers that they convert into various dairy products. Large scale dairy processors handle more than 1000 litres of milk per day while the small scale ones process less than 1000 litres. The range of dairy products tend to differ according to individual firms and include pasteurized liquid milk; UHT, Butter, cheese, ice-cream, yoghurt, lacto, Sour cream or Mabisi and a range of blended dairy fruit juices. The processing of UHT milk has increased availability of milk in areas off the line of rail and hence has increased milk consumption levels in the country. Some of the milk processors have farms, they process the milk before taking it to the market for sale. Most of the producer-processors also buy milk from farms in surrounding areas, which they process together with their own milk. Some of the producer-processors are large scale commercial farmers and may

be located off the rail line where they is no easy access to established processing companies. There are also a number of dairy farms that have installed equipment for pasteurizing milk that they package in sealed sachets. Farms that are involved in on-farm milk processing include Momba, Cedrics, Mupplehurst and Northern Dairies (Emonger 2007). Although not classified as processors, a number of households have capacity of converting their milk into fermented sour milk. Others even make products like ice cream, yoghurt, cheese and butter for family consumption. The problem is that it is rather difficult to quantify milk processed at household level. Examples of various processing companies under each category are shown in Table14.

Table 14: Dairy Processors

Component: Enterprise			
Processors	Large Scale	Parmalat, Diamondale, Kaposhi, Dairy King	Lusaka
		Finta	Livingstone
		Zammilk	Chisamba
		Cedrics Farm	Kitwe
		Greenveld Farm	
		Ndola Dairy Farm	Ndola
	Small Scale	Mukupa Wesu-Vineyard, S & M Enterprises, Mukutu Farms, Murrayfield, Kalwa Dairy, Creamy Land	Lusaka
		Sayyah	Kafue
		Eastern Dairy, Mayana, Mosali Foods and Dairy, Sunnyside Dairy	Chipata
		Nice Products	Ndola
		Maplehurst, Staal	Kabwe
		Hungry Lion	-
		Chartonel	Chisamba
		Musi-o- Tunya Dairy	Livingstone
		Moomba Farms	
		Households	-

Source: Survey data: Zambia 2009

Dairy Service Industry and Input Suppliers

The dairy industry cannot survive without input suppliers and professional service providers. These organizations provide both milk producers and processors with raw materials and equipment for them to carry out daily business activities. The list starts with animal breeders that supply breeding stock to intending farmers. This group is mostly made up of the farming community itself like Kushiya Farms that in addition to producing milk are also involved in selected breeding and marketing of dairy animals to intending farmers. Also included in this group is the Batoka Livestock Development Centre under the Golden Valley Agricultural Development Trust (GART) that is involved in crossbreeding dairy cattle with beef animals for sale to the general public for milk production. A number of privately run companies are also engaged in the importation of

semen for sale to farmers and breeders involved in Artificial Insemination. Associated with provision of AI services, are the suppliers of liquid nitrogen such as AFROX Limited for preservation of imported semen and individual AI technicians that go on to provide services to farmers. A number of NGOs are involved in the training of local personnel in AI techniques.

The dairy industry can also not survive in the absence of feed manufacturers and suppliers. There a number of feed manufacturing companies such as Tiger Animal Feeds Limited, National Milling Company limited and others that produce feeds for dairy animals. These companies are mostly involved in the manufacturing of various types of dairy rations required to meet nutritional needs of milk animals. The feeds may be in form of compounded dairy rations or individual ingredients that are used in compounding rations. Associated with feed manufacturing companies are individual traders that buy various feed ingredients in bulk for sale to farmers at retail prices. Key among these is the Livestock Services Cooperative Society of Zambia and the Cross Border Traders in Lusaka and Copperbelt provinces, respectively. There are also a number of individual transporters that purchase raw materials such as No3 meal from farmers and millers for sale to dairy farmers who mix their own concentrates. The oil processing companies produce oilseed cakes that are used as protein supplements in dairy rations. Included in this category are Zamanita, a subsidiary of ZAMBEEF limited, High Pro Feeds Limited and a number of cotton processing companies. The main products from oil processing companies are soybean, sunflower and cotton seed cakes. The Uniturtle Quarrying Industries are also famous for supplying agricultural lime, a key ingredient in dairy rations. Local pharmacies sell macro and micro mineral elements and other nutrient supplements required in dairy rations. Pharmacies also supply veterinary drugs and other supplies for disease control and prevention. Most of these products are imported through private initiatives including the Livestock Cooperative Society of Zambia. Also critical to supply of feed ingredients is the Zambia Sugar Company through Nakambala Sugar estates that produce molasses and bagasse used in feeding dairy animals. The two products are critical to the survival of dairy animals, especially in the dry season when there is limited supply of natural fodder and other feed supplements.

The dairy industry also depends on suppliers of farm equipment including animal and milk handling machinery. Most of the animal handling equipment are supplied by private companies such as Shepherd Agriculture, supplying capital goods for effective handling of animals and milk. Most of the capital equipment and milking utensils are imported into the country by the Livestock Cooperative Society of Zambia.

Other service providers to the dairy industry are the suppliers of professional advice to both milk producers and processors. Critical in this area are the suppliers of animal health and veterinary services. Provision of Veterinary services in Zambia was privatized in 1994, and since then individual farmers are responsible for the cost of health care and management of their animals. The government is only responsible for monitoring and controlling diseases of national importance such as Contagious Bovine Preural Pneumonia (CBPP), Foot and Mouth Disease (FMD), Anthrax and others. This means farmers have to engage private practitioners for veterinary services. The practical situation on the ground is that most areas have a government employed veterinary assistant who is called upon when there is a health problem on the farm. The farmer will

mostly like be told to provide fuel for transportation to the farm and pay for prescription drugs. It is unfortunate that very few farmers are able to afford such fees and as such will only call for assistance when there is a desperate situation on the farm. This tends to result in fatalities even in potentially curable cases. Privatization of veterinary services has also minimized use of preventive medicine such as dipping, spraying and vaccination of animals against preventable diseases. The NGOs have in some cases come to assist farmers by providing veterinary services through personnel trained or employed by Donor funded programmes. Through farmer cooperatives, local farmers tend to select and send one of their members for training to assist the community, as a primary contact person when faced with a disease problem. Most of these people are usually termed as Auxiliary Livestock Workers (CLWs) and are capable of advising fellow farmers in other animal husbandry practices such as feeding, milking and others. Other service providers include suppliers of technical services in form of laboratory analysis of feed and milk quality.

