TECHNICAL CHALLENGES AND AGRIBUSINESS PROSPECTS FOR DEVELOPING PRO-POOR SMALL SCALE DAIRY PROCESSING SCHEMES IN OMAHEKE REGION OF NAMIBIA:

Lessons from Zimbabwe's Dairy Development Program

By

MARJORY J. KANDJOU

(BSc. Agric. Food Science and Technology, UNAM)

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University of Zimbabwe

Faculty of Agriculture

Department of Animal Science

DECLARATION

I, **Marjory Joneth Kandjou**, declare that this thesis is a product of my own work and all other sources of materials are duly acknowledged. I also affirm that the work is original and has not been previously submitted to any other institute for an award of any academic degree.

APPROVED BY:

_____

DR. R.T. MANO

(Major Supervisor)

_____

MR. B. MASUNDA

(Co-Supervisor)

_____

PROF. I. M. MPOFU

(Co-Supervisor)

ABSTRACT

A study was conducted to assess the potential of establishing small-scale dairy processing schemes that would bring development and economic growth, alleviate poverty and enhance the standards of life of the Namibian livestock rearing population. Lessons were deducted from the Zimbabwe Smallholder Dairy Development Program (DDP). Secondary data was collected at Nyarungu DDP head Quarters and the NPC, DVS, DEES in Namibia. A structured questionnaire was also used to collect data to assess the potential for milk production in Otjinene. Descriptive statistics were computed using SPSS (version 16.0). Economic viability of small-scale processing centre in Zimbabwe and Otjinene was done using the GMA and NPV tools. The potential for milk production in Otjinene was 12 716 l/day which was obtained from 748 households, each producing an average of 17 litres per day. It was concluded that Otjinene has potential to produce surplus milk that would sustain a processing centre. DDP processing centres had negative GM, indicating unvaiblity coupled to a horde of challenges. GM and NPV for Otjinene Projected centre were positive indicating viability and profitability. In conclusion, the smallholder dairy processing centres that are marginally viable or unviable in Zimbabwe are feasible and profitable options in Otjinene. The success of the Otjinene centre was attributed to the number of cattle for milk production and the processing of different high value products that increases the revenue bases. Nevertheless similar assessments need to be done during the late summer and the dry season in order to estimate the potential milk supply surpluses or shortfalls in different seasons.

DEDICATION

This work is dedicated to my beloved husband Edison, my baby girls Kamuiiua, Undjakuje, Ututjinda and my mother Maria Kandjou, for the support and for being my inspiration at all times.

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ABBREVIATIONS

ADC	Agricultural Development Centre
AN	Africa Now
ARDA	Agricultural and Rural Development Authority
AVE	Average
CBN	Cost of Basic Needs
CBS	Central Bureau of Statistics
DDP	Dairy Development Programme
DEES	Directorate of Extension and Engineering Services
DMB	Dairy Marketing Board
DVS	Directorate of Veterinary service
DZL	Dairy Zimbabwe Limited
EB	Ethiopian birr
ESAP	Economic Structural Adjustment Programme
FAO	Food and Agriculture Organization
GM	Gross Margin
GM/VC	Gross Margin/Variable Cost
HIV	Human Immune-Deficiency Virus
IDF	International Development fund
IFAD	International Fund for Agricultural Development
MDG'S	Millennium Development Goals
NB	Net Balance
NADF	National Association of Dairy Farmers
NDP	National Development Plan

NGOs	Non-Governmental Organizations
NORAD	Norwegian Agency for Development
NPC	National planning Commission
RoN	Republic of Namibia
WTO	World Trade Organization
SD	Standard Deviation
SPSS	Statistical Package for Social Sciences
TC	Total Costs
TFC	Total Fixed Costs
TR	Total Revenue
TVC	Total Variable Costs
UHT	Ultra High Temperature

CHAPTER ONE

1 INTRODUCTION

1.1 BACKGROUND

The largest portion of Namibia is utilized by both commercial and subsistence farmers for livestock farming with the natural vegetation as grazing (Els, 2004). Livestock farming play an important role in the livelihoods of people living in Namibia. The communal areas occupy about 48 percent; of the total farming area of Namibia and hold approximately 62 percent; of the total cattle herds, 72 percent of the goats and 17 percent; of the sheep (Sweet and Burke, 2006). Beef production is the main activity in Namibia's agricultural sector, contributing approximately 85% of agricultural incomes and on average 10% of gross national product (Kruger and Imbuwa, 2008; Emongor, 2008). Livestock production in Namibia can geographically, according to rainfall distribution, be divided into small stock production areas in the south and the large stock and mixed livestock production areas in the central and northern areas (Els, 2004).

Omaheke region in the eastern central part of Namibia is an area well renowned for livestock production since rearing of cattle is the dominant activity in all communities in the region. The inhabitants are predominantly the Herero tribe who are pastoralists, with large herds of cattle on which they depend for their livelihoods. Milk and meat constitute staple foods for many people in the rural areas of Omaheke. Cows are milked and the milk is either consumed fresh or cultured in calabashes to produce *omaere* (sour milk) for domestic consumption. Excess milk at household level is made into butter, which is processed into traditional butterfat or sold for cash. The butter oil is also consumed at household level, supplied to relatives in towns, or sold for commercial gain (Republic of Namibia, 2006).

Despite all the livestock wealth, the region is hampered by problems such as pervasive poverty, lack of income, lack of employment opportunities, lack of skills and appropriate technologies to add value to animal by-products. Reducing poverty in the region must therefore exploit the most abundant resource available to the farmers, which is their livestock. This can be done through sustainable livestock production and marketing as well as economic diversification through the development and strengthening of small scale schemes that add value to livestock products.

1.2 STATEMENT OF THE PROBLEM

Namibia has one major processor of milk and dairy products, Namibia Dairies. Its current production levels provide approximately half of Namibia's needs for dairy products (Mendelsohn, 2006). However, the national dairy market faces a 50% deficit, presently being met through the influx of cheap dairy products from South Africa and other countries. On the other hand, there is a scenario were the rural people have large cattle herds that can produce enough milk to meet the national shortfall.

The farming household milk their cows to supply domestic demand and market the surplus within the villages and nearby towns. Nevertheless, local village markets are very thin as almost every household is self-sufficient in milk, reducing local milk market prices to a minimum and diluting the incentive for commercialization of dairy production system. High temperatures and lack of refrigeration has led to the inability to produce and store fresh milk. Milk is traditionally preserved through means other than refrigeration, including immediate consumption of warm milk after milking, by boiling, or by conversion into more stable products such as fermented milks, cream, and butter oil (RoN, 2006). In summer there are milk surpluses in most of the traditional settings. This therefore brings in the need for processing at village level, in order for the products to reach distant markets, were there is

demand for dairy products, especially in the cities and small towns. Despite this, using the Cost of Basic Needs (CBN) approach, the Omaheke region has been identified to have 30% of the people who are poor and an 18% who are severely poor (Central Bureau of Statistics, 2008).

1.3 RESEARCH QUESTION

With all the large numbers of cattle, why are there no small to medium scale processing enterprises in the rural areas that can supply the demand for milk and dairy products to the rural and small towns near the rural areas?

Is there sufficient surplus milk to sustain small to medium scale processing enterprises in the Omaheke region of Namibia?

Are the technically viable processing technologies found in Zimbabwe or in Kenya's smallholder dairy sectors feasible options for commercializing dairy production and processing in the Omaheke community of Namibia?

1.4 JUSTIFICATION

Delgado *et al* (1999) have estimated that between 1993 and 2020, the annual demand for milk and dairy products in developing countries would more than double, from 168 to 391 million tones. Driven by population growth, urbanization and increased purchasing power, the estimated annual growth in the consumption of milk and dairy products is 3.3% (Thorpe *et al*, 2000). It is vital that Namibia, as part of this trend, be set towards commercialization to meet the increasing demand of dairy products. Organized small-scale milk production can contribute to the development of a formalized milk collection, processing and distribution system (Bennett *et al*., 2006). It is vital to improve the value of surplus milk through

processing into different products so as to increase the shelf life and find new markets for the products. “Eradication of extreme poverty and hunger” tops the list of the eight Millennium development Goals (MDGs), which Namibia have pledged to address by 2015. It is also the central and recurrent development objective of the First and Second National Development Plans (NDP1, NDP2) and Vision 2030, NDP2 in particular envisages the “sustainable and equitable improvement in the quality of life of all people in Namibia” (RoN, 2006; NPC, 2004). Commercialization of dairy products among the Herero people could potentially reduce the national shortfall, reduce prices and deprive the influx of cheap dairy imports. It will also contribute to poverty reduction, and ensuring food security in the region and country. This is in line with the National Development Plan and Millennium Development Goals (RoN, 2006). It is therefore vital to identify if the Omaheke region has a potential for commercialization of milk and milk products.

Milk processing in the region will automatically lead to development of the region on an effective basis such as improved livestock resources management and productivity; improved infrastructure; there will be improved coordination within the community and of cause it will open new market linkages with the outside (Bennett *et al*., 2006). In attempting to initiate and commercialize smallholder dairy production, Namibia could benefit from the success stories of Zimbabwe and other countries, by adopting what is more favorable to the local conditions. The study would generate valuable information on dairy that would assist policymakers in designing appropriate policies for intervention. Governmental and nongovernmental organizations engaged in the development of livestock sub-sector would also benefit from the results of this study.

1.5 OBJECTIVES

The main objective of the study was to assess the potential of establishing small-scale dairy collection, processing and distribution system in Namibia's rural area of the Omaheke region, to achieve development and economic growth, alleviate poverty and enhance the standards of life of the people in the region and Namibia.

1.5.1 Specific objective:

A. Assess the potential of the Omaheke region to produce adequate surplus milk to sustain a commercially viable small scale dairy processing plant.
B. To evaluate commercial viability of alternative Zimbabwe-styled Smallholder dairy processing and value-adding technologies under current versus improved livestock production system and Namibian economic conditions.

1.6 HYPOTHESIS

A. Under its present livestock farming system and animal husbandry practices, the Omaheke region of Namibia has potential for supporting a commercially viable small-scale dairy processing plant under the prevailing economic conditions.
B. Small-scale dairy processing and value adding technologies that are marginally viable in Zimbabwe are technically viable and profitable options for the Omaheke community of Namibia.

1.7 ORGANISATION OF THE STUDY

The thesis is organised into five chapters. Chapter one gives an overview of the study, providing background information, research questions, objectives and hypotheses of the study. It also gives the rationale for carrying out the study, such as the benefits or outputs of the study to the different stakeholders.

Chapter two mainly focuses on literature review and serves to give a frame of the study of what has happened and is happening in this particular field. It is composed of an introductory section and a vast array of issues. There is a dearth of research and documentation regarding the informal dairy sector in Namibia, Omaheke region in particular to this study. Therefore this chapter gives background information on the Omaheke region looking specifically at the biophysical features, population and the livestock production systems in the communal areas. This is to enlighten the reader on the conditions in which the people of the Omaheke region has to produce. Thereafter, the existing data on the evolution of the dairy development programme which gave rise to smallholder dairy farming in Zimbabwe is presented. The last part of the chapter looked at the success stories of small-scale processing, in different countries and the factors to be considered in developing small scale processing scheme, including costs and determination of the viability of such schemes.

Chapter three focuses on determining the potential for milk production in the Otjinene constituency in the Omaheke region of Namibia. In-depth description of the Otjinene constituency area was given and the methodology that was used to obtain and analyze data is presented. The next section includes the results obtained from the study and the household demographics, livestock ownerships and issues pertaining to livestock production, milk

consumption patterns. A summary of the salient issues contained in the chapter is presented as the concluding section.

Chapter four looks at the economic viability and profit margins of the existing Zimbabwe's Dairy Development schemes (DDP) and prospected Otjinene dairy centre, using lessons from the Zimbabwe's DDP. Different scenarios used to assess the viability of the projected Otjinene dairy processing scheme are presented in the chapter.

Chapter five is a presentation of the summary of results and what is entails in terms of the final output of the study. It looks at the recommendations and areas for further research that can help to solidifying the study for further references.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

The production of livestock, particularly cattle is the major agricultural activity undertaken by the majority of smallholder farmers in the communal areas of Omaheke region in Namibia. This is evidenced by the fact that almost all households own cattle of varying herd sizes (DEES, 2003). The ownership of cattle endows a good social status to the farmer but more importantly, they supply meat and milk for domestic consumption. Cattle sales used to be occasional but are now becoming an important source of income. Despite ownership of cattle and other livestock, pervasive poverty characterizes the lives of the farmers in the Omaheke region. This poverty can be tackled by diversification and value addition of the livestock products that the farmers' produce. This review looks at the features of Omaheke region and the possibilities of value addition of milk from beef type cattle. It also looks at the dairy development experiences of other developing nations

2.2 THE NAMIBIAN DAIRY INDUSTRY

During the German colonial administration, 1892 to 1915 much effort was placed on the production of diverse foods, on experimentation, and support for farmers (Mendelsohn, 2006). During that era residents participated in a cream scheme, supplying cream (or butter fat) used in the manufacture of butter. A creamery was registered and established in 1934, it was one of the country's leading producers of butter and cheese until the 1960s, and also the first powdered milk factory in the territory. Butter was exported on a large scale; an average of over 4,000 tons was exported each year between 1935 and 1958. There were 77 separators

in the Aminius reserve in 1955, and in Epukiro there were approximately 2 separators per settlement, while a larger centre such as Otjinene had 27. The cream was taken to the creamery at Gobabis twice a week in the Aminius and Otjinene reserves and from Omawe zonyanda (POS 3) once a week (van Rooyen and Reiner, 2009).