Table 15: Specific Actors in the Dairy Service and Input Supplies

Component: Enterprise		
Dairy Service industry / Input Suppliers	Feed Manufacturers	Tiger Feed,
		National Milling
		Private Millers,
		Farmers like Miller,
		GART
	Animal Production Supplies and Services	Balmora/ CVRI (vaccine production)
		UNZA – School of Vet (Training)
		Agrivet – Private company
		NISIR- Chilanga
		Other Agro-dealers in buying and selling of Drugs- Chemists and Pharmacies
		Live stock Services
		Vet extension services
	Dairy Processing Supplies. E.g. Ingredients	
	Laboratory Services	UNZA, NISIR, Food and Drug, ZABS, NISIR-Balmoral
	Farm and Dairy Processing Machinery	SARO, AFE, World Parts,
	Packaging Materials	Zampack

Survey data: Zambia 2009

3.3.2 Market/Demand

Consumers of raw milk

The main actors within the cluster of Market/ Demand include consumers of milk, the principal raw material for processing companies. The majority of the milk produced by both large and medium scale producers is sold to milk processing companies that add

value through the standardization and manufacturing of various products out of milk. These companies consume raw milk by adding value to it through manufacture of a range of dairy products that they sell either directly to consumers or through established wholesale and retail chain stores. They may also sell processed milk through other middle men. There are also a number of local milk producers that have set market outlets in residential compounds where they sell raw milk from their farms. Milk vendors have no established permanent shops but instead buy milk from farmers to sell using bicycles along streets in low and high residential areas. Milk vendors may add value to their milk by marketing it as sour milk.

Consumers of processed milk

After processing, the milk must be distributed to various market outlets where consumers access it. This is mostly done through established wholesale and retail shops. Most processing companies distribute their milk through supermarket chain stores like Sho-prite Checkers, Spar limited, Melisa and others. Some processing companies have established market outlets in residential areas and also run their own retail outlets in markets scattered throughout urban centres. There also a wide range of retail shops that trade in processed dairy products. It should also be acknowledged that they are a number of farms that process by pasteurizing their milk and packaging it into sealed plastic sachets that they sell directly to consumers or through retail shops. Some farms simply ferment their milk to make it sour before selling it to their neighbours.

Other consumers of processed milk may also include established institutions such as hospitals, schools, restaurants and food manufacturing enterprises such as bakeries, guest houses and school canteens, which use milk as a raw material in their menus. Dairy products are also consumed by individual households, orphanages, private companies, especially those involved in mining, who buy milk for their workers as a safety measure. Milk is also used by the hospitality industry including hotels, lodges and restaurants and public institutions such as schools, hospitals, prisons and others. All these institutions use varying amounts of milk every day depending on their clientele and their main business activities.

Table 16: Actors in Market / Demand

Market / Demand	Consumers of Raw Material (Milk) e.g. Processing Industries for value addition	Parmalat, Finta, Zammilk Buy, Process and Sale
		Kaposhi, Dairy Cooperatives Produce Milk, Process and Sale
		Friesland Buy and Sale- Milk or Processed Products
	Chain Stores	Shoprite, Spar. Buy and Sale
	Shops	Buy and Sale
	Vendors	Buy and Sale
	Middlemen	Buy and Sale
	Small Producers and Processors	Marplehurst Produce/ Sale
	Direct Market	Farmers Sale

	Demand (End Product Consumers)?	Individual Households	
		Orphanages	
		Companies E.g. Mining. Buy Milk For the workers	
		Hospitality Industry	Hotels/ Lodges
			Restaurants
		Public service organizations	Health institutions such as hospitals and clinics
			Schools
			Prisons

3.3.3 Diffusion/Information Transmission

This cluster includes all actors that are involved in the transmission of different kinds of information concerning the dairy industry to end users who are actors in all the other clusters. The main actors involved in diffusion and information transmission include media organizations, various NGOs and government extension services. Discussed below are some of the operations of selected actors that are part of the diffusion and information transmission cluster in the dairy industry.

Extension Services

The government runs extension services through the Department of Agriculture in the Ministry of Agriculture and Cooperatives. It is unfortunate that most of the personnel employed as extension workers under the Ministry are usually for crops. In the past, there even used to be commodity or crop specialists dealing with specific crops in a given area. It is rare nowadays to find such specialists let alone dairy extension workers. The Department of Animal Health and Production is responsible for implementing government extension services related with livestock development. The department employs livestock and veterinary assistants that are responsible for carrying out extension services to livestock farmers on animal husbandry and veterinary services. Since the privatization of veterinary services in 1994, these people have not been very effective in assisting farmers with extension work. There is need to review the situation especially with the separation of livestock from the Ministry of Agriculture and Cooperatives to create a Ministry of Livestock and Fisheries. It must be acknowledged that a number of NGOs including Land O' lakes and GART have employed extension personnel to assist dairy cooperatives and farmer associations with extension services. However, such people are few and far between to have a positive impact on the farming community. There is need for the country to revisit the privatization of veterinary services in Zambia. The livestock extension workers should also be made available to livestock farmers just as is the case with crops.

Training and Research Institutions

Training institutions such as universities, colleges and agriculture training centers are also involved in the diffusion of knowledge to farming communities and other stakeholders. This is usually done through publication of research results, hosting of

field days and organization of research seminars. Technical knowledge and skills are also passed on to students who are either farmers or are likely to end up working with farmers. Training and research institutions also work with farmers and other stakeholders through which they interact for their research findings to be transmitted to their end users. Some research organizations like GART work with farmers and other stakeholders for on-site demonstrations and training to farmers.

The Media

The media transmits information on various issues concerning the dairy industry directly to farmers and other actors within the system. The most popular media organization as far as transmitting information of dairying is concerned is the National Agriculture Information Services (NAIS) under the Ministry of Agriculture and Cooperatives. It is hoped that NAIS will continue to disseminate information of livestock and dairying despite the separation of Livestock from the Ministry of Agriculture and Cooperatives. Other media organizations relevant to covering issues on dairying are the Zambia National Broadcasting Cooperation (ZNBC) that runs government radio and television stations. Even outputs from NAIS are aired through ZNBC. Other media coverage of dairying activities are through established Newspapers such as the Zambia Daily Mail, Times of Zambia and the Post. The post actually runs a weekly feature on farming through which information on dairying may be distributed.

Non Governmental Organizations

A number of established NGOs working to promote agriculture in Zambia also run newspapers or magazines that inform clients about their activities. The most notable ones include "The Farmer" a weekly magazine produced by the Zambia National Farmers Union. The Magazine covers all aspects of farming and marketing of agricultural commodities including milk. The Catholic NGO "CARITAS" is also a media organization that is involved in the transmission of information of farming including dairying. There also a number of NGOs like Land O lakes, HPI and World Vision that have weekly radio programmes to inform farmers and other stakeholders about their activities. The Herd Book Society of Zambia runs a magazine and has scheduled meetings for members for information sharing on various livestock breeds including dairy cattle. Information is also diffused through individual animal associations. Another NGO involved in transmitting information on dairy is the Herd Book society of Zambia that runs a monthly magazine informing farmers on breeding activities and animals available for sale to the general public.

Table 17: Actors in Information transmission

Component: Diffusion/ Information Transmission		
Extension Services	Government	MACO and Ministry of Livestock- livestock officers and veterinary assistants- Transmit information directly to farmers
		Nutrition Commission- Information to consumers on nutrition related issues
	Private Extensionists	Artificial Insemination Specialists
Training and Research Institutions	UNZA	Knowledge, Research and Skills
	NRDC	Knowledge, Research and Skills
	GART	Research, on-site Demonstrations and Training
	ZCA	Training Livestock workers
	Palabana Dairy Institute	Knowledge and skills
	Balmora	Information on health
	Zambia Institute of Animal Health (ZIAH)	Training veterinary assistants
	Herdbook	
	Elias Mutale Skills Training Center - Kasama	Knowledge, and Skills
	Other Colleges and Agricultural Training Centers	Knowledge, Research and Skills
NGOs and CBOs	Land' O Lakes	Training and market information
	Heifer International	Training, extension and market information
	ZATAC	Market information
	Kepa Zambia	Extension
	Plan International	Extension
	LDT	Training and research
	Farmer Cooperatives	Training and Market information
Media	Magazine; Zambian Farmer	
	ESADA Dairy Mail	
	Post, Daily Mail, Times of Zambia	
	National Agricultural Information Services (NAIS)	
	Zambia National Broadcasting Cooperation (ZNBC)	
Associations	Zambia National Farmers Union (ZNFU)	Market information
	ZDPA	Health and Market information
	ESADA	Market information at regional level- Training and Research
	Creamland Dairy Association- Palabana	-

International (Trade) Organizations	WHO, WTO, SADC, COMESA, etc	Research and Market Information

Source: Survey data: Zambia 2009

3.3.4 Research and Training

This cluster is made up of organizations that are termed as generator of knowledge and technical information. The training organizations range from those offering programmes at certificate level to those offering degree and masters programmes. Details of training and research institutes are highlighted in Sections 2.4 and 2.5, respectively.

Table 18: Actors under the cluster of research and training

Component: Training and Research	
Training Actors	Function
Zambia Colleges Agriculture (ZCA)	General Training in Dairy. Student/Farmer certificates
UNZA* (School of Agricultural Sciences & School of Veterinary Medicine)	Pastures, Product Development, Milk Quality and Disease control- Student/Farmer certificates Student Degrees
CBU*	Agro-forestry, Business and Marketing- Degrees
NRDC	Student/Farmer certificates Students/ in-service Diploma
Livestock Services Cooperative Society	AI Farmer know-how
Twin Fountain	Student/Farmer certificates
Palabana	Student/Farmer certificates and practical aspects of milking and Diploma in dairy management.
NAIS/ MACO	AI/ PD certificates. Farmers, especially cooperatives and government staff
NGOs e.g. Heifer, Land O' Lakes, World Vision	Dairy management
Misafu/MACO	Pastures
Kasisi Agricultural Training Center (KATC)*	Farmers
Ukwimi Trades Training Institutes and other agricultural training centers	Students-certificates
Research Actors	
NISIR	Animal Production and Breeding
UNZA – Animal Science	Animal nutrition research
Tiger Animal feeds	Feed Production
LDC/GART (Batoka)	Breeding
GART (Chisamba)	Pastures
CVRI	Vaccine Production
ZARI (Msekera Chipata)	Agro-forestry pasture and fodder production

NANGA (Mazabuka)	Pastures and fodder research

Source: Survey data: Zambia 2009

3.3.5 Infrastructure Development

The key players under infrastructure development are mostly the government ministries that provide policy directives and funding to community development projects. The private sector also plays a key role in funding certain capital projects including funds for business enterprises. Key to government policy development is the Ministry of Agriculture and Cooperatives that have in the past come up with developmental projects aimed at expanding the dairy industry. Included are smallholder dairy development projects of the early 1980s and the recent dairy restocking project under the Livestock Development Trust and GART. The foreign NGOs have also played important roles in infrastructure development. The NGOs usually work in collaboration with the Zambian Government. A good example has been the establishment of milk collecting centres throughout the country to facilitate milk production and marketing in rural areas as a way of improving social livelihoods of rural communities. All the collecting centres have been equipped with facilities for milk cooling and testing to allow for easy marketing of milk to processing companies in towns. Other government ministries critical in the development of infrastructure in the dairy sector are the Ministry of Works and Supply that is responsible for the construction of road networks in the country. This also includes the Ministry of Local government and Housing that is equipped with equipment for constructing feeder roads that link farms with the main roads leading into towns. It must be acknowledged that all government funding is channeled through the Ministry of Finance and National Planning.

Infrastructure development also includes the private sector enterprises such as banks and other financing institutions that provide capital funds for new dairy farming projects. Key in this area are the recently introduced Micro Bank Financing institutions that provide loans to farmers and other investors trying to start businesses related to the dairy industry. The government run Citizen E (CEEP) and the Zambia Development Agency are critical to Feed manufacturing companies have established companies that supply quality feeds to the farming community. Installation of such machinery and equipment resulted in increased infrastructure development. There can be no sustainable dairy production in the absence of a reliable power supply. This has mostly been through generation and distribution of power through ZESCO Limited. Other companies supply milking and animal handling equipment of which Livestock Services Cooperative Society, SARO, AFE and Parts World Limited are the most prominent.

Table 19: Actors within the infrastructure cluster

Component: Infrastructure			
Policy Making agencies	Government ministries	MACO/ LIVESTOCK	Policy development- Formulation, legislation, Regulation
		Mo Health	Public Health – Milk Inspection
		Mo Trade Commerce and Industry,	Trade/ Marketing
		Mo Education,	Training Policy framework
		MSTVT	Training and Research Policy, Co-ordination
		Mo Justice	Legislation
		Mo Local Government	Public Health
	NGOs/ Associations	ZNFU, ZDPA, OPPAZ	Advocacy
Banking and Financial Institutions	Commercial Banks	ZANACO Barclays	Loans
	NGOs	Heifer Land O' Lakes World Vision ZATAC	Animals
	Micro finance	Micro Bankers Trust	Loans
	MoFNP		Legislation, Regulation
Transport and Marketing	Transport	Mo Local Government	RAMP, Feeder roads
		RDA/ Mo Works and Supply	High Ways
		Private Companies	Commodity Conveyance
		NGOs	-
	Marketing	Dairy Cooperatives	Milk Collection Centers
		Private Companies	Milk Collection
		Individuals	Milk Delivery
Networking/ Information Communication	NGOs	Information Centers/ Dissemination	
	NAIS	Information Dissemination	
	UNZA	Libraries Information	
	NRDC	Information Dissemination	
	PDTI	Information Dissemination	

	GART	Information Dissemination
	NISIR	Information Dissemination
	ZDPA	Information Dissemination
Regulatory agencies	ZABS	Standards formulation, regulation
	Mo Health	Inspection / Enforcement
	Mo Local Government	Inspection / Enforcement
	MACO/ LIVESTOCK	Inspection
	ZP/ Mo Home Affairs	Enforcement
Standards Setting Bodies	ZABS	Standards formulation
	International- WTO, WHO	Standards formulation

3.4 Analysis of Actor Characteristics, Habits, Practices, and Competencies

3.4.1 Characteristics Dairy Producers

Demographic profiles of the small holder dairy farming households
Table 20 shows the profile of small holder dairy farmers in the sample. Household heads were generally in their 50s with the mean age of 51.8 years. The average age of a spouse was 41.6 years while that for a child and step child were 18 and 18.8 years respectively. About 25 percent of members of the households were children aged 15 years and below. Of the household members aged 16 years and above, the majority of them were female. A small proportion (13.6 percent) of the surveyed households was headed by females while the rest was headed by male. The mean number of persons living in each sample household was 9.28 and a majority of the households had a family size ranging from 6 to 10 members. Most of the household heads were married while a few of them were widowed and single respectively.