South African influences from 1920 -1990 changed the complexion of Namibian agriculture. The country became a fifth province to South Africa, its agricultural policies tailored to the needs of South Africa. The vibrant dairy industry was replaced with by beef production (Mendelsohn, 2006). The Dairy Co-operative Ltd began experiencing serious financial difficulties and the company was offered for sale by public tender in February 1983. The creamery was closed, and dairy farmers in the district were obliged to supply their milk to Windhoek (van Rooyen and Reiner, 2009).

Currently, dairy production is mainly carried out on large scale farms. There is one main dairy processor, namely Namibia Dairies, which was formed in 1997 through the merger of Bonmilk and Rietfontein Dairies (Emongor, 2007; Unknown, 2009). Namibia Dairies Pty Ltd have a processing plant in Windhoek, (Emongor, 2007) and is the major supplier of fresh and long-life milk, value-adding dairy products and other beverages. It operates depots in Windhoek, Keetmanshoop, Swakopmund, Otjiwarongo, Oshakati and Ondangwa (Els, 2004). The dairy sector relies on a very small number of farmers, only 17 dairy producers keeping about 2920 cows and employing 211 workers. Most of the farmers are situated in the Grootfontein, Gobabis, Mariental and Windhoek areas.

Domestic milk production is insufficient to meet domestic demand and more than 25 000 tons of milk equivalents are imported annually (Emongor, 2008). The local processing industry supplies 50% of the demand for UHT (long life) milk and 100% of the fresh milk to the urban

community. The bulk of, cheese, cream and yogurt are imported from South Africa, which makes Namibia a net importer of dairy products (Els, 2004). On average, 1.7 million liters of milk is produced each month of which 500 000 liters is converted to UHT milk. The dairy sector is under constant pressure from dairy imports from South Africa at predatory prices and surviving would be difficult unless protective measures are implemented to protect the local dairy industry

The Ministry of Trade and Industry through the infant industry protection within the SACU agreement have therefore put a 40% levy on all imported UHT milk, to protect the dairy processing industry. This lasts for eight years and from then the country should be able to compete with others. The infant industry protection in Namibia ended in 2008 (Els, 2004; Eita and Mbazima, 2007).

The semi–arid climate in Namibia means dairy farmers have to buy roughage and fodder from whatever available sources, at sometimes expensive prices (Eita and Mbazima, 2007). Compared to other milk producing countries these fodder costs are rather high and have a negative influence on prices and the profitability of the enterprise. With regard to the dairy industry, the high customs tariffs to potential markets such as Angola and Botswana hampers exports to these countries and thus prevents the expansion of the market. Most of the inputs in the production process in Namibia are often imported from South Africa. There are high transportation charges, added to the cost of the inputs, thereby increasing the overall production costs (Mushendami and Gaomab, 2008). Currently the government of the Republic of Namibia does not have a specific dairy development policy instead the dairy industry can be formulated and implemented on the basis of the National Agricultural Policy.

In the Omaheke rural areas, almost all the households are self sufficient in milk, excess milk at household level is made into butter, which is processed into traditional butter oil or sold for cash. The butteroil is also consumed at household level, supplied to relatives in towns, or sold for commercial gain (RoN, 2006).

2.3 BACKGROUND INFORMATION ON THE OMAHEKE REGION

2.3.1 General introduction

One of the thirteen regions of Namibia, Omaheke region lies on the eastern border of Namibia, it takes the name from the Herero word for Sandveld and it is commonly known as "Cattle Country" (RoN, 2006). The region covers an area of 84,732 km^2 and it occupies 10.3 per cent of the country's total land surface. Gobabis is the only municipality, with services, administrative and financial functions in the Region. Gobabis is about 205 km east of Windhoek along the Trans-Kalahari Highway and is also linked to the national capital by a railway line. The region is further divided into seven constituencies namely; Gobabis, Aminius, Kalahari, Otjombinde, Epukiro, Steinhausen and Otjinene (DEES, 2003; RoN, 2006) as shown in figure 2.1. The communal areas of north-eastern Omaheke are poorly served in terms of road infrastructure, as well as telecommunications, water provision and access to electricity supply (RoN, 2006).

The Agricultural Development Centres (ADC) and the Directorate of Veterinary Services (DVS) are located in the central business areas in all Omaheke constituencies. The distance from the ADC 's, to the villages where farming activities are taking place, ranges widely, but most villages (61%) fall within the 10 to 40 km range. They serve the region in aspects of informing and advising farmers on technologies, practices, and other support information needed to improve their farming as well as animal health issues (DEES, 2003).

2.3.2 Biophysical resources

2.3.2.1 Climate and rainfall

The hottest temperatures of just below 40 °C are recorded during November and December, although the most representative daily temperature of the summer, ranging between 17 °C and 34 °C, are common in January. Lowest mean daily temperatures of about 2.5 °C to 6 °C during winter are recorded in July increasing from west to east (Mendelsohn *et al*., 2002). Omaheke experiences summer rainfall between November and April. Mean annual precipitation in northern Omaheke ranges from 300 and 500 mm, and in southern Omaheke decreases to between 200 and 400 mm (DEES, 2003). Rainfall is generally characterised by sporadic and erratic patterns of occurrence within a single rainy season, as well as from one season to another.

2.3.2.2 Vegetation

Vegetation in Omaheke varies with episodic rainfall events and differences in soils. In the southern part, Camelthorn Savannah predominates, along the southern and south-western fringes the Thorn Bush Savannah is observed, forest and woodland savannas of the northern Kalahari. The most predominant and widely distributed type of vegetation in the northern and north-eastern Omaheke Region is broad-leafed *Terminalia–Combretum* savannah, characterised by *Terminalia sericea–Combretum collinum* shrubland association (Strohbach *et al*. 2004; Mendelsohn, 2006). Western parts of Omaheke fall within the central highland shrub land dominated by *Acacia* shrubs intermixed with extensive herbaceous grass cover. Substantial swathes of farmland in Omaheke are encroached by *Terminalia sericea and Acacia mellifera* trees, reducing its grazing potential and carrying capacity. The poisonous plant, *Dichapelatum cymosum* is prevalent in some central and northern parts of Omaheke, and is known to cause heavy animal losses.

2.3.2.3 Water resources in the region

Farmers in Omaheke Region obtain their water from underground water sources through boreholes. There are no perennial surface water sources, except during the rainy season (RoN, 2006; DEES, 2003). According to DEES (2003), only a small percentage of the boreholes are privately owned, others are owned or drilled by the government. In Otjinene, Epukiro and Rietfontein boreholes could range from 50 to 200 m deep. In Aminius, boreholes range from 5 to 20 m deep (DEES, 2003). Groundwater in Omaheke is generally of good quality and fit for both human and livestock consumption although problems of hardness and a brackish taste are regularly reported (RoN, 2006). Omaheke region as a whole is well served in terms of water supply, 65% have piped water either inside their houses or within their homesteads (RoN, 2006).

2.3.2 Demographic characteristics

Omaheke is a sparsely populated region with 68,039 inhabitants and a population density of 0.8 /km^2 (RoN, 2006; DEES, 2003). The total population of the region recorded a growth rate of 2.5 per cent per annum, between 1991 and 2001. Males head two-thirds (67 per cent) of all households in Omaheke. There are several languages spoken in the region, according to RoN 2006, Otjiherero is the majority with about 38 percent followed by Nama/Damara, 27 percent, Afrikaans is 12 percent and San and Tswana are 7 and 5 percent respectively.

2.3.3.1Population Distribution

The population distribution by urban and rural areas as well as by constituencies is shown in Table 2.1 below. About 54 000 people, who make up 80 percent of the total population are found in the rural parts of the region and close to 14 000 people are found in the urban area which makes about 20 percent of the population.

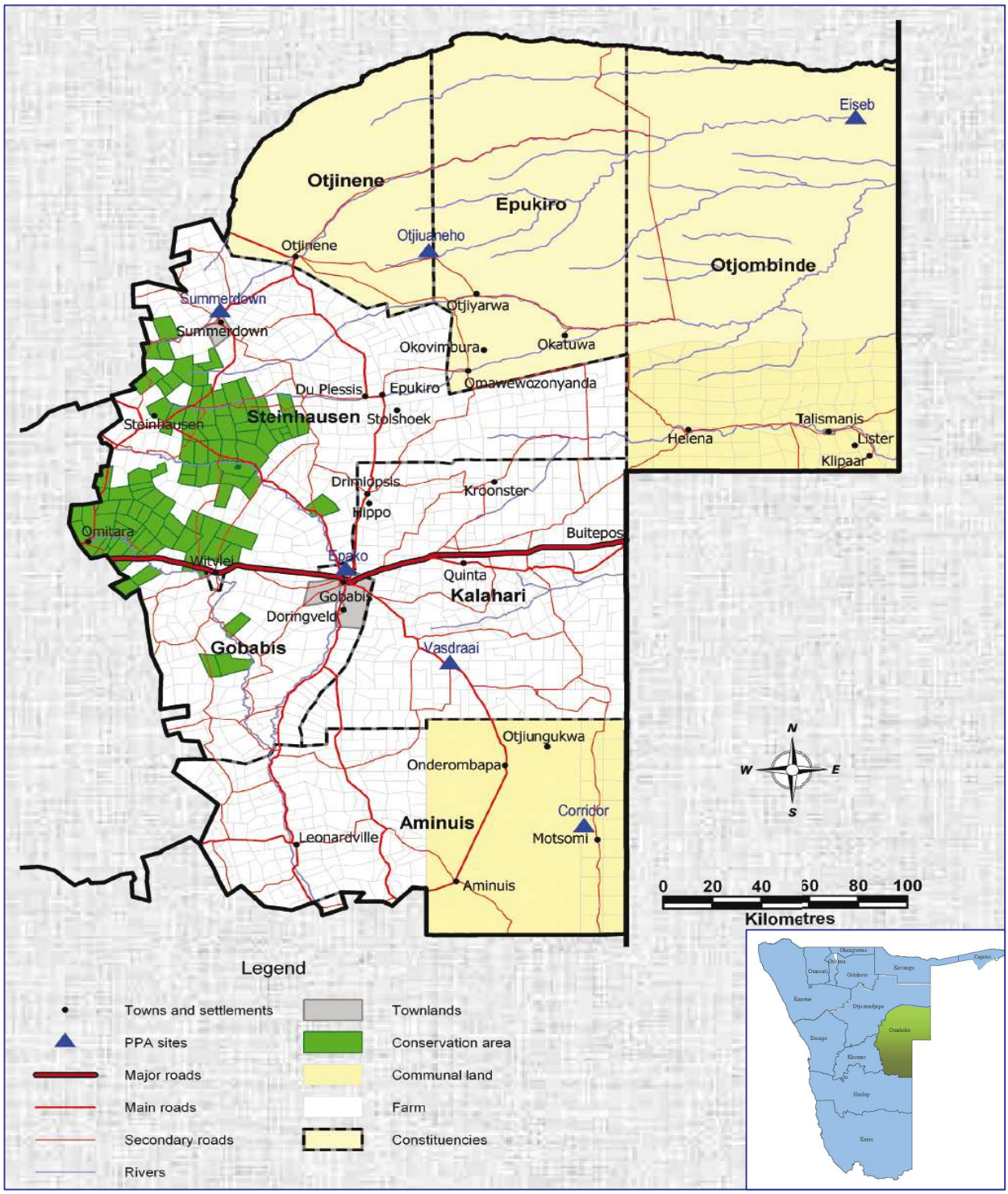

Figure 2. 1: Location of Omaheke and the constituencies in Omaheke

Source: RoN, 2005

Of the 7 constituencies in the region, Gobabis constituency is the most populous with about 22% of the regional population and Otjombinde is the least populous with about 10 % of the total population (RoN, 2005) slightly more than half of the population belong to the economically active age groups of 15 to 59 years. The proportion of the population aged 60 years and above, i.e. the senior citizens is about 6 percent.

2.3.3.2 Number of households in the different communal areas

Total populations and numbers of households in different communal areas are presented in Table 2.1. According to data from RoN 2005, the total population in the region's communal areas totals 29 668, the average number of people per household is 6, and the total number of households, assumed to be equivalent to the number of farming households, is 4 620.

2.3.4 Livelihood patterns

Cattle farming for subsistence and commercial gain are the most prevalent form of livelihood in all of Omaheke, bestowing the designation of "Cattle Country" to the Region. Rearing of cattle in Omaheke is primarily for beef production, which is the main driving force behind the regional economy. Subsistence farming associated with communal areas is less obvious in Omaheke, where a large number of communal farmers have built up large herds of cattle that they market regularly on a semi-commercial basis (RoN, 2006).

The main sources of income include livestock sales (goats are favored), others being pensions, wage/self employment, business, homemade produce such as local crafts and remittances (Rethman and Acidri, 2008). Other than serving as a source of cash income, cattle provide nourishment in the form of meat, milk, butter and butterfat. Complimentary to cattle farming is small stock farming, although there are households who farm small stock exclusively.

Table 2.1: Population distribution and number of households in the different communal areas

Constituency	Population	Ave. HH Size	No. of HH
Aminius	8 183	5.9	1 387
Otjinene	7 790	6.6	1 175
Epukiro	7 135	7.1	1 000
Otjombinde	6 560	6.2	1 058
Totals	**29 668**	**6**	**4 620**

Source: RoN, 2005

The agricultural sector is the largest employer in Omaheke, with over 60 per cent of the labor force working on commercial farms as laborers (RoN, 2006). The public sector, which includes the Regional Council and Central Government institutions are the second largest provider of jobs, employing teachers, extension officers and regional planners. The remainder of the workforce is employed in the Private sector companies.