Most of the household heads had some formal education with only 2.8 percent with no formal education giving an indication that people who enter into dairy production are those with some formal education. The majority of the household heads had some secondary education. Evaluation of the people working on farms that participated in the survey showed that 89.6% were found to be related with the household head. Thus, only 10.6% of the people working on those farms were not related to the household head and mostly worked as employees. At management level, only 2.3% of the respondents were not related with household heads. This again emphasizes the fact that most of the dairy farms in Zambia are family owned enterprises

Table 20: Profiles of the small holder dairy farming households

Mean Age	Years
Mean age of the Household head	51.8
Mean age of a spouse	41.6
Mean age of a child	18

Mean age of a step child	18.6
	Percentage
children 15 years and below	25.4
male members 16-59 years	43
female members 16-59 years	57
male members 60 years and above	32.2
female members 60 years and above	67.8
Number of persons in household	Percent of households
1-5	26.5
6-10	53.8
11-15	14.5
16 and above	5.1
Total	100.0
Education Level of Household head	Percentage
No Education	2.8
Primary	14.7
Secondary	48.6
Post Secondary	33.9
Total	100
Marital Status of Household head	
Monogamous Marriage	72.3
Polygamous Marriage	8.9
Single/underage	4.5
Widowed	12.5
Divorced/separated	1.8
Total	100

Source: Survey data, Zambia 2009

Farm Characteristics

Characteristics of dairy producers are as shown in table 21. The study revealed that 29% of the farmers had small sized farms, 36% of the farmers had medium sized farms and almost 35% had large farms. The farmers with medium sized farms were evenly spread between 6 and 20 hectares. The results showed that 46.6% of the farmers had a small sized dairy herd of less than 5 dairy animals while 37.4 % had a medium sized dairy heard (5 – 20 dairy animals) and 16% of the farmers had a large dairy herd of more than 20 dairy animals. Most of the farmers (78%) with small sized dairy herd had dairy animals in the range of 2- 4. It was also shown that 24% of those with a large dairy herd had more than 130 dairy animals.

It was shown that 94.8% of the farmers had milk volumes of less than 500litres/day and 1% had milk volume in the range of 500 -1000litres/day and 4.2% had volumes of more than 1000 liters per day. In addition 49.42% of the farmers had been in dairy production for less than five years, while 24.14% had been in production for 5 – 10 years . A further 9% of the farmers have been in dairy farming for 10 – 15 years and 17.24% had been in dairy farming for more than 15 years. Clearly most of the farmers were new to dairy farming and this could perhaps account for the low milk volume produced.

Table 21: Farm Characteristics for Dairy farmers

Farm size	Frequency	Valid Percent	Cumulative Percent
Small sized (Less 5 ha)	39	29.3	29.3
Medium sized (5 – 20 ha)	48	36.1	65.4
Large (greater than 20 ha)	46	34.6	100
Herd size			
Small sized (<5 animals)	61	46.6	46.6
Medium (5 – 20 animals)	49	37.4	84
Large (> 20 animals)	21	16.0	100
Milk Volumes			
Low (<500L/day)	61	46.6	46.6
Medium (500 – 1000L/day)	49	37.4	84
High (> 1000L/day)	21	16.0	100
Number of years in dairy farming			
Less than 5 years	43	49.42	49.42
5 – 10 years	21	24.14	73.56
10 – 15 years	8	9.20	82.76
More than 15 years	15	17.24	100

Source: Survey data Zambia 2009

Table 22: Ranking of other farming activities in addition to that of dairy farming

Other farm activities	Number	Percentage (%)
Field crops	124	43.1
Cash crops	73	25.3
Beef Ranching	30	10.4
Poultry	46	16.0
Pasture and Fodder	15	5.2
Total	129	100

3.4.2 Habits and Practices (Learning, and investment)

When asked about the main focus of their farming activities, nearly all respondents indicated production (70.3%) to be the main purpose for their farms with very few of the respondents indicating value addition and other aspects of farming enterprises. Table 23 shows the main focus of farms belonging to various respondents. It was shown that very little value addition takes place as only 0.5% indicated that this is a focus area for their enterprises. Marketing of products was another activity that was relatively popular as 21.1% of the respondents indicated that they are engaged in it. The rest of the activities were scored by less than 2.0% of the respondents. This shows that issues of research and development, contract farming, quality control and value addition were not yet receiving much attention at farm level. The same pattern was manifested when it came to the allocation of resources among farming communities. Production and marketing were allocated more resources than all the other farm activities. In terms of

business ownership, nearly all (98.4%) the farms are owned by family or private individuals. Very few farms were owned by government and sometimes religious institutions. Most of the farms seem to focus on crop production, which was seconded by livestock keeping to which dairying belongs. This was also reflected in the amount of resources allocated to various activities in terms of time, labour and money. It was surprising that the allocation of the three resources in the production chain was identical in all three categories.

Table 23: Farm production characteristics and allocation of resources

Main Purpose of farm	Number	Percentage	Resources* (%)
Production	130	70.3%	51.5
Contract farming	4	2.2%	1.8
Added value / Commercialization	1	.5%	1.2
Marketing, sales & distribution	39	21.1%	11.7
Quality assurance / control	3	1.6%	1.2
Extension/ Outreach/ Information dissemination	4	2.2%	1.2
Research & Development	1	.5%	0.6
Policy / Advocacy	3	1.6%	1.8
Total	130	100.0%	100.0

*Same type of scoring for money, time and personnel.

The study revealed that the main focus areas for most of the farmers was crop production (43.5%) followed by livestock keeping at 32.7% and poultry rearing at 14.5% (Table 24). Clearly crop production remains the most popular farming activity for most farmers. This could be attributed to the fact that much attention is given to it in terms of subsidies and marketing by the government. Farmers also want to start by growing crops to meet their own food security before engaging in other income generating activities. It is worth noting that livestock rearing is key to household income generation for both small and large scale farming. Most respondents (98.2%) indicated they generate their own resources for investing in their farming activities. Farmers only get government subsidies for crop production in the form of seed and fertilizers through the Fertilizer Support Programme (FSP). It is worth noting that those institutions which

indicated that their source of funding was the government were mainly government institutions such as Colleges, Universities and Government Ministries.