2.3.5 Livestock production

Livestock kept in Omaheke are cattle, sheep and goats, with cattle dominating the livestock production sector. Cattle farming occur exclusively on natural grazing, supplemented with mineral licks to which a limited amount of grain is added (Kruger and Imbuwa, 2008). Locally, stocking rates are often high, leading to severe overgrazing and hence bush encroachment causing cattle to be in poor condition (Mendelsohn 2006; DEES, 2003). However a number of communal farmers are adopting animal husbandry practices that were usually practices on freehold farms but rare or absent in communal areas. These include castrations, dehorning, vaccinations against disease and the treatment of sick animals using veterinary medicines. The composition of the herd are currently controlled to make up 40 to 50% of animals, oxen 20 to 40%, calves 30 to 40%, and bulls between 1 and 2% of an average herd (Mendelsohn, 2006). The cattle population in Namibia are continuously being improved by addition of good genetic material from stud animals, mainly Brahman, Afrikander, and Simmentaler, Bonsmara and Sanga breeds and crossings between them. The Brahman x Simmentaler crosses is the most popular for beef production (Els, 2004; Mendelsohn, 2006).

Many communal farmers perceived that the indigenous cattle are inferior, due to the small frame size; therefore a lot of cross breeding has taken place. Calving periods in the communal areas commence from September through to December since the bulls are placed with cows in

January, February and March. The calves and their mothers can then benefit from the fresh summer pastures.

Diseases and insufficient feed resources cause most losses as it leads to starvation and greater susceptibility to infections, particularly botulism, anaplasmosis, pasteurellosis, and black quarter evil. Cattle are commonly vaccinated against brucellosis, vibriosis, black quarter, anthrax and botulism. The vaccinations and the treatments for internal and external parasites contribute to high survival, generally over 97% per year (Mendelsohn, 2006).

2.3.6 Livestock ownership

The livestock owned by a household can belong to the entire family rather than to the household head alone. In most cases cattle are shared between members of a family, for example relatives who live elsewhere may have their animals herded with others belonging to a rural family. The number of cattle also depends on the type of off-farm incomes and numbers of extended family members who contribute remittances. Herd boys are in most cases family members and therefore they contribute by providing labor (Mendelsohn, 2006).

The total number of cattle in Omaheke is 321 263 of which 204 971 are found in the communal areas (DVS, 2007) as shown in Table 2.2. Gobabis figures include all commercial farms including the resettlement farms in Omaheke such as Ben-Hur, Vergenoeg, Blouberg and other such farms (DEES, 2003). The 2006 DVS census, average herd size in the communal areas of Omaheke was 69 animals. Farmers are extremely heterogeneous, particularly in terms of household wealth, herd sizes and assets of value in farming cattle. Livestock ownership is strongly skewed, with a small number of people owning large herds and others owning few animals or none at all (Mendelsohn, 2006, Sweet and Burke, 2006).

2.3.7 Sources of food

The main sources of food include local market purchases in shops within towns and villages, livestock products such as meat and milk, food assistance; with some own crops particularly small scale vegetable production, hunting and gathering veldt foods and products (Rethman and Acidri, 2008). The main food from the farm in the rural Omaheke is milk and milk products. Milk is soured in calabashes and taken as it is or used as relish with porridge from maize meal. Excess milk is made into butter and cooked into butteroil and the by product called buttermilk is also consumed as it is (RoN, 2006). Butter oil is stored (since it has a longer shelf life) for later use during droughts and added to dry meat or for spreading on traditional bread (Bille and Kandjou, 2008). The production of butteroil leave a nutritious low fat, buttermilk (*Omatuka*) as a by-product, which is consumed or fed to domestic animals and pets. Cowpeas planted during the rainy season are dried and consumed as a protein supplement when cooked. Animals are not readily slaughtered for own consumption except at social gatherings. Veldt fruits such as, truffles and berries contribute significantly to seasonal diets. DEES (2003), reported that there is potential for farming diversification in addition to livestock production, both for commercial and domestic consumption purposes, diversified livestock farming, value addition relating to meat processing, surplus milk utilisation and leather manufacture.

Table 2.2: Livestock census figures for 2006

District	Cattle	Sheep	Goats	Horses	Donkeys	Poultry	Pigs
Gobabis	116292	230154	68171	6947	3928	26521	327
Otjinene	70787	7643	11245	365	684	432	10
Epukiro	37656	6447	12693	1605	1313	1484	57
Rietfontein	66276	7355	11810	1666	1616	2380	0
Aminius	30250	25800	47050	500	630	1830	8
Total	**321263**	**277399**	**150969**	**11083**	**8171**	**32648**	**402**

Source: DVS, 2007

2.4 DRIVERS FOR DAIRY DEVELOPMENT

The abundant livestock ownership and the important role of livestock in the livelihoods of rural people have made governments and institutions to consider promoting smallholder production of different products. Populations are rapidly increasing, growing rural and urban population create greater markets and growth of demand for dairy products, due to westernization of diets and per capita incomes in sub-Sahara Africa (Birthal *et al.,* 2005; Bennett *et al*., 2006; Somano, 2008). This offers greater opportunities and potentials for the development of milk production and processing industry (Redda, 2001; Wouters and van der Lee, 2009). Multilateral (WTO) and other free trade agreements result in less protection for traditionally protected dairy markets while milk producers in traditionally protected dairy markets will face less security as world market prices will fluctuate more (Wouters and van der Lee, 2009).

The recent hike in prices of food and feed commodities has drawn the attention of policy makers to the need for local food production. For governments, increased self-sufficiency and food security i.e. lower dependency on the world market are important drivers to increase milk production by smallholder dairy development.

Smallholder dairy farming has become popular in most developing countries (Banda *et al.,* 2000; Ngongoni *et al.,* 2006). It is estimated that over 80% of milk consumed in developing countries, an estimated 200 billion liters annually are handled by informal market traders with inadequate regulation (Bennett *et al.,* 2006). It improves and diversifies livelihoods, creates a regular income and employment, and is likely to counteract rural migration and reduce growth of urban slums (Walshe *et al.,* 1992; Kuranaratne and Wagstaff 1985). It offers opportunities for empowerment, especially for rural women therefore governments have been implementing various programmes which support women to take up new ventures and start self-employment

(Tangka *et al.,* 1999). The hike in prices of food and feed commodities has drawn the attention of policy makers to the need for local food production. For governments, increased self-sufficiency and food security i.e. lower dependency on the world market are important drivers to increase milk production by smallholder dairy development (Wouters and van der Lee, 2009). Public policies, interventions and investment decisions also shape up the process of dairy development (Staal *et al.,* 2006). These are the main driving force, which has led to the evolution of the many smallholder dairies in different countries, such as Kenya, Tanzania, Uganda, Zambia and Zimbabwe, to mention but a few.

2.5 SUCCESS STORIES

Small-scale dairy processing is growing in importance in countries all over the world, both in the developing and developed countries. If Governments in eastern and southern Africa provide conducive policy environments, there are good opportunities for smallholders and their families to benefit from marketed dairy production (Thorpe, 2000). Small-scale processing schemes are those that process from under 500 (micro-scale) up to 5000 (small-scale) litres per day (Dugdill, 2000).

2.5.1 Kenya

Previously the dairy industry was dominated by one huge processor, Kenya Cooperative Creameries, a de-facto para-statal (Thorpe, 2000). Reduced government activities in providing livestock services, milk marketing and the dairy policy change of 1992 has consequently led to dairy cooperative societies (FAO and IDF, 1998). Since then a growing number of small and medium scale entrepreneurs have entered the processed milk market. Producer welfare was improved through higher real milk prices and timeliness of payments. Consumers have also

benefited from a wider range of more competitively priced dairy products. It is estimated that over 200 dairy co-ops and self-help groups are currently engaged in active milk marketing in Kenya. Most are small scale enterprises process between 1,000-10,000 liters per day and mostly process and sell pasteurized milk, with a small proportion of throughput devoted to yoghurt and cheese, either as wholesalers and/or retailers (FAO, 2004). Amounts that cannot be sold fresh are often sold to private milk traders and KCC or processed into mala (FAO and IDF, 1998). Many had little or no experience of handling and processing milk into the safe, longer keeping products now demanded by the Kenyan market (FAO, 2004). The Government therefore sought project assistance from FAO's Technical Cooperation Programme to tailor training to the dairy industry's new requirements. The project started in mid-1996 with a nationwide survey to identify training needs. External specialists were also used to provide industrial experience (FAO and IDF, 1998).

2.5.2 Ethiopia

The Ministry of Agriculture has formulated strategies to improve milk marketing and processing in the villages. The strategy was to develop an environment for smallholder dairy farmers, which enables farmers to immediately respond to the market demand. That is, at village level, to develop the market for the existing sellable surplus, regardless of the quantity, so that the producers will be stimulated gradually to satisfy the market (Redda, 2001). Milk received by the unit is processed into various milk products namely, cream, skim milk, sour skim milk butter and soft curd-type cottage cheese made in many parts of Ethiopia. Butter is the major value-added product produced at the units. The processing unit gate price for one liter of milk varies from 1.25 to 1.50 Ethiopian birr (EB) (EB 1 = US$ 8.4). If EB 1.25/liter is assumed as the price for calculation purposes, it can safely be said that a farmer can earn about EB 188 (U$ 1579.2) or more each month from the sale of morning milk (Redda, 2001). The

units have created employment opportunities in rural areas, with each unit employing up to four permanent workers. Two are milk technicians who are responsible for running the milk unit's daily operation and are trained by the project in rural dairy technology, product marketing and equipment handling. The other two are a cleaner and a guard. Their salaries are paid monthly from the profit of the respective milk-marketing group. As the volume of milk handled increases, the units call for more employees (Redda, 2001).

2.5.3 Zimbabwe

Historically, from 1912 commercial dairy production in Zimbabwe was exclusively a privilege of the large scale commercial farmers, due to policies of separate development (Mupeta, 1996). Dairy Marketing Board (DMB) was a monopolistic parastatal which had tight control over the processing, distribution marketing of dairy products with no or little value added (Mupeta, 2000). The Dairy Act and Dairy Marketing Board (currently (DZL) Dairiboard Zimbabwe Limited) were established in 1937 and 1952 respectively in order to ensure organized and orderly development of the dairy industry (Mupeta, 2000). Other policies such as the Economic Structural Adjustment Programme (ESAP) were introduced. The aims were to improve efficiency and resource utilization, generating employment as well as developing an industry which was more responsive to consumer needs.

After independence 1980, government policies, encouraged farmers in the smallholder sector to produce milk on a commercial scale (Mupeta, 1996; Mupunga and Dube, 1992). A dairy development programme (DDP) was established in 1983, to widen the country’s milk production base by assisting smallholder farmers in the communal, resettlement and small-scale commercial farming areas to be involved in producing and marketing milk commercially.

The smallholder farmers produce more than 2,000,000 liters of milk per annum. Funding is from the Government of Zimbabwe and the donor community (DDP, key informants).

2.5.3.1 Management of the dairy centres

A management committee (MC) through subcommittees oversees the overall activities of the dairy center and projects. The MC is elected annually and it consists of a chairperson, vice-chairman, secretary, vice-secretary, treasurer and 2 committee members of which two are women. Members of the centers organize themselves to form an Association which is governed by a constitution. The next most important committee is the marketing committee, which have five members, a chairman, vice-chairman, secretary, vice-secretary and one committee member. The marketing committee monitor the production process and thereby ensure the quality of the final product, establish new markets, monitor prices, maintain high quality products, monitors deliveries to markets and supervises the driver, center attended, processor and vendors (DDP key informants, 2010).

2.5.3.2 Milk production

Annual milk production in the DDP smallholder dairy sector has been fluctuating, the highest yield was achieved in 1995. A gradual decline was experienced from 1995 although there were peaks between 1998 and 2001. This is because small scale milk producers in developing countries faces a lot of challenges in realizing the opportunities offered by growing demand for dairy products. Wouters and van der Lee, (2009) grouped the challenges in broader groups as market, production and institutional challenges. Many authors (Hanyani-Mlambo *et al.,* 1998; Francis and Sibanda, 2001; Ngongoni *et al.,* 2006; Chinogaramombe *et al.,* 2008; Somano, 2008 and Wouters and van der Lee, 2009) have elaborated and shed more light on the factors that affect the smallholder dairy production.

2.5.3.3 Processing plant size and capacity utilization

Most of the processing facilities are equipped to process 500 litres of milk per day. Most of the plants are failing to operate at full capacity due to low milk deliveries from the farmers. This is caused by low producer prices paid to the farmer, which lead to side marketing and milk being retained for household consumption. When volumes of milk are low, overhead costs tend to be heavier than revenue and therefore eat on the profits leaving the dairy enterprise unprofitable.

2.5.3.4 Milk processing and marketing

The DDP had two phases in their operation, phase I was the production and marketing of fresh milk and naturally fermented milk (NFM). These products were not packaged since they were not preserved in accordance with the Ministry of Health regulations (Mutukumira, 1997). Therefore the consumers had to come with their own containers. As milk production increased, methods to process fresh milk and protect it from spoilage became increasingly essential (Africa Now, 2000), since the reliance on the local market was faced with numerous problems. Huge amounts of losses were incurred in most projects, with whey being a particular problem. Africa Now identified the possibility of introducing the technology that was used to produce cultured milk in Tanzania and Kenya (Maphosa, 2006). This was piloted in two projects, Nharira and Honde Valley and it proved to be the most profitable product. The profitability of the centres was attributed to the sale of this value- added product. The simplicity of its technology and low capital requirements makes this product well suited to the rural environment and small farming communities within Zimbabwe. This product has been proven to be efficient and viable in most dairies in Zimbabwe and DDP projects (Africa Now, 2000; Maphosa, 2006). There are other products that can be processed in the small-scale value-adding schemes that would bring higher profits than the production of pasteurised fresh milk or that of cultured milk, such as yoghurt, cheese (Begg, 2001; Maphosa, 2006).