Table 24: Main areas of focus in farming activities as ranked by respondents

Main farm activity	Number	Percentage
Crops	117	43.5%
Livestock	88	32.7%
Fisheries	22	8.2%
Poultry	39	14.5%
Post harvest handling	1	.4%
Processing	1	.4%
Packaging	1	.4%
Total	130	100.0%

Source: Field Survey Data 2009

Dairy Manpower and Specialization

In terms of education background and specialization in dairy farming, the study revealed that most of the respondents working in the dairy sector had a wide range of educational background, ranging from people with just primary or no formal education at all to those with higher level qualification. Most of the post secondary training programmes were done locally. The level of education among respondents, indicates that people involved in dairy farming have mixed backgrounds, an evidence of a diverse nature of the farming communities. It was noted during interviews that most of the farmers with university degrees were either former public or private employees in town or are still working and have taken up dairy farming as a part-time business activity. The educated group of farmers was generally doing very well as dairy farmers. This may be attributed not only to their education background but also their ability to acquire the needed farming inputs and other resources. The group with only primary or no formal education mostly includes rural traditional farmers, who mostly keep dual purpose traditional cattle that they milk from time to time to generate some income. Some members of this category also own one or two pure breed dairy cattle that they received from a government sponsored livestock restocking programme.

Table 25: Post secondary education obtained by respondents and their employees from local, regional and overseas training institutions.

Obtained Certificate	**Local**	**Overseas**	**Total**
College Certificate	26	2	28
College Diploma	2	0	2
University Degree	3	0	3
Masters Degree	1	0	1
Total	**32**	**2**	**34**

In terms of specialized training in various fields of dairy management, about 36% of the respondents indicated to have received some form of training. This was contrary to more than 61.8% of the respondents that indicated to have no formal training at all. When compared among districts, the results showed Lusaka, Kafue and Chongwe to have more people with formal training than Monze, Mazabuka and Choma. This may be an indication to the fact that as people stay closer to urban centres, the more chances of them having some formal training in dairy management. This was particularly true for Chongwe and Lusaka, that are within proximity to Palabana, where a dairy training institute is located. It must also be appreciated that most of the indicated dairy management training was done in the form of short courses that were organized through local and foreign donor support as part of the requirement for recipients of the dairy restocking programme. It must be acknowledged that most of the formal training was obtained from local institutions as in-service training short courses organized through farmer associations and cooperatives with the assistance of Government and Non-Governmental Organizations. Very few training programmes were obtained from over seas and regional institutions. When the form of training was related to performance on the farm, the results of the survey showed most employees to be good or average with very few extreme cases (Table 26).

Table 26: Performance of respondents in relation to the place of training in dairy management techniques.

Performance level	**Locally Trained**	**Regional**	**Overseas/NA**
Excellent	18	4	0
Very Good	88	3	0
Good	56	0	1
Average	38	0	1
Not Good	12	0	7
Respondents	212	7	9

The type of training skills obtained from various institutions varied considerably among respondents. They mostly included business and a variety of dairy husbandry skills. The number of people and type of training skills obtained from local, regional and overseas training institutions are detailed in Table27. As pointed out earlier, most of the training skills were locally obtained with very few from regional and overseas institutions.

Table 27: Source of training for dairy management skills obtained from local, regional and overseas institutions.

Dairy Skills	**Local**	**Regional**	**Overseas/ Other**
Business skills	13	0	3
Pasture management	15	0	2
Feed Formulation	34	1	2
Dairy Husbandry	51	3	2
Disease control	30	1	2
Milk processing	10	0	2
Milk quality/safety	26	1	1

Record keeping	27	1	2
Others	7	0	0

In terms of performance as related to source of training, most of the respondents rated their employees or relatives to be between average and very good. There were only a few cases of excellent and very good and not good. The ratings for performance of people trained in various dairy management skills are highlighted in Table28.

Table 28: Rating of performance of dairy management skills obtained by local farmers and their employees or relatives.

Dairy Skills	**Excellent**	**Very Good**	**Good**	**Average**	**Bad**
Business Skills	2	2	4	4	1
Pasture Management	2	5	3	3	3
Feed Formulation	2	18	11	4	1
Dairy Husbandry	4	26	17	8	0
Disease Control	2	14	7	7	2
Milk processing	1	6	2	1	1
Milk safety/quality	3	11	7	5	2
Record Keeping	4	7	4	6	9
Other Skills	3	2	2	1	0
Totals	**23**	**91**	**57**	**39**	**19**

The respondents were also asked to indicate as to whether they provide training opportunities to their employees. With the exception of Kafue, most of the districts responded negatively, which was as expected considering that most farms have no resources to sponsor their employees for training. It must be appreciated that most of the training in dairy management to farmers is organized through farmer associations and cooperatives with the assistance of NGOs. The farm may also choose to train one person for all sessions or may send different persons for various programmes. Sometimes, a local cooperative may choose to train one of their members on behalf of the community. This person becomes a contact person for the community with the outside agencies including government employees. The person attends to minor livestock problems including treating minor ailments and when need arises calls for expert assistance from veterinary services. Such a person is usually termed as Community Auxiliary Worker. CAWs are also trained to do Artificial Insemination in the community. The only drawback with CAL is that, since these people are not paid, they tend to go for paid assignments at the expense of the communities that trained them. Perhaps communities should think of a proper reward system for effective delivery of dairy services in rural communities. The other common form of training on farms is on-job training where the manager or owner teaches employees or relatives how to carry out various activities on the farm.

Training Opportunities and Manpower Structure

Availability of training opportunities on farms in various districts was, as shown in Table 29, where the only positive response was in Mapepe area of Kafue District. This was rather surprising considering that the area where the survey was conducted is not any

different from the other districts. It may be assumed that the positive response could have been due to training opportunities offered to farmers through cooperative movements by local and foreign NGOs. The rest of the cooperatives in various districts had fewer positive results, which was expected considering that very few farms have enough resources to send their employees for training.

Table 29: Availability of training opportunities among respondents from selected districts that took part in the survey.

District	Yes	No	Total
Lusaka	3	2	5
Kafue	24	13	37
Mazabuka	5	22	27
Monze	5	23	28
Choma	5	5	10
Chongwe	5	0	5
Total	**47**	**65**	**112**

Results on manpower show that there seems to be an unexpected relationship between those in management and those with technical skills and labourers (Table 30). The most likely scenario is where there are more labourers, a few technical and less management personnel. It is possible that on most farms, the same people are engaged in both management and provision of labour. This may be demonstrated by the seemingly equal number of people doing management, technical and labour services. With the exception of Mazabuka, most districts had relatively a small number of technical staff as compared with management and farm labourers. It may also depend on the number of workers on each farm. The more workers you have on a particular farm, the more chances for specialization. It must be appreciated that in most traditional farming setups, family members do most of the activities including management and providing labour. There is very little room for specialized training unless one goes for a technical course. The current scenario is where parents choose to send one or two of their children for specialized training in dairy husbandry. It must be noted that most small scale traditional farms have more than a few employees for milking and herding animals.

Table 30: Dairy manpower structure in various districts that took part in the survey.

District	Management	Technical	Labourers	Other	Total
Lusaka	4	3	5	1	13
Kafue	8	3	11	0	22
Mazabuka	28	23	28	0	79
Monze	31	16	29	0	76
Choma	11	5	9	0	25
Chongwe	5	3	5	0	13
Totals	**87**	**53**	**87**	**1**	**228**

Analysis of changes in manpower structures in the previous five years showed only gradual changes with more cases of decline in the earlier years (from 2004 to 2006). There were gradual cases of increase in manpower structure in the last few years (Table

31). The situation is still more negative than expected as there were more people indicating decline than same and increase throughout the entire five year period. Thus, manpower structure in dairy is generally on the decline.

Table 31: Changes in manpower structure over the previous five years in various districts that took part in the survey. (%)

Structure	Lusaka	Kafue	Mazabuka	Monze	Choma	Chongwe
2004						
Declined	3	14	33	41	12	8
Same	4	3	10	9	4	0
Increased	3	3	31	26	6	2
2005						
Declined	2	14	33	38	13	7
Same	2	3	9	11	3	1
Increased	3	3	32	27	6	5
2006						
Declined	3	14	30	36	12	6
Same	2	3	9	12	3	1
Increased	5	3	38	28	7	6
2007						
Declined	3	12	26	38	12	5
Same	2	2	8	10	4	2
Increased	5	6	44	28	6	6
2008						
Declined	5	14	22	35	12	5
Same	3	2	8	9	4	1
Increased	5	6	4	32	9	7
Totals						

Farmers were also asked to assess their capability to adapt to changes in their farming activities. This was in response to external factors such as drought, floods or economic shocks including the recently experienced economic cruch. In most cases, the response tended to fluctuate between good and average with very few cases on the either side of the extreme (Table32).

Table 32: Response of farmers on their capabilities in adapting to changes in the dairy as a result of shocks in the natural or economic environment.

District	Excellent	Very Good	Good	Average	Not Good	Total
Lusaka	0	16.7	50.0	16.7	0.0	5
Kafue	2.1	25.0	41.7	16.7	6.3	44
Mazabuka	0	3.6	14.3	42.9	25.0	24
Monze	3.2	9.7	32.3	41.9	9.7	30
Choma	9.1	9.1	27.3	36.4	18.2	11
Chongwe	16.7	33.3	16.7	16.7	0.0	5
Total	3.1	15.3	31.3	30.5	11.5	119

The farmers were also asked as to how they generate or acquire the money which they invest in their dairy business activities. The findings were that most of the farmers generate investment funds through self efforts. This shows that almost all the money invested in dairying activities is generated through personal efforts by individual farmers. The only funding farmers receive sometimes, is from government for maize production subsidies in the form of seed and fertilizer under the Fertilizer Support Programme. Funding through private financiers such as banks and credit houses are not popular due to lack of collateral for farmers who do not have title to their land. However, even those with titled land expressed fear in using their land as collateral as most people thought banks could grab their farms in case of failure in paying back the loans. A number of farmers in Chongwe had accessed financing through the Zambia National Commercial Bank using the Cooperative to guarantee their loans. This was more of a group loan scheme. The other form of financing for dairying activities in most study areas is whereby a farmer is given an animal on loan and is expected to pay back by passing on the first heifer calf to the next beneficiary. This scheme is mostly implemented through donor agencies including World Vision, Heifer Project International, Land O' lakes and a number of local institutions including Livestock Development Trust, GART and ZATAC. The only concern with the scheme is that it takes too long to pay for the cow, especially in cases of consistent bull calves. At present, this is the most popular form of donor funding to the dairy industry for small scale farmers. Changes in the source of funding over the years show a clear reduction from government, private and donor sources. The only increase is noted in self generated funds that have been on a steady increase from 2006 to 2008 (Table 33).

Table 33: Number of respondents indicating changes in the source of funding to dairy sector in the previous five years.

Year	Self	GRZ	Private	Donor	Other
2004					
Declined	63	42	31	35	2
Same	13	3	4	1	0
Increased	38	0	3	1	1
2005					
Declined	59	42	31	36	0
Same	13	3	4	1	1
Increased	43	0	4	2	2
2006					
Declined	49	41	30	34	2
Same	11	3	4	1	0
Increased	55	1	5	4	2
2007					
Declined	35	39	30	33	1
Same	20	3	4	1	0
Increased	61	3	5	5	3
2008					
Declined	32	38	29	32	1
Same	14	3	4	1	0

Increased	78	4	6	5	3

Farmers were also asked how they spend the incomes generated from the sale of milk and other dairy products. In most cases the response was that most of the income is spent on paying salaries for workers and home requisites. Very little amounts of money from the sales was indicated to being used on improving farm operations including market and product development, research and training, and extension or outreach services. The findings are highlighted in Table 34. A similar finding was noted in Kafue District for incomes generated from the sale of goats and chickens (Simbaya et. al., 2009).

Table 34: Average portion (%) of income from milk sales that is spent on various farm activities by respondents from selected districts that took part in the survey.

District	Salaries	Markets	Research	Training	Extension	Others*
Lusaka	18	-	-	-	-	70
Kafue	29	-	-	-	6.0	67.5
Mazabuka	26	36.7	-	-	-	85.8
Monze	26	40.3	-	-	-	94.2
Choma	20	50	-	-	-	66.0
Chongwe	39	5.0	2.5	-	-	40
Average	27	32.3	-	2.5	6.0	73.7

* Other activities include household requisites and crop farming in puts.

The "other" component of the farm incomes was mostly used for purchasing household requisites and other non-dairy farming activities including crop production expenses in terms of seed, pesticides, fertilizers and others. It was noted that farmers rarely used income from their dairy farming activities to improve their business activities. Review of changes in dairy farming activities in the past five years indicated a variable picture with a bias toward increased activities.

The farmers were also asked who they collaborate with among local and foreign government and non-governmental organizations. More than 50% of the respondents in Lusaka and Kafue indicated collaborating with a number of local and overseas institutions, while those in Mazabuka, Monze, Choma and Chongwe indicated to mostly have more of local than overseas collaborators (Table 35). It was assumed that most of the overseas collaborators indicated were mostly foreign NGOs that have come to promote dairy farming in Zambia including Land O' lakes, HPI and World Vision.

Table 35: Percentage scoring by respondents from various districts on their collaboration with local and overseas institutions in their dairy farming activities.

District	Local Collaboration		Overseas Collaboration	
	Yes	**No**	**Yes**	**No**
Lusaka	100	0.0	50.0	33.3
Kafue	93.8	0.0	70.8	22.9
Mazabuka	82.1	14.5	32.1	60.7
Monze	100	0.0	19.4	80.6
Choma	90.9	0.0	27.3	72.7
Chonwe	100	0.0	16.7	83.3
Average	**93.1**	**3.1**	**43.5**	**51.9**

3.4.3 Competences (E.g. Trust, Tools, Knowledge Information Access/Analysis of Linkages Between and Among Actors

The results also revealed that most of the collaboration with respondents was mostly for exchange of information through formal and informal meetings. This was mostly through organized seminars, farm visits, trade shows and training sessions. Other effective communication channels included the radio, television and extension officers. Only a few respondents indicated to have been involved in joint publication of research results and writing of research and development proposals. The results also showed minimal collaboration between farmers and other stakeholders through personnel exchange and joint venture research funding (Table 36). This shows weak linkages between the farming community and institutions involved in research and development of technical knowledge.