2.6 FACTORS TO CONSIDER WHEN ESTABLISHING A PROCESSING SCHEME

Several technical and economic considerations are crucial issues that need to be taken into cognizance in the establishment of small scale processing scheme (Mbogoh and Okoth, 1995).

2.6.1 The technical issues to be considered

2.6.1.1 The selection of the location for the processing scheme

Manufacturers of longer shelf life products, such as butter or cheese, can be located in rural areas, closer to the sources of milk. It is cheaper for processors to transport products rather than to transport milk (Axtell *et al*, 2008). It is vital to be located where there is a good supply of services such as adequate and good quality water supply and sanitation, good drainage and effluent disposal, power supplies, good access to public transport, distance to good roads and good quality roads (O'Connor, 1995).

Each dairy will need a suitable mode of transport for collection and distribution of raw milk. According to Africa Now (2000), the mode of transport needed depends on the proximity of the producers to the dairy center and the amount of milk to be delivered. DDP members should be within 15 km radius from the center. If large number of farmers are located outside the 15 km radius, sub- collection center become necessary. Farmer's delivers milk using different means of transport, such as foot, bicycles, donkey carts, busses, motor vehicles, depending on the distance. In all cases the most cost-effective and economic way of transporting should be explored and adopted.

2.6.1.2 The lay-out of the main building for processing

The size of the building depends on the quantity of milk processed during the peak production period. The dairy should be hygienically designed and easily cleaned to prevent contamination

of products by insects, birds, rodents or micro-organisms (Africa Now, 2000). The building should have sufficient space for the intended scale of operation.

2.6.1.3 Equipment

Dairy products present a high risk of containing food-poisoning micro-organisms and equipment that is correctly and hygienically designed is essential to enable high quality products to be made (Axtell *et al*, 2008). It is important to find the correct size of the equipment (its capacity or throughput) for the intended scale of production to ensure that all equipment has a similar throughput. There are difficulties when importing equipments such as finding information on the available types of equipment, the willingness of overseas suppliers to meet small orders for equipment, and the higher freight and clearing charges, import duties and the capital cost (Fellows and Rottger, 2005).

2.6.1.4 Sources of packaging and ingredients

Most common ingredients that are used in dairies, including starter cultures, rennet and some types of food flavorings/colors, can be obtained reasonably easily, especially if a large number of processors exist in a particular area or country, or the ingredients can be obtained from specialist import agents. The lack of locally produced plastic films and glass or plastic containers is a major constraint on the production of dairy products. The only option for many producers is to import packaging from a more industrialized country.

2.6.1.5 Products to be processed

It is important to concentrates on traditional products or on products that are easily made, need little specialized equipment and can be easily adapted to the rural processing plant. Developing a "niche" market is vital to achieving success with the small-scale processing plant. In many African countries farmers produce sour milk, butter, ghee and cottage cheese for home consumption and sale (O'Connor, 1995).

2.6.1.6 Quality assurance and legislation

When milk from all producers has been collected and mixed, a sample is tested for acidity, density and fat content. All food manufacturers have a responsibility to ensure that quality assurance systems are in place to provide consumers with a product that is wholesome and safe to eat. Control of quality by the processor during distribution and retail display can prevent quality problems that would cause consumer complaints. Dairy processors should contact the responsible ministry and request copies of national regulations related to their range of products.

2.6.2 The major economic issues to be considered

There are two types of finance needed; the first is the investment finance. It is required before a business is set up and while the processing unit is being established. The second type is required to meet the costs that arise during operation of the processing unit, and this is met by income from sales of products (Fellows and Rottger, 2005). Realistic forecasting of revenues and costs of value-added dairy production requires estimates and assumptions in areas such as market demand for products, productive capacity of the plant, labor costs and efficiency, electricity and fuel costs and requirements, water supplies and wastewater disposal costs, market prices for raw milk, and potential premiums above federal minimum requirements that may be paid to farmers (Becker *et al*, 2007). Labor, raw milk prices, factory overhead (depreciation, maintenance, insurance, etc.), and interest expenses are the most significant costs, in terms of their percentage of total cost of goods sold. Therefore, the greatest attention has been paid to these cost items. The cost of production is key information that producers operating in competitive markets use to determine how much to produce and supply to the product market at a given price.

2.6.2.1 The cost of establishing the centre

The initial inputs in the business are known as the fixed inputs which include capital assets, processing plant, the building, the refrigerated trucks and storage tanks. Fixed inputs are not used up in the production process but continue to be used over many years of production. The payments of the fixed inputs are called the fixed cost or overheads and it involves annual cost of depreciation, repairs and maintenance of the fixed capital resources required for production. The investment in construction should be appropriate to the size and expected profitability of the business. The building costs for dairy processing unit are higher than other types of agro-processing units because they require separate cold rooms for incoming milk and for finished products (Fellows and Rottger, 2005).The cost of the building structure for the milk collection and cooling centres must be kept as low as possible, subject to the adequacy of the building for the handling of the expected milk throughput. Buildings in rural areas may cost more to construct because of higher transport costs for building materials, but rents in rural areas are usually lower than those in urban centres (Axtell *et al*, 2008).

Dairy processing has higher requirements for refrigerated storages, and depending on the product, may require expensive cream separators or pasteurizers. However micro and small scale dairies can be equipped with low cost equipments for production of yoghurt, cultured milks, butter and cheese (Fellows and Rottger, 2005).

2.6.2.2 Costs of operating the centre

The inputs that are all used up in the production process and get transformed into the output(s) or product(s) are called variable inputs and the payments to these inputs are total variable costs and therefore, vary with the level of output. The main cost in dairy is the milk, according to Fellows and Rottger (2005). Milk payments to producers should be based on both the quantity and quality of the raw milk delivered. Incentives for quality, facilitate increased milk

production, and hence ensure continuous and sufficient deliveries of milk to the milk collection and cooling system so as to keep the operating costs low (Mbogoh and Okoth, 1995).

Transport costs on milk collection from some places are high, especially when the number of suppliers becomes smaller and milk vehicles cannot make up full loads. With reference to high collection costs from small producers, milk processors pay them much lower price for their milk therefore; producers have no motivation to keep their dairy farms. Transport to distant centres adds costs, as does maintaining the appropriate cold chain (van Vuuren, 2006).The running costs must also be minimized, by engaging well trained personnel, and by avoiding overstaffing. The final prices of milk and milk products depend on the milk producer price, the milk collection and cooling costs, the milk processing and packaging costs, and the product distribution and marketing costs (Mbogoh and Okoth, 1995). Therefore measures must be put in place to ensure that the final prices of milk and milk products are affordable by the target markets.

2.6.3 Determining viability

Dairy processing scheme have very high establishment costs, due to its complex machinery, and therefore prior to its establishment proper planning and budgeting is required to ensure sustainability. It is important to determine the economic viability and profitability of any enterprise before making any major investments.

A Gross Margin Analysis (GMA) is one of the tools that can be used to measure the viability of an enterprise. It provides a more convenient and simple way to summarize information required in determining the financial performance of an enterprise. Gross Margin (GM) budgets completely ignore fixed costs, which are difficult to compute (Francis, 2001; Majuru, 2009). Therefore it is the difference between the gross income and the variable costs of

undertaking activities of an enterprise. The variable costs are directly related to the production process and change according to the level of production. If variable costs such as water, electricity, labor, ingredients for processing, consumables etc are subtracted, gross profit can be obtained. GM is also equals to gross income divided by net sales, and is expressed as a percentage. GM is convenient because it can be used to provide a measure of returns on resources employed in production such as returns on every dollar invested in labor or its opportunity cost. A firm with higher GM will have enough money left over to spend on other business operations, such as product development, training and marketing. However GM does not tell whether a particular way of producing a product is optimal, most profitable. This therefore means that positive GMs does not mean the enterprise is technically efficient in production.

The profitability of an enterprise is calculated using the -Net present value (NPV).The present value (PV) of future earnings takes into account the future stream of annual cash revenues minus the future stream of annual cash costs (cost of goods sold, operating expenses, and interest payments) discounted for the time value of money (Adelman and Marks, 2001). The NPV calculations rely on the initial investment costs determined for the type of enterprise from the economic-business assessment paid out at time period zero (present value of costs), and the stream of annual cash flows from the operating costs and returns assessment over a defined number of time periods into the future at a specified discount rate (Becker, et al, 2007).

CHAPTER THREE

ESTIMATION OF THE POTENTIAL MILK PRODUCTION IN OTJINENE CONSTITUENCY OF OMAHEKE REGION

ABSTRACT

A study was carried out in Otjinene constituency in the Omaheke region of Namibia to assess the potential of the local cattle production systems to produce enough surplus milk to sustain a small-scale milk processing plant. Questionnaires were administered in February 2010, to sixty households selected from 11 villages within 40 km of Otjinene town. The questionnaires collected information on animal production practices such as livestock numbers and productivity, current milk production and consumption patterns and processing of milk on farm and farmers perceptions on a processing scheme. Descriptive statistics were computed using SPSS (version 16.0).The mean number of cows per household was 46 ±78.847 of which 21 ±29.910 were lactating at the time of the survey and the mean number of cows milked was only 11 ±9.339, each cow producing a mean of 2.5 L/day. On average, each household produces 17 litres of surplus milk per day. Marketed milk was from 32% of the households the remainder either gave the milk away to relatives or found ways of consuming it. The majority of the farmers (83%) thought the establishment of a milk processing plant could improve their livelihoods. A substantial amount of milk 12 716 litres per day could be obtained from this area and this would sustain a small-scale processing plant. It is nevertheless recommended that similar assessments need to be done during the late summer and the dry season in order to estimate the potential milk supply surpluses or shortfalls in different seasons.

3.1 INTRODUCTION

An estimated 75% of poor people in the world live in rural areas and more than 600 million of these people keep livestock (LID, 1999). The global livestock sector is changing rapidly; increased urbanization and growing incomes are creating a dramatic increase in the demand for meat and milk in the developing world. This increasing demand for livestock products poses not only challenges, but also opportunities for the reduction of poverty among poor households with a good potential in livestock production. Livestock development has thus been assigned a dual role of satisfying the rapid rising demand of the expanding global population for meat and milk, and helping to meet the Millennium Development Goals in poverty reduction International Fund for Agricultural Development (IFAD, 2004).

Omaheke region is mostly known for its strong livestock production sector, but its people live in poverty, due to lack of opportunities and skills. Most of the farmers in the Otjinene district, like the rest of Omaheke, keep livestock, from which they derive their livelihood. Cattle production is the main form of land use in the area (Rethman and Acidri, 2008). Cattle are sold live as a source of immediate cash for supporting households. Milk forms an integral part of the diet of these people and is considered to be a very important nutrient source. However, for many of the farmers, milk is a by-product of beef production. Therefore milk yield per animal is of minor importance, perhaps because traditionally farmers keep large herds and only produce enough milk for their families rather than for sale. During good seasons surplus milk is obtained and it sometimes sold for cash or sent to relatives in the cities. Some farmers market raw fresh milk directly to consumers in the traditional or informal markets (RoN, 2006). There are public food safety concerns should milk continue to be marketed in such a manner. Nevertheless, the informal market is very important in supplying the increasing demand of milk, therefore there is need to investigate the possibility of establishing small

processing plants that can at least pasteurise the milk before sale to make it safe. Such plants can also make value added products to improve income options for the farmers.

Namibia relies heavily on dairy imports to meet the demand of dairy products. The local village markets are very thin as almost every household is self-sufficient in milk, especially during summer, reducing local milk market prices to a minimum and diluting the incentive for commercialisation of dairy production system. Dairy processing can be a means of diversification in order to maximize incomes from keeping livestock, rather than keeping large herds with little income.

The establishment of a dairy processing plant requires a constant supply of good quality raw milk and a market to absorb the value added products in order to operate viably. There has to be a good base of cattle production from which milk can be supplied to the plant. The objective of this study was therefore to look at the cattle production systems in Omaheke region of Namibia and to determine its capacity to supply milk to a dairy processing plant.

3.2 MATERIALS AND METHODS

3.2.1The study area

The study was carried out in Otjinene communal area (21°S 19ºE) in the Omaheke region. This area lies about 300 km east of the Namibian capital, Windhoek. The total land area of Otjinene is about 1283 000 ha (Katjiua and Ward, 2006). Climatic conditions are semi-arid with temperatures ranging from 4°C in winter to about 38°C in summer. Average annual rainfall ranges from 250mm–450mm with approximately 60% of the rainfall activity occurring between January and March (DEES, personal comm., 2010).

The vegetation is classified as the northern Kalahari broadleaved woodlands, characterised by dense stands of edible bush covering the dunes (Mendelsohn 2002). *Terminalia sericea* and *Philenoptera nelsii*, and shrubs such as *Bauhinia petersiana* and *Grewia* species are the most dominant. Acacia species such as *Acacia erioloba* and *Acacia mellifera* occur together with *Boscia albitrunca*. *Terminalia sericia* is considered an encroaching bush species by range ecologists, contrasting with the pastoralists as they regard this woody species as an important component of cattle diet, particularly during the hot-dry season or during drought (Katjiua and Ward, 2006). The landscape is generally undulating, covered with sand and sand dunes with limestone outcrops at some places, traversed by low-lying inter-dune depressions (RoN, 2006). The sandy areas have low levels of phosphorus and nitrogen contents (de Paw *et al.,* 1998).

The total population of the constituency is 7 790 people and there are 1175 households (RoN, 2005). The district capital is the settlement of Otjinene and it has a population of just under 1000 people.

3.2.2 Data collection

Purposive sampling was used to designate the study area to a 40km radius of Otjinene urban centre. From this area, 11 villages were randomly selected for the survey. Information was then obtained from 60 households, selected from the 11 villages. Data collection was done using a pre-tested questionnaire (Appendix 1) that had been designed to capture household information and cattle production with particular emphasis on milk production and some aspects of reproduction. The respondents were also requested to give their opinion on the establishment of milk processing plant closer to their farms. The survey was done during February 2010 after the commencement of the main rainy season and milk production was thought to be increasing. Four trained enumerators carried out the interviews and in general, each session lasted about 45 minutes.

3.2.3 Data Analysis

Descriptive statistics (mean, median and standard deviations) were computed for parameters such as household information; cattle herd sizes, milk production, and surplus milk. Frequencies were also calculated for parameters such as educational levels, current milk usage farmer opinion on the establishment of a processing centre. All these analysis were done using the Statistical Package for Social Sciences (SPSS version 16.0).

3.3 RESULTS AND DISCUSSIONS

3.3.1 Basic Household Information

Sixty eight percent of households were male headed and 32% were female headed. This corresponds well with RoN, 2006 that stated that males head two-thirds (67%) of all households in Omaheke leaving (33 percent) to be female headers. The mean number of people was 6.7 ±2.8 for each household. This corresponds with National census indicators in RoN, 2005 that the average size per household was 6.6. At least 53% of households had more than four adults, implying that there is enough labour available for milking and transportation of milk to the centre. Mendelsohn (2006) has also articulated that the herd boys are mainly family members and therefore contribute by providing labour. Somano (2008) has referred dairy production in general and marketable surplus of dairy products in particular as a function of labor and that families with more household members tend to have more labor which in turn increase milk production and then milk market participation of the dairy household.

Eighteen percent of the respondents had no formal education of any kind, 25 percent had attended part primary school, 45% stated that they have attended some secondary education and only 12% have gone to tertiary institutions. This implies an 81% literacy rate, which also

suggests that there is a mass of people that are trainable on issues to do with technicalities of running a dairy processing plant. However these findings contrast differently to an earlier study by DEES, (2003). This study found out that 39% of Omaheke inhabitants had not attended any formal school in their lives, 25% had part primary school, 23% had attended part secondary and the remaining 11% of households had above secondary school qualifications. These disparities can be attributed to the difference in time between this study and that of DEES (2003). A difference of eight years is enough to change national demographics in terms of education. At the time of this study, many young people were becoming farmers, either by starting their own homesteads, inheritance from their parents or by taking over from their retired parents.

Thirty percent of the respondents earned off-farm income from salaries, 27% from own businesses, 25% were pensioners and 18% do not earn any off-farm incomes of some kind. On farm incomes come mainly from cattle sales for all the respondents. Almost 72% of incomes were earned on-farm from beef cattle sales, 12% income from a combination of beef cattle sales and goats, 8% get income from cattle sales and milk and the remaining 8% got income from milk, cattle and some garden vegetables.

3.3.2 General Livestock Ownership

The majority of households (47%) owned between 1 to 50 cattle, this agree with a DEES (2003) study that found that most households owned about 11 to 49 heads of cattle. A very insignificant 1.3% has no cattle in Omaheke according to DEES, 2003. This means that almost every household (99.7%) have cattle of a different herd size. Table 3.1 shows details of the different livestock species owned by the farmers in Otjinene constituency as obtained from the respondents during the survey.

Table 3.1: Livestock ownership in Otjinene

Type	Number owned	Percentages
Cattle		
	1-50	46.7
	51-100	25.0
	101-200	13.3
	>201	15.0
Small stock		
(Goats and Sheep)	0	8.3
	1-50	43.3
	51-100	26.7
	101-150	11.7
	>150	10.0
Equines		
	1-4	43.3
	5-10	35.0
	>10	21.7
Poultry (Chicken)		
	0	10.0
	1-10	63.3
	11-50	26.7

Source: Results from survey data

The result agrees with (Mendelsohn, 2006, Sweet and Burke, 2006) that farmers are extremely heterogeneous, particularly in terms of household wealth, herd sizes and assets of value in farming cattle. They stipulated that livestock ownership is strongly skewed, with a small number of people owning large herds and others owning few animals or none at all. The majority of the households (43%) own between 1-50 small stock such as goats and sheep, only 8% of the households do not own any of the type of livestock. Forty three percent, of the households own 1 to 4 equines which include horses and donkeys; these are used as a means of transport. All the households have at least 1 horse or donkey for transport. Households that does not own any chickens are 10 % and 63% of the households own between 1 to 10 chickens and a 27% owns 11 to 50 chickens. These are important livestock species for the people in the region as the small stock provides most of the meat requirements and sometimes goats' milk is used for feeding small children. Equines such as horses, donkeys and mules are commonly used for transport and draught power in the area.

3.3.3 Cattle breeds in Otjinene

The most common breeds (70%) found in the area are mainly crosses of Brahman, Simbra and Simmentaler with the indigenous Sanga breed (Figure.3.1). Els (2004) supported these findings when he stated that crossbred cattle dominate in the communal areas south of the Veterinary Control Fence, which include Omaheke. Many communal farmers had a perception that the indigenous cattle are inferior because of their small frame size, therefore became eager to improve the genetic material of their cattle, by crossing with Brahman, Simmentaler, Afrikander and Bonsmara breeds as supported by Mendelsohn (2006). Most farmers in Otjinene have these improved breeds of cattle for increased beef production. Since the breeds are mainly beef breeds and therefore their genetic merit is mainly for beef production.

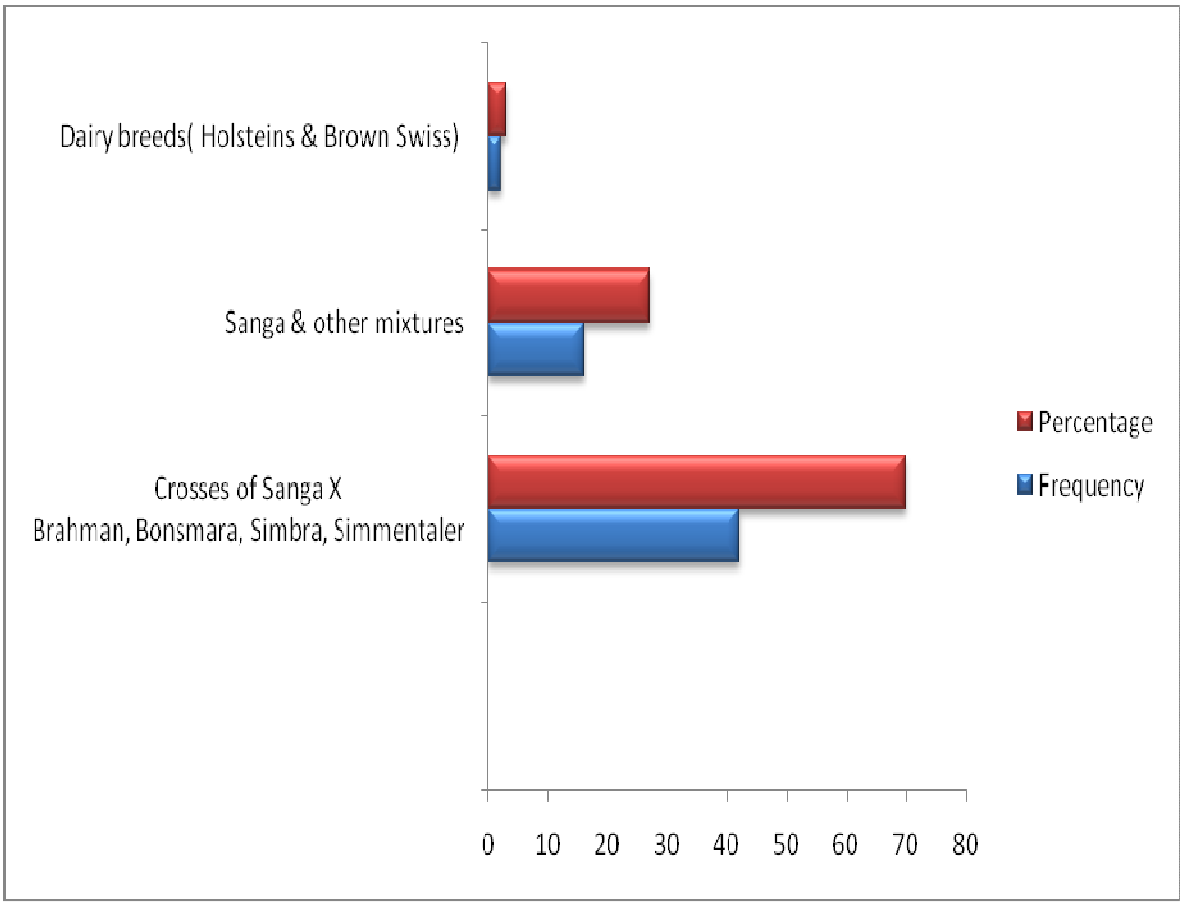

Figure 3.1: Cattle breeds in Otjinene

Source: Results from survey data

The milk produced by such animals is mainly for their calves in a suckler system. This implies that milk production from these breeds is low. On average these breeds produce 2.5 litres of milk per day (Table 3.4). This is well supported by literature that on average local cattle produce 3 to 5 litres of milk per day (Aregheore, 2006, Mupunga and Dube, 1992; Hanyani-Mlambo *et al.,* 1998; Ngongoni, et al 2006). They also indicated that the indigenous cattle, which are low yielders and have short lactation period, are more dominant and are used to produce milk for household consumption and for sale. In Ethiopia rural milk production is based on the low producing (1 to 3 litres per day depending on the season and stage of lactation) indigenous breeds of zebu cattle as well, which are low yielders with a lactation period of about 7 months (Tangka, 1999). However, there is a global move towards dual purpose animals that can produce both milk and beef (Halhead, 2010).

Only 3% of the farmers kept dairy breeds (Dairy Swiss and Friesian-Holsteins) and they are therefore small-scale dairy farmers. These two farmers produce more milk during the dry season and are able to exploit dry season milk shortages by selling at higher prices.

3.3.4 Herd Structure

The average cattle herd structure is shown in Table 3.2. The mean numbers of cows per herd is 46 ±78.847. Cows thus make up about 40 % of the total herd. Steers/ oxen and the male calves make up 23 % of the herd. However the composition of steers on there is low (14%) as compared to finding from Mendelsohn (2006) who reported it to be 20 to 40% of the total herd. Male calves and steers are more important for the farmers in the region, as they are mainly raised and weaned for sale. Heifers and the female calves, which are the replacement stock, form 23% of the total herd. This information is important in that it helps one to understand the productivity of the herd.

Table 3.2: Cattle Herd composition

Type	Mean	±SD	Mean % of cattle population
Cows	46	78.85	38
Heifers	17	30.02	14
Steers/oxen	17	29.20	14
Male calves	10	16.91	8
Female calves	11	13.75	9
Bulls	4	5.40	3

Source: Results from survey data

Considering that farmers follow a rural production system, reproductivity of the cows is often low. This is mainly because of lack of resources such as feed supplementation, insufficient water, and lack of knowledge on animal husbandry it is mainly characterized as a low input production sector (Els, 2004).

The herd composition and proportions of different classes are similar to the figures reported by Mendelsohn (2006), that the herd composition is more controlled so that cows make up 40 to 50 percent of the animals, oxen 20 to 40%, calves 30 to 40%, and bulls between 1 and 2% of an average herd. From the proportion of calves to cows, the calving rate can be estimated to be 46%. It is important in any dairy farming situation to have good reproductive performance because the more the cows calve, the higher the number of cows in lactation and the more the milk that is obtained from the system. The reproductive performance of these cows is on the lower side, reasons for this are attributed to the feeding condition of the animals. The cattle mainly depend on the natural vegetation, with limited supplementation as reported by Els, (2004) and Kruger and Imbuwa (2008). The authors further enunciated that a cow supplemented has a higher calving percentage than one that depends on natural vegetation and salt blocks only.

With good extension services, there is scope for improving calving rates to above 60% which is reasonable for the communal areas. From the proportion of calves to cows, the calving rate can be estimated to be 46%. It is important in any dairy farming situation to have good reproductive performance because the more the cows calve, the higher the number of cows in lactation and the more the milk that is obtained from the system. The reproductive performance of these cows is on the lower side, reasons for this are attributed to the feeding condition of the animals. The cattle mainly depend on the natural vegetation, with limited supplementation as

reported by Els (2004) and Kruger and Imbuwa (2008). The authors further enunciated that a cow supplemented has a higher calving percentage than one that depends on natural vegetation and salt blocks only (Kruger and Imbuwa, 2008). With good extension services, there is scope for improving calving rates to above 60%.

3.3.5 Milk production and consumption patterns

Of the 46 mean numbers of cows, 21 cows (46%) were in lactation at the time of the study. The farmers only milked 11 cows (52%) of the 21 cows in lactation (Table 3.3). The cows were milked primarily to satisfy household demand for milk (50%) as stipulated by the farmers in the survey. This demand was obviously satisfied by milking a fraction of the total number of lactating cows. The farmers, (40%) stated they wanted to leave the milk to the calves to promote growth. These non-milked cows represent an opportunity for increased milk off-take once the farmers realize that they can raise extra income from selling milk to a processing factory.

The potential average milk production from the lactating cows was 2.5 litres per day per cow. The implication of these figures is that on average, each household produces about 25 litres of milk daily. Aregheore (2006) Ngongoni *et al* (2006), Hanyani-Mlambo *et al* (1998), Mupunga and Dube (1992); reported similar production levels (3-5 litres of milk per cow per day) for local beef breeds. In Ethiopia rural milk production is based on the low producing (1 to 3 litres per day depending on the season and stage of lactation) indigenous breeds of zebu cattle as well, which are low yielders with a lactation period of about 7 months (Tangka *et al.,* 1999).