Collaboration with local, regional and overseas research institutions was also very weak as was demonstrated by rating the intensity of collaboration between respondents with these institutions (Table 36).

Table 36: Rating the intensity of collaboration between respondents with local and foreign institutions as a percentage of farmers taking part in the survey.

Rating Intensity	Local	Foreign
None	26	68.7
Weak	7.6	6.1
Average	28.2	5.3
Strong	25.2	2.3
Very Strong	12.2	9.2
Total		

When rating the most useful source of information or channels of communication, the respondents indicated fellow farmers to be the most useful. This was closely followed by input suppliers and seed companies, radio and television and meetings including trade fairs and seminars. Extension workers were deemed to be useful as a source of vital information to farmers. It was rather surprising to see television, government

researchers, universities and internet not to be so useful. This may be due to the nature of farmers that were being interviewed as most of them were from a rural setting where some of this infrastructure may not be readily available. The rating for the usefulness of the university appeared to occupy both extremes as equal numbers of respondents found it to be useful and not useful at the same time with very few cases in between. Perhaps farmers need to be exposed more to the operations of research institutions and other information providers and the internet. This remains a challenge to enhance interactions among all stakeholders to achieve the aspirations of the dairy farming community in Zambia.

Table 37: Rating on the intensity of effective channels of collaboration between respondents and other collaborating institutions.

Mode Communication	Not Useful	Inadequate	Average	Useful	Very Useful
Radio	3	16	18	35	36
Television	16	21	13	20	37
Other farmers	3	6	17	29	57
Meetings/seminars/trade fairs	2	9	14	55	32
Extension Officers	8	18	21	53	10
Government researchers	27	8	7	32	8
Input Suppliers	15	10	12	9	38
University	32	3	5	34	7
Internet	33	0	17	19	4
Other	16	0	1	14	6

The table shows a clear indication that the majority of the respondents have average to strong interaction in collaborating with local institutions and almost none or very weak linkages when it comes to collaborating with foreign institutions. This was not surprising considering that there has been increased promotion of dairy farming activities through the establishment of farmers into cooperatives and associations that interact with each through seminars, farm visits and training sessions. This has mostly been promoted through local and foreign NGOs. A closer look at the collaboration of respondents with local and international research and other scientific institutions including the universities and colleges was either non-existent or very weak (Table 38).

Table 38: Intensity of collaboration rating between respondents and local and foreign institutions as a percentage of farmers that took part in the survey.

Institution	None	Weak	Average	Strong	Very Strong
National Agricultural Research organization	62	11	36	15	3
Sub-regional agric. Research network	85	16	12	13	0
Regional Agricultural Research organization	87	6	26	8	0
International Agric. Research Organization	83	3	11	24	2
National Science Council	79	12	29	4	0

Regional Science Body	84	12	15	4	0
Small scale farmers	14	8	23	38	43
Medium-large scale farmers	37	7	15	31	33
Farmers Association	26	7	20	34	37
Agricultural Cooperatives	16	4	20	53	36
Universities/colleges	68	8	10	26	14
Extension agencies including CSOs	39	18	31	35	4
Public Laboratories	74	39	7	4	1
Private Laboratories	78	35	4	4	4
Standard Setting Body	80	12	21	4	7
Input Suppliers	46	12	19	15	33
Agro-machinery Supplies	69	9	7	17	23
Government Ministries	51	9	23	35	6
Policy Makers	70	16	27	6	4
Financing/credit/venture Capital	59	18	18	18	3
Others	22	2	5	5	1

The strongest linkage in terms of collaboration with dairy farmers was amongst small scale farmers with medium and large scale farmers including farmer groups and cooperatives. More than 80% of the respondents indicated no collaboration with international and regional sub-regional research organizations. There were generally weak linkages between farmers with national scientific and agricultural research and scientific institutions. This is a clear testimony that research institutions do not seem to be concerned with the needs of small scale farmers or that the planning of the national research agenda does not include consultating the dairying community. This calls for the need to change the approach in national research planning to include all stakeholders in coming up with sustainable research programmes. It was also disappointing to note that most respondents felt that, there has not been much change in terms of interaction with all local and foreign research and scientific institutions in the previous five years. Increased levels of collaboration were only noted among small scale farmers themselves with agricultural cooperatives and input suppliers. The intensity of collaboration with public and private laboratories was noted to have actually declined in the last five years. This was not surprising considering changes that have taken place after the liberalization of the national economy. This reduced interaction could also have been a result of the current government efforts of emphasizing that public institutions should generate their own money for operations and as such media organizations have started charging for any air time and with reduced funding creating public awareness in most institutions is not a priority. This is contrary to the past when the role of the public media was to inform citizens of what various government institutions were doing.

There were minor increases in the intensity of collaboration between the respondents and scientific institutions including universities, teaching collages and research

organizations, particularly in the two to three years. This may be as a result of the role some institutions like GART and LDT have played in establishing milk cooling and testing facilities in rural areas. The two institutions have also been involved in the training of dairy farmers in various aspects of management. Thus, generally interaction between respondents with universities, agro-machinery suppliers, NGOs and training institutions were noted to have increased in the previous five years.

Farmers were also asked to indicate the type of innovations that have taken place on their farms in the last three to five years. The innovations were categorized in terms of products and services that they rendered to their clientele. About 80% of the respondents indicated to have introduced some innovations in the period under consideration (Table 39). The same was true for improved technology, new information, markets and products.

Table 39: Rating on the extent and type of innovations that have taken place among respondents that took part in the baseline survey.

Type of Innovation	**1-4**	**4-9**	**Above 10**
New breeds	80.3	11.5	8.2
Improved technology	80.9	14.9	4.3
New Information	81.9	15.3	2.8
New markets	81.3	9.4	9.4
New Machinery	65.0	27.5	7.5

As % of the people who took part in the survey.

5 CONCLUSIONS

This study used the innovation systems approach to evaluate the Agriculture Science Technology and Innovation (ASTI) system as it relates to the performance of the dairy industry in Zambia. The findings show that the dairy industry in Zambia has evolved since colonization to the post independence period; however, it still faces some challenges. An enabling policy framework including the provision of subsidies for capital inputs such as the importation of dairy breeding stock pre-independence ensured that the sector was able to meet local demand for milk. The situation changed after independence when the government encouraged local Zambians to get involved in commercial dairy farming, established government dairy farms, and introduced a two-tier milk pricing system to increase milk consumption by. These policies and an unstable political environment resulted in the reduction in the numbers of commercial white settler farmers and a reduction in milk production.

The adoption of a liberalized market economy in 1991 resulted in privatization of production, processing, marketing and related services including veterinary services. 19 new companies were established as more players became involved in the production, processing and supplying milk. Through both government and NGOs efforts, milk collecting centres were established in many parts of the country to stimulate more farmers to take up dairying activities. To regulate the industry, several laws and regulations that govern effective and orderly production and marketing of milk were enacted in the country. However poor funding, lack of follow-up and bad roads limited

the success of some of the initiatives aimed at expanding the local dairy industry. Implementation of some of these regulations has not been very effective and others are outdated and may need to be repealed. There are still a number of challenges in the industry which need to be overcome for it to progress and deliver the expected results.

There are numerous actors in the system and most operate in isolation: there is limited interaction between and amongst them except among the farmers. There is considerable interaction among farmers and between them and established farmer groups, input suppliers and NGOs. The training and research organizations were found to be isolated and farmers had very little knowledge about their operations. The media was also fragmented and did not seem to be very interested in dairying activities. Despite efforts of NGOs to train farmers in various aspects of dairy management including artificial insemination, the success rate is low. The privatized veterinary and extension service for livestock is weak despite training offered by NGOs.

The limited supply of milk for processing into various products is a major limitation as several processing companies are operating below capacity despite regional market opportunities. The lack of milking animals and the limited capacity of farmers to increase productivity and manage dairy animals are underlying factors. The restocking programme did not work very well and the quality of animals supplied to farmers is poor. The shortage of dairy animals in the country may be resolved through application of modern technology such as Artificial Insemination and embryo transfers. Research being undertaken on genetic conservation of indigenous breeds and cross breeding local and exotic breeds are notable but the results of these efforts must contribute to enhanced performance at the farm level.

Several organizations are involved in research and training. Progammes exist at the certificate, diploma and degree levels; however facilities are underfunded and rundown and practical training is limited. International scholarships are available for postgraduate training. There is ongoing research on dry season supplements to increase meat and milk productivity during the dry season; improved pasture and fodder; disease diagnosis; control of vectors. However, research findings are not finding application at field level. Research efforts need to be grounded in the local context and reflect the aspirations of producers, processors and all those involved in the dairy industry. There is also need for greater coordination and information sharing.

6 RECOMMENDATIONS

Growth in the dairy industry in Zambia will rely on the ability of small and medium scale farmers to increase milk production of a sufficiently high quality at reasonable costs. The policy and enabling environment including access to knowledge and financing must be improved. The following recommendations are made:

i. The dairy industry in Zambia has been privatized and growth and development rely heavily on private investors but government support is needed. Smallholder farmers have limited access to financing and cannot afford some essential veterinary services which impact on the volume and

quality of milk produced and sold. There are a number of gaps in the system and limited collaboration among key actors and poor coordination restrict performance. Despite a wide range of policies and statutory legislations, there seems to be no agency charged with the clear responsibility of regulating the industry. There is need for increased information sharing and interaction among stakeholders for the industry to meet the desired goals and objectives of increased production for domestic production and enhanced regional trade.

ii. Dairy breeding centres are needed to address the shortage and problems of poor quality milk animals being distributed to farmers. This may be done through private initiatives, public/private partnerships or government efforts, which may include expanding programmes at Batoka Livestock Development Centre, which is currently crossbreeding Friesians with Borans. Establishing a breed performance testing centre for evaluating dairy animals can be considered.

iii. There is limited availability of veterinary and livestock extension services to assist smallholder farmers. Most farmers admit having been trained in various aspects of dairy management, but application of the acquired knowledge is still rather limited. The delivery of veterinary services is currently focused on treatment as farmers only call for veterinary assistance when there is a serious illness on the farm. Privatization of the veterinary services has not yielded the expected results and government should review the programme with the view of building on successes while addressing areas of concern. The extension services should be strengthened to include livestock specialists given the dominance of smallholder farmers and the importance of the industry to food and nutrition security and livelihoods.

iv. Nearly all the Milk Collecting Centres and processing plants are operating below capacity. Provision of venture capital or other innovative funding mechanisms through a national credit scheme for AI services and purchase of more milk animals could address the limited milk production. The possibility of renewing operations of ASP and ZATAC and making them more efficient could be considered.

v. Most farmers who have adopted dairying have not embraced the culture of growing feeds for their animals. Increased cultivation of pasture and fodder crops for dairy animals should be promoted. Attention should be given to increased use of locally adapted feed crops that require minimum external inputs. More research should also be directed at improved utilization of high performance locally adapted crops as alternative cost effective dairy feeds.

vi. Dairy research in Zambia needs to be better coordinated and incentives and additional funding available made available to improve facilities and motivate researchers to provide new insights in genetic improvement, animal reproduction, feeding and processing of milk to increase productivity and stimulate development of new products. Farmers, processors, the media and

policy makers should also be involved in the identification of research topics and evaluation of outputs. There is also a need to link research with extension and training to improve collaboration and the identification, development, evaluation and diffusion of new or improved technologies.

vii. Milk consumption in Zambia is generally low. The industry in collaboration with R&D organizations should develop innovative dairy products that will encourage more Zambians to increase milk consumption; thereby ensuring local demand for milk increases.

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ANNEX

Summary of Actors in the ASTI –case of Dairy Industry in Zambia

Component	**Actors**		
Enterprise	Breeders		
	Dairy Producers (Farmers)	Commercial, Medium, Small Scale and Emergent	
	Processors	Large and Small Scale	
	Dairy Service Industry/ Input Supplies	Feed Manufacturers Animal Production Supplies and Services Dairy Processing Supplies Laboratory Services Farm and Dairy Processing Machinery Packaging Materials	
Diffusion	Extension Services	Government Private	
	Training and Research Institutions	Universities, Colleges, Research Centers, Training Institutes and Training Centers	
	NGOs and CBOs	Farmer Cooperatives	
	Media	Magazines, news papers, newsletters, Television	
	Associations	-	
Research and Training	Training	Universities, colleges, Training centers, and NGOs	
	Research	Universities, colleges, Research Centers	
Market / Demand	Consumers of Raw Materials (Milk)	Milk Processing Companies	
	Buyers/ Retailers (sellers)	Chain Stores, Vendors, Middlemen, Small Producers/ Processors	
	Direct Markets		
	Demand (End Product Consumers)	Individual Households	
		Orphanages	
		Companies	
		Hospitality Industry	
		Public Service Organiszations	
Infrastructure	Policy Making agencies	Government ministries	
		NGOs/ Associations	
	Banking and Financial Institutions	Commercial Banks	
		NGOs	
		Micro finance	
		Mo FNP	
	Transport/ Marketing	Transport	Mo Local Government
			RDA/ Mo Works and Supply
			Private Companies
			NGOs
		Marketing	Dairy Cooperatives
			Private Companies
			Individuals

	Networking/ Information Communication	NGOs, NAIS, UNZA, NRDC, PDTI, GART, NISIR, ZDPA
	Regulatory agencies	ZABS, Mo Health, Mo Local Government, MACO/ LIVESTOCK, ZP/ Mo Home Affairs.
	Standards Setting Bodies	ZABS