Table 3.3: Milk production

	Units	Mean	±SD
Total number of cows	Count	46	78.847
Number of lactating cows	Count	21	29.910
Number of cows milked	Count	11	9.339
Average milk production	(litres/day)	25	19.426
Average milk production/cow	(litres/cow/day)	2.5	1.571
Household consumption	(litres/day	8	5.341
Total Surplus	(litres/day)	17	18.499

Source: Results from survey data

Milking behavior of farmers also shows potential for further growth in milk production. Sixty seven percent of the farmers only milked cows for 5 to 9 months while eleven percent only milked their cows for under five months and a 21% milked for more than 10 months. However the 65% who milk for up to 9 month can produce substantial amounts of milk for quite a long time. However if the 11% farmers milked their cows up to 10 months, the potential milk supply can also be increased. With an average of 8 litres used for household consumption the remaining 17 litres become surplus (Table 3.3).

With the household population of 748 and surplus of 17 litres per household, the total surplus in the study area is estimated to be 12 716 litres per day (Table 3.4). Forty two percent of the households stated that they keep it within the household, presumably they processed it to some other value added products for family consumption, 32% stated that they sold surplus and 27% gave away the milk to relatives or children in the cities. Therefore of the surplus amount produced, only 32% or 4 069 litres is traded. The rest is disposed of in unknown ways. Whether 12 716 litres or 4 069 liters are considered, both figures represent a huge amount of milk that could be channeled to sustain a small to medium sized milk processing plant. Given the fact that farmers are milking only 52% of the cows in lactation, the volumes of milk could be increased if the farmers realized that they can make extra income from milk sales to a processor. These projections are based on the assumption that all the farming households in the region which are producing milk will deliver to the factory. It is acknowledged that this may not be the case, due to different factors such as distance to the centre, roads infrastructure, transport, household wealth and many others. It is highly likely that those farming households that are closer to the factory will deliver most of the milk.

Table 3.4: Milk production within 40 km of Otjinene

District	Total number of Households (40 Km)	Current production (25 L)	Current Surplus L/day	Current Milk Sales L/day (32%)	Potential Milk Production L/day	Potential Surplus Milk L/day	Potential milk sales L/day (32%)
Survey	60	1 500	1020	326	3780	3300	1056
Otjinene	748	18 700	12 716	4 069	47 124	41140	13165

Source: Results from survey data

A report from Africa Now (2000) have identified distance to markets and the standard of roads as factors that affect the total milk deliveries to the centers and they influence the proportion of local sales. Roads in the Omaheke region are mainly gravel and this can be a disadvantage were milk is concerned. However these amounts of milk are obtainable within 40 km to the central town and that put the Otjinene area to a greater advantage. Were a distance exceeds 20 km, sub collection centres can be incorporated as according to Africa Now (2000).

When the respondents were asked how they consumed their milk, 7% of the respondents replied that they consume their milk raw, 93% stated they processed the milk into sour milk and butter oil. These findings are in agreement with the Republic of Namibia report (RoN, 2006) which stated that milk and meat constitute staple foods for many people in the rural areas of Omaheke and that excess milk at household level is made into butter, which is processed into traditional butter oil. The butter oil is consumed at household level, supplied to relatives in towns, or sold for commercial gain.

3.3.6 Market, products and prices of milk and milk products

The surplus milk that is produced, thirty two percent of it is marketed in Otjinene urban settlement. It being a town, with a sizeable working population means that demand will be concentrated here rather than in the farming district. Raw milk is the most common product sold taking 90% of the sales and some households also sell butter oil (5%) and yoghurt (5%). The price of raw milk ranges from N$ 6.00 to N$ 7.50 and the average is N$ 6.50 per liter. Raw milk has a very short shelf life and also poses a threat to the lives of the people, there is therefore scope to process the milk into value added products that, in addition to extended shelf life, can be marketed further than the Otjinene urban settlement. Traditional value added products such as butter oil are already being produced, albeit on a smaller scale.

3.3.7 Farmers' opinions on dairy businesses

Seventy percent of the farmers indicated that they would dispose their surplus milk through selling to a processing factory if one established in Otjinene and 30% said they would not do so. The majority of the respondents (83%) also thought that such a dairy enterprise can improve the livelihoods of the people compared to 3% who said they saw no improvement and 13% who were not sure. The above responses indicate that the proposed milk processing centre would have no shortage of milk supply. The respondents who indicated that they expect improved livelihoods through dairying explained that this would come in the form of cash income on a regular basis. This is in line with reports in literature (Bennet *et al.,* 2006) that indeed smallholder dairying can improve the cash flow situation of the farmers as they will receive payments for milk delivered on a monthly or weekly basis. This unlike beef production where an animal is reared for at least 3 year to attain slaughter weight for it to be sold so that the farmer realizes some income. Furthermore, milk production from beef animals has the advantage of diversifying the product range that is obtainable from the same animals.

3.4 CONCLUSIONS

There is a potential for milk supply of 12000 liters per day, through the current production system in the Otjinene constituency. Farmers only milked 52% of the cow that were in milk at the time of the study. The calving rate was estimated to be 46%. These factors demonstrated that there is a potential to produce enough milk to support a small to medium-scale processing centre. This amount can be obtained from households that are within 40 km of the Otjinene town settlement. There was already some trade in milk and milk products (32% of the households) that was taking place. The products were made using traditional methods and milk was sold as raw fresh milk and no pasteurization was taking place due to lack of facilities. This

pose a significant health risk, therefore the establishment of a processing centre would eliminate the health risks through processing using modern methods. Farmers' attitudes towards such a scheme were positive. They would therefore require training in dairying to produce good quality milk suitable for processing.

The fundamental question is either this potential growth in milk production can be harvested, processed and sold on a commercially viable manner. Learning from a case and example of Zimbabwe's DDP for smallholder farming suggests that Namibia has a potential to transform rural livelihoods through commercialization of dairy production. Exploration of this potential is subject of the next chapter.

CHAPTER FOUR

COMMERCIAL VIABILITY OF SMALLHOLDER DAIRY PROCESSING UNDER NAMIBIAN LIVESTOCK PRODUCTION AND MARKET SYSTEM

ABSTRACT

The study was done in order to evaluate the economic viability of existing smallholder processing schemes in Zimbabwe and Otjinene projected dairy center in Omaheke region of Namibia. Data from Nyarungu dairy center was obtained from monthly financial statements such as the income statements, sales records and cash flow statements for a year.This study presents a generalized estimate of the capital investment, operational costs, and potential returns from small-scale processing plants for fluid milk, fermented products such as cultured milk, yoghurt and butter oil from the potential identified in the Otjinene constituency. Costs were based on dairy market prices in Otjinene and in Namibia. Economic analysis was based on Gross Margin Analysis and the Net present value for the schemes. Zimbabwe smallholder processing center showed negative annual gross margins of U$-210.00, implying that processing in the smallholder schemes was not viable. The Otjinene projected scheme proved to be viable and profitable options as it showed positive gross margins and net present values on different discounted prices from the retail price. Value adding was more profitable in terms of revenue than raw or pasteurized milk. It is concluded that dairy processing would be a viable option for smallholder farmers in Otjinene. However policies need to be put in place to encourage dairy development.

4.1 INTRODUCTION

Rapidly increasing population size and expanding rural and urban population create greater markets and growth of demand for dairy products. This affords greater opportunities for milk producers, for development of milk production and processing industry. Empowering farmers in becoming self-sufficient in milk is a excellent undertaking but when there are surpluses, milk can go to waste and in cases were milk is sold informally it can cause a multitude of health threats to the consumers (Aregheore, 2006). Much of the milk produced by rural smallholders is processed on-farm using traditional technologies. Successful small scale dairy processing and marketing can be a powerful tool for sustainable rural economic development especially when generation and sustaining off farm dairy related employment is considered and increased incomes (Bennett *et al.*, 2006). The system should be able to provide milk to consumers at affordable prices. Hence the system should not be expensive, so that whatever measures are taken in order to make and keep milk safe for human consumption should be cost effective. The pricing of the final milk and milk products are depended on the costs associated with raw material procurement, processing and marketing. It is therefore vital that these costs are kept as low as possible (Mbogoh and Okoth, 1995; van Vuuren, 2006).

This therefore justifies the need to evaluate the commercial viability of existing small-scale processing and value-adding technologies in Zimbabwe, from which inferences can be made for developing a new scheme. It was identified in chapter 3 that Otjinene constituency has the potential to produce enough surplus milk to sustain a processing centre. This study presents a generalized estimate of the capital investment, operational costs, and potential returns from small-scale processing plants for fluid milk, fermented products such as cultured milk, cheese, or yogurt and butter oil from the potential identified in the Otjinene constituency.

4.2 MATERIALS AND METHODS

4.2.1 Study Sites:

4.2.1.1 DDP Milk Centres e.g. Nyarungu

The Dairy Development Programme (DDP) is a department under Agricultural Rural Development Authority (ARDA), a policy initiatives crafted by the government of Zimbabwe. The development objective of DDP is to increase incomes for smallholder dairy farmers in Zimbabwe's Commercial, Resettlement and Communal areas. The mandate was to promote milk production, processing and marketing within the farming community of Zimbabwe. The program has initially been funded by the Government of Zimbabwe and NORAD, although Africa Now has also been assisting the farmers in the processing of dairy products, like yogurt and cultured milk (DDP, unpublished paper). To date, ARDA DDP is involved in milk collection, processing and marketing (Chimboza and Mutandwa, 2007) and operates in at least 30 projects in all the provinces countrywide such as Manicaland (Rusitu, Tsonzo, Honde, Dowa); Mashonaland East (Chikwakwa, Marirangwe, Nharira); Mashonaland Central (Guruve); Mashonaland West (Zvimba); Midlands (Gokwe).

Nyarungu Dairy Centre is one of ARDA DDP's projects, domiciled at the ARDA DDP Head Office west of Harare, some 20 km along the New Chitungwiza Road. Nyarungu Dairy has been in operation since 1999, owned by DDP and operates as a Strategic Business Unit (SBU). It is a model dairy processing scheme, which offers training for new and existing projects. The program emphasizes effective animal health, nutrition and breeding systems, as well as marketing systems, in order to increase milk production. The beneficiaries produce milk and deliver to the milk collection centers. Farmers are paid for milk delivered to the centre at the time to be agreed by the beneficiaries. However the Nyarungu farm supplies its own centre

with milk, processes and markets all its products. The centers are managed by a seven-member Executive Committee, elected from the beneficiaries, under the guidance of DDP and stakeholders. The business of the project is governed by the constitution that is drafted by the farmers with help of DDP and stakeholders.

The dairy brands (Appendix 3) used by DDP projects are Delite (for cup yoghurt), Joy (for sachet yoghurt), Amasi (for cultured milk), Hodzeko (for naturally soured milk) and Super Fresh (for pasteurized fresh milk). However most of the projects process milk and milk products for the local business market, close the centre and nearby towns. The main markets or stakeholders served by Nyarungu Dairy centre are the retail outlets in the form of supermarkets with major ones being Batanai Supermarket, Mubaiwa Supermarket, Mupfunya Supermarket, nearby schools and collages like Nyatsime Collage and individuals who come across the dairy (Key informants, DDP centre).

Most of the dairy products are consumed in the Chitungwiza market, (St. Mary's, Zengeza and Makoni suburbs) which lies 25 km to the south of Harare. Other DDP projects (farmer-managed) supplying milk and milk products into the Chitungwiza and Harare markets (mainly Glen View, Glen Norah, Waterfalls, Highfield and Budiriro) include Nharira/Lancashire, Sangano, Wedza, Chikwaka and Mhondoro dairies (Chimboza and Mutandwa, 2007).

4.2.1.2 Otjinene

A description of Otjinene has already been given in section 3.2.1.

4.2.2 Data collection

4.2.2.1 Nyarungu Dairy Centre

This study mainly used secondary data obtained from Nyarungu records at the DDP offices. The most recent monthly reports of 2009-2010 were obtained for the extraction of data. Monthly reports were based on the financial statements such as the income statements, sales records and cash flow statements. The reason for selecting the time frame based on the change in currency form Zimbabwe dollar to a more stable currency the US dollar. This data was used to assess the viability of the small-scale processing schemes in Zimbabwe. To compliment recorded data, key informants like the DDP director at Nyarungu, centre administrator at scheme were also consulted for information.

4.2.2.2 Otjinene projected dairy centre

Data has been collected as secondary or existing data from the Directorate of Veterinary Services (DVS) for information on livestock numbers and the National Planning Commission for data on the population and from the FAO on the cost and equipments required for the processing centre.

Key informants from the Directorate of Extension and Engineering Services, Otjinene Town Council, and the University of Namibia were consulted for information on the area, costs and procedures for acquiring land, water and electricity charges in the Otjinene town and also the procedures used for acquiring equipments for processing and the cost prices.

The study also used information obtained from a survey conducted in the area, to assess the current and potential milk production in the area.

4.2.3 Data analysis

The data obtained from the Nyarungu records were put into tables and the economic viability of the scheme was assessed using a Gross margin Analysis (GMA). Gross Margin (GM) serves as the unit of analysis in evaluating the economic performance of an enterprise. GM is defined as the difference between the value of an enterprise's gross output and the marginal cost of that production (Mano, 2009).

The milk potential in Otjinene was computed from the average surplus milk per household by the total number of households that are within 40 km of the Otjinene town settlement.

Budgets were developed on spreadsheet for facility construction, operation, and economic viability assessment for pasteurized milk, cultured milk, pasteurized milk, and yogurt and butter oil.

Profitability for the processing of pasteurized milk, fermented products such as cultured milk, yogurt and butter oil proposed for the plant in Otjinene of the enterprise was calculated using the Net present value (NPV). The present value (PV) of future earnings takes into account the future flow of annual cash revenues minus the future flow of annual cash costs (cost of goods sold, operating expenses, and interest payments) discounted for the time value of money (Adelman and Marks, 2001). This study used a 5 years period and an 8% discount rate across firms' potential.

4.3 RESULTS AND DISCUSSIONS

4.3.1 Market Challenges for DDP dairy products

4.3.1.1Costs of production

The gross margins of Nyarungu processing scheme were both negative and positive throughout the year. However at the of the year term for the period under study the scheme had a negative gross margin, implying that the centre was unable to make any profits, considering that it is a old scheme, established in 1999. This was attributed to by the higher costs of production in this case the variable costs. Table 4.1 shows the cash flow for Nyarungu dairy centre, the variable costs are very high as compared to the revenue obtained. The reason for the high variable cost is mainly due to the amount of raw milk purchased in association to the cost of raw milk (Appendix 2). February to June signifies the months when the scheme was making economic losses. This month's signifies the flash period and therefore the demand for milk and milk products is reduced since almost every household is able to supply its demand for milk and milk products.

The GM/VC shows that for every dollar invested the company is making the losses as depicted by the negative GM. The highest loss per dollar was 29 cents and the highest gain was 27 cents. This clearly shows that the scheme is marginally viable if not unviable. This in line with Maphosa (2006) that the potential for milk processing in rural Zimbabwe was found to be financially unviable even though processing of milk had a value.

Table 4.1: Nyarungu Dairy Centre Cash flow Summary (2009-2010)

	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	Total
TR	2821.82	4926.40	7284.82	8707.67	10097.40	10142.91	8417.90	8143.87	8716.97	6157.60	6504.72	7951.57	**89873.54**
TFC	92.38	262.00	0.00	175.00	100.00	94.00	102.90	194.48	139.00	139.00	139.00	139.00	**1576.76**
TVC	3971.77	5500.48	6600.38	8472.37	7942.63	8709.64	8162.02	8081.16	9526.00	6625.38	6728.04	9763.67	**90083.54**
TC	4064.15	5762.48	6600.38	8647.37	8042.63	8803.64	8264.92	8275.64	9665.00	6764.38	68667.0	9902.67	**91 660.3**
NB	-1242.33	-836.08	684.44	60.30	2054.77	1339.27	152.99	-131.77	-948.03	-606.78	-362.32	-1951.10	**-1786.65**
GM	-1149.95	-574.08	684.44	235.30	2154.77	1433.27	255.89	62.71	809.03	-467.78	-223.32	-1812.10	**-209.89**
GM/VC	**-0.29**	**-0.10**	**0.10**	**0.03**	**0.27**	**0.16**	**0.03**	**0.01**	**-0.08**	**-0.07**	**-0.03**	**-0.19**	**-0.16**

Key: TR=Total revenue, TFC= Total fixed Cost, TVC= Total Variable Cost, TC= Total Costs, NB= Net Balance, GM= Gross Margin
GM/VC= Gross Margin per Variable cost

Source: Results from Nyarungu records

Most of the smallholder dairy schemes rely on milk delivered to the processing centre, and this creates a big challenge since milk delivered and handled at the MCC has a bearing on the net revenue attained. When volumes are low, overhead costs tend to be heavier than revenue and therefore eat on the profits leaving the dairy enterprise unprofitable (Maphosa, 2006). Unlike all the other schemes, Nyarungu dairy farm provides all the milk since they have their own dairy cows were milk comes from. However milk is obtained at a cost of U$ 0.66 per litre. The Nyarungu dairy has sufficient amount of raw milk intake (Appendix 2) nevertheless they are failing to make profit let alone breakeven.

Milk that is received is located to the different products such as Amasi, Yoghurt, Naturally fermented milk, and some are sold as raw fresh milk, some of the milk are allocated as staff rations, calves, substandard milk, promotion and some of it is lost as whey. Some of the losses were due to the electricity problems experienced in the country, causing power shortages at the different centers. This somehow has a serious bearing on the processing centers, meaning delayed product processing causing delayed products deliveries that can result in loosing valuable customers. A lot of damages could also result from the shortages of electricity supply, due to the disturbances in the cold chain during storage of the products (DDP, key informants).

Table 4.2 shows that for every product that they are producing they are making a loss. Cost per unit shows that the cost of production is higher than the selling price. Since the selling price of a product is made with the costs of production in consideration, it is relatively important that the centre improves on their costs of production. In order for Nyarungu to make profits they have to improve the efficiency of their production, in order to keep the costs of production low. It is very important to find ways to produce at the least cost so that the production cost will not exceed the selling price.

Table 4.2: Cost per unit product at Nyarungu Dairy Center

Product	Price	TS (Litres)	TR (U$)	TC	Cost/ Unit
Amasi	0.5	97 739.30	48869.65	49841.16	0.51
Yoghurt	0.5	5524.9	2762.45	2817.37	0.51
Natural sour	1.5	2606.07	3909.1	3986.81	1.53
Raw fresh	0.66	52 018.86	34332.45	35914.95	0.67

Source: Results from Nyarungu records

The findings here agrees with Mbogoh and Okoth (1995) and van Vuuren (2006) who stated the importance of keeping the costs of procurement, processing, transportation and marketing as low as possible since it has a bearing on the pricing of the final milk and milk products. According to Fellows and Rottger (2005) the price charged for a product should ensure that the income meets all of the costs and generates sufficient profit. The simplest method to determine the correct price for a product is to add up all the costs of production and then add on a percentage profit (mark-up pricing). Many processors use a profit margin of 20–30 percent, although lower margins are possible if the efficiency and productivity of the business are high. Conversely, if a product has little competition and or a high demand, a higher profit margin may be possible. Chimboza and Mutandwa (2007) stated four factors identified as key determinants of dairy product choice as promotion, price and availability of product, attractive packaging and product quality. However, promotion of dairy products was the most important determinant of brand choice. This study will look at this four factors and how they affect DDPs products on the market.

4.3.1.2 Price and demand for dairy products

Given the low revenue bases for these DDP schemes products, incomes can be increased by increasing the price of products, increasing credit sales of products or by finding buyers for by-products that were previously discarded. However this is impossible for the DDP processing scheme since they are operating in a perfectly competitive market, characterized by the presence of many suppliers and many buyers making independent economic decisions. The prices are set by the firms that found the market basing on their production cost or were determined by market forces of demand and supply. DDP entered the market, bound to follow the market prices, which were prevailing at that time.

The demand of dairy products is elastic to price, meaning that any price changes will greatly affect the demand of the products as well as the centre's viability. Opting for a price reduction will be unviable because the costs of producing the products are higher and that will lead to abnormal losses and increasing the price will cause the consumers to go for products from other company that are more affordable. The law of demand states that, everything else being equal, the quantity of good that consumers are willing and able to buy from the market falls as price of that good rises.

Academic studies by Chimboza and Mutandwa (2007) and others have proven the importance of price in determining consumer choice of dairy brands. The products are identical in the eyes of the buyers hence there is perfect substitution. For substitutes the demand for one good increase as the price of the other good increases. This brings in the issue of competition between the products of other processors when displayed on retail shelves. The products' presentation in terms of packaging and promotion becomes important as this can determine the choice of buying the product. Not only can one talk of the demand for products based on the price one also has to consider the market were the product is sold in relation to the price. The DDP centers were fashioned to serve the local market so as to avoid the long distances and the special conditions associated with transportation of dairy products. The local markets i.e. Chitungwisa are known as low income suburb therefore the buying power is low. For low income earners milk is milk whether presented in an attractive packaging or sold in unattractive packages. These consumers are not willing to pay an extra dollar associated with value addition.

4.3.1.3 Promotion and product availability

Due to the low revenues in most of the DDP schemes or processing centers, product promotion is given little or no attention at all. In a personnel communication with the director of one of

the DDPs scheme stated that the "consumers are well familiar with the products therefore no promotion is done" at that particular centre. This is somehow one of the reasons why most of the centers are not promoting their products due to the perception that most of the consumers are familiar with the products. As stated earlier studies in Zimbabwe has identified promotion to top the list of factors that determines product choice. Chimboza and Mutandwa (2007) stated that the company must not only develop a clear positioning strategy; it must also communicate it effectively" and this clearly demonstrates the need by ARDA DDP to engage into promotional campaigns if its brands are to be visible in the market.

There are many dairy products as the industry is a competitive one with many sellers and many consumers who make their own choices based on their preferences (likes and dislikes). There is need to increase brand visibility of DDP products through promotion and ensuring that brands are readily available. In a study by Chimboza and Mutandwa (2007) attractive packaging was the most significant factor in the preference for Delite, Joy and Super Fresh whereas availability was the most significant factor in the preference for Amasi and Hodzeko (Naturally fermented milk). It therefore becomes apparent that DDP puts much effort in developing attractive brands of products and of good quality. Promotional vehicles that could be used in this respect include radios, TVs, newspapers, road shows and also e-commerce.

Low revenue margins experienced in the DDP scheme like Nyarungu are also due to the seasonality of in milk production. During the flash season there are sufficient amounts of milk and therefore increased milk intakes, which are then reduced during the dry season. This causes the DDPs' dairy products not to be available in the up market. In addition, the program should focus on ensuring product availability at strategically located markets to increase convenience to local consumers. Investing in improved packaging to add value to a product and relocate it

up market, where a higher price can be achieved. Consumers' income is an important determinant of the choice of dairy product. As income increases the demand for high value products also increases. Ice-cream and yoghurt are luxury goods that are appreciated and consumed by high income earners.

Product quality was another issue attributed to the choice in purchasing and consumption of dairy products. As far as quality of DDP products is concerned there has been complains about the in-sachets pasteurized milk. The separation of cream in milk up on storage is visible even through the packaging and milk is thought to be sour by the consumers. These are some of the problems associated with DDP products and therefore the sale of these products in the up market will surely have limitations, since people want value for their money.

4.3.2 Otjinene scheme design and performance projections

A potential for milk production exist in Otjinene as it is seen in table 4.3. A surplus of 12 000 liters per day exist for all households that are within a 40km distance to the center. The distance to the centre has been limited to 40 km reasons are because of the nature of the milk. Milk is a perishable commodity and high temperature increases risks of spoilage and wastages over longer distances especially when the mode of transport is the oxen or donkey driven carts and trucks not non refrigerated trucks. Milk is bulky and can be very costly to transport to central processor especially where distances exceeds 40 km when distances are further to the center there is reduced participation due to inaccessibility to roads. However this is well known that due to various reasons it is impossible that the centre will be supplied with milk by all (748) households.

Table 4.3: Projected milk production within 40 km of Otjinene

District	No. of HH* (40 Km)	Production (25 L)	Surplus L/day	Sales L/day (32%)
Survey	60	1 500	1020	326
Otjinene	748	18 700	12 716	4 069

***HH**-Households

Source: Results from survey data

Like in the case of Otjinene 32% of the household are already participating in the milk sales and therefore this study was mainly based on the current supply. Thirty two percent of the748 households represent 240 households who can supply about 4000 litres of milk per day. It is also impossible to get a 100% milk intake from these farmers; therefore scenario analyses based on milk supply at different levels, such as 30%, which represent 71 households being able to supply the centre with 1200 liters per day. A 50 % which represents half of the targeted population, which is 120 households, who are able to supply 2000 liters of milk per day and a 75% milk intake which represent about 180 households which will be able to provide 3000 litres per day.

Estimating centre revenues for pasteurized milk, yogurt, cultured milk and butter oil required a projection of sales volume by year, multiplied by a sales price (based on the current retail price in Omaheke supermarkets) per unit of product. Product prices can range from a low end for generic products to the high end for premium quality from established brand name companies. Given the marketing hurdles for a start-up company together with the purchasing power of the likely consumer market in which these products would initially be introduced, wholesale prices were used in this study (See Appendices 4,5or 6). The retail prices of the different dairy products were multiplied by 0.90, 0.85, 0.80 and 0.75 to ascribe wholesale prices used for this study.

Table 4.4: Otjinene Projected Dairy Centre Cash flow Summary

Capacity utilization	**Year 1** 30 % milk intake	**Year2** 50 % milk intake	**Year3** 50 % milk intake	**Year 4** 75 % milk intake	**Year 5** 75 % milk intake
Initial capital investment N$	4714552		292765		
Loan Payments @ 11% interest = N$ 7307556	1461511	1461511	1461511	1461511	1461511
TVC	**4131864**	**7458264**	**7667712**	**10417644**	**10417644**
Centre Revenue					
Income (90% of retail)	4276800	10692000	13476726	14813442	14813442
Income (85% of retail)	4212000	10098000	12728019	13990473	13990473
Income (80% of retail)	3974400	9504000	11979312	13167504	13167504
Income (75% of retail)	3736800	8910000	11230605	12344535	12344535
Gross margin					
GM at Wholesale price/liter (90% of retail)	144936	3233736	5809014	4395798	4395798
GM at Wholesale price/liter (85% of retail)	80136	2639736	5060307	3572829	3572829
GM at Wholesale price/liter (80% of retail)	-157464	2045736	4311600	2749860	2749860
GM at Wholesale price/liter (75% of retail)	-395064	1451736	3562893	1926891	1926891
Total Costs	**5593375**	**8919775**	**9421988**	**11879155**	**11879155**
NB at Wholesale price/liter (90% of retail)	-1316575	1772225	4054738	2934287	2934287
NB at Wholesale price/liter (85% of retail)	-5593375	1178225	3306031	2111318	2111318
NB at Wholesale price/liter (80% of retail)	-1618975	584225	2557324	1288349	1288349
NB at Wholesale price/liter (75% of retail)	-1856575	-9775	1808617	465380	465380

Source: Assumptions of projected area

Looking at the projected cash flow for the Otjinene centre as shown in Table 4.4, the dairy centre in Otjinene is clearly a viable option. The scheme was based on the production of value added products such as pasteurised milk, cultured milk (Omaere, in Omaheke, Amasi, in Zimbabwe) and yoghurt in the first and second year, example form Zimbabwe DDP schemes. In the first year capacity utilization was based on a 30% milk intake (1200 litres/day) out of a 4000 litres per day potential as seen in Table 4.3 the reason for that is taking into consideration the adoption rate, since not all the farmers who are currently selling will be willing to supply milk to the processing centre. This however represents the worst case scenario, against all the costs incurred in obtaining the equipments and in the establishment of the dairy processing centre (Appendix 3).The second year was also based on the same products; however the capacity has increased from the 30% capacity utilization to 50% capacity utilization (Appendix 4 and 5).

The capital investment was based on the assumptions that the centre will obtain a loan from the bank at an 11.25% interest rate according to the First National Bank of Namibia (FNB, 2010) which is to be paid in 5 years time. The loan was to cover for the first year expenses such as buying the land, building, and procurement of equipments and the variable costs for that year. A summary of the cash flow for the centre is provided in Table 4.4. Since the company has achieved some profits during the second year, a set of other equipments was obtained in the third year for the production more value added products (Appendix 6). The purchase of new equipments has added to the cost of the yearly loan disbursement of N$1,461,511, 00 and the Total Variable Costs incurred during that year.

Like any other businesses, the summary presented in Table 4.4 shows that the centre made a loss in year 1 and as from year 2 it started making profits especially were prices were higher.

The GMs are both positive and negative, depending on the price. Selling at a higher price shows a positive GM, while at a price lower than 10% the GM falls into negative. From the second year a 50% increase in milk intake is projected since most of the producers have identified the benefits of supplying milk to the processing scheme. One being it saves the farmer time for standing there and selling the product, it also saves them the resources and labor costs in case someone else was hired to sell the milk. From the second year the centre start realizing profits this is attributed to the increased milk intake, in that the centre is able to sell more products and therefore increased in capacity utilization, which reduces the overhead costs even thought the variable costs are increasing. It shows that for every dollar invested there are profits unlike the case of DDP centre.

From the second year the centre is even able to pay for its fixed costs and still make profit, milk intakes continue to increase in the third to the fifth year and so does the revenue. These results might be surprising, since it is well known that the first years of business; a new company normally makes substantial losses, and this can be justified by the milk intake and the ability to sell at different prices. This can be supported by Kitikiti (2007) who stated the most critical issues that ensure the success of any dairy, as being raw milk intakes, the pricing policies, hyperinflationary conditions, capital replacement and availability of foreign currency for inputs. Namibia having a stable economy is an advantage to obtaining inputs from other countries such as the equipments. Kitikiti (2007) has illustrated that there is a high risk for processor if milk intakes are low and that is one of the key issue why the Zimbabwe smallholder dairy centre are not viable. This is mainly caused by the low milk production in the smallholder sector due to a horde of factors, ranging from management to environmental.

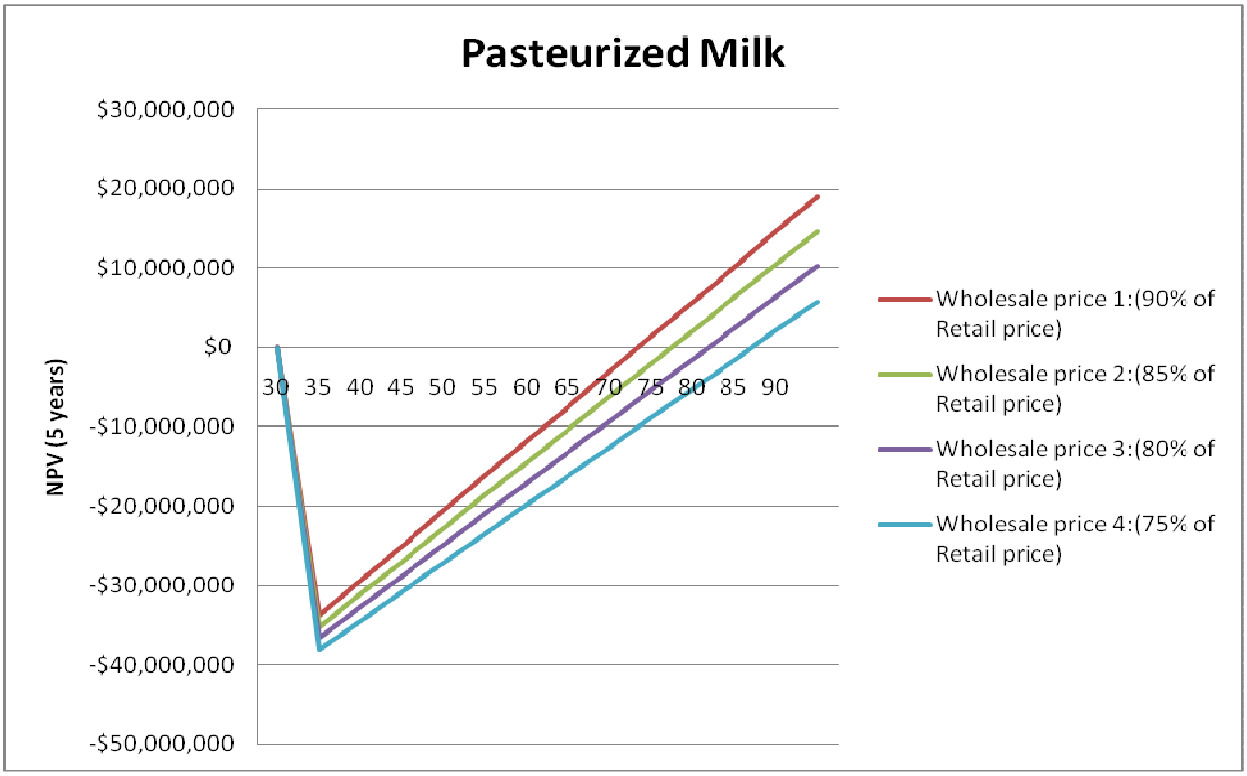

Figure 4.1: NPV for pasteurized milk

4.3.3 Scenario Analysis 1: Pasteurized milk

This presents a situation of a typical small-scale processing centre, that does not have the capacity to process value added products and it is therefore based on processing all the milk into pasteurized milk. The figure 4.1 shows the NPV of the processing scheme over a period of five years at an 8 % discount across the firms' potential. According to Adelman and Marks (2001) the present value of potential earnings takes into account the future flow of annual cash revenues minus the future flow of annual cash discounted for the time value of money. Figure 4.1 shows the centre processing at different capacity utilization (30-90%) four different prices, 90%, 85%, 80% and 75% of retail price. The discount on the retail price is a marketing strategy, offering the product at an affordable price to the consumers, which will be an advantage, in terms of competition from other dairy products.

In this case, it can clearly be seen that from 30% (1200 liters per day or 360 000 liters per year) milk intake the NPVs are negative up to almost 75% capacity utilization. The centre has been making losses up to 75% (3000 liter/day or 900 000 litres per year) capacity were it has started to breakeven, when selling at 90% of retail price. Breakeven point is the level of sales at which profit is zero. According to this definition, at breakeven point sales are equal to fixed cost plus variable cost.

Therefore when only processing pasteurized milk for sale, the target is to operate at over 75% capacity utilization to breakeven on project fixed costs over a period of five years. The lower one goes with the price the higher the capacity required to breakeven, i.e. when the price is at 75% of retail price the capacity utilization to breakeven is over 85%. Operating at such higher capacities is not practical, considering the nature of the centre. This simply implies that if a

center is only processing pasteurized milk, it cannot be viable and profitable unless high amounts of milk can be supplied to the centre. This findings agrees with earlier studies (Becker *et al.,* 2007) that have determined that "economy of scale generate processing cost reductions between 7% and 13%." In studies conducted on the Vermont's, fluid milk processing plant, have closed due to inefficient economies of scale, and because the product is essentially an indistinguishable commodity (Howick *et al.*, 1993). It is very difficult for a processor to position a fluid brand to strategic advantage.

The factors that were found to have the greatest direct impact on costs were labor, size of plant, plant capacity utilization, level of technology in processing, filling, cooling, and loading areas, and the type of ownership (Erba *et al.,* 1997). Pasteurized milk in some countries have no market, due to the tradition of the consumers, like in Zimbabwe most of the consumers in the smallholder dairy sector prefer to buy raw fresh milk and therefore the processing of pasteurized milk can be detrimental to the centre. If a processor have to venture into such an activity it has to be demand driven and provided there are economies of scale to milk production. According to Bennett (2006) the cost of packaging represents an excessively high proportion of liquid milk retail price in many developing countries, therefore the selling price is affected by the costs of production.

4.3.4 Scenario Analysis 2: Processing of yoghurt a high value products

This is a situation of a small-scale processing centre, that process all of the milk into a high value added product such as yoghurt and its revenues are therefore based on this product. Figure 4.2 shows the NPV of the processing scheme over a period of five years at an 8% discount across the firms' potential

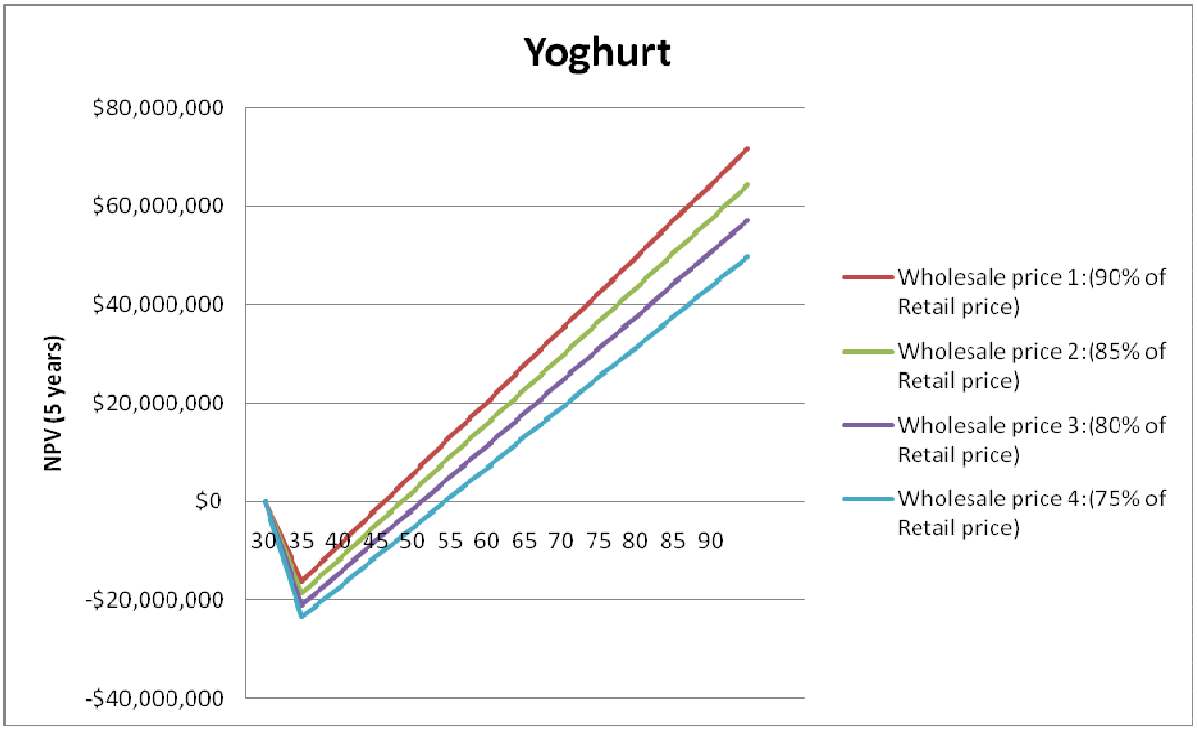

Figure 4.2: NPV for Yoghurt processing

Figure 4.2 show the different capacities of milk intake (30 to 90%) and therefore the centre capacity utilization at the four different prices, 90%, 85%, 80% and 75% of retail price. Figure 4.2 shows that the yoghurt plant the NPV's is positive from 45 % capacity utilization (at 90% of retail price) and increases as milk intake increases. As price decreases, the capacity utilization required to breakeven is increasing. The (figure 4.2) shows that at 75% of retail price breakeven is at 55% capacity utilization. This plainly indicates the profitability of yoghurt over processing only pasteurized milk. With lower milk intake and processing only one product like yoghurt, which is high value product revenue can be generated for the center. These findings are not surprising since yoghurt is known to be a high value and luxury product as supported by Maphosa (2006) and Begg (2001) in stating that other products such as yoghurt, cheese can bring higher profits than the production of pasteurised fresh milk or that of cultured milk. Consumers put a high value to it and they are willing to pay an extra cost to have it. As said earlier it is a luxury product and therefore an important product in the diets of the wealthy communities, who's' demand for milk and dairy products increases as income increases. Studies by Becker *et al.,* (2007) arrived at similar findings on yoghurt processing plant. In that it showed positive NPVs and it fared better than the small-scale cheese plant, presumably because of a more favorable conversion from raw milk into saleable product (1:1 vs. 10:1). Increasing the size of the yogurt plant is predicted to yield greater returns both to owners and managers as well as the farmers supplying the milk.

4.3.5 Scenario Analysis 3: Processing of combined dairy products

The scenario analysis based on the processing of milk into different dairy products such as cultured milk such as Amasi or (Omaere), pasteurized milk, yoghurt and butteroil and a by product of butteroil called buttermilk is presented in Figure 4.3.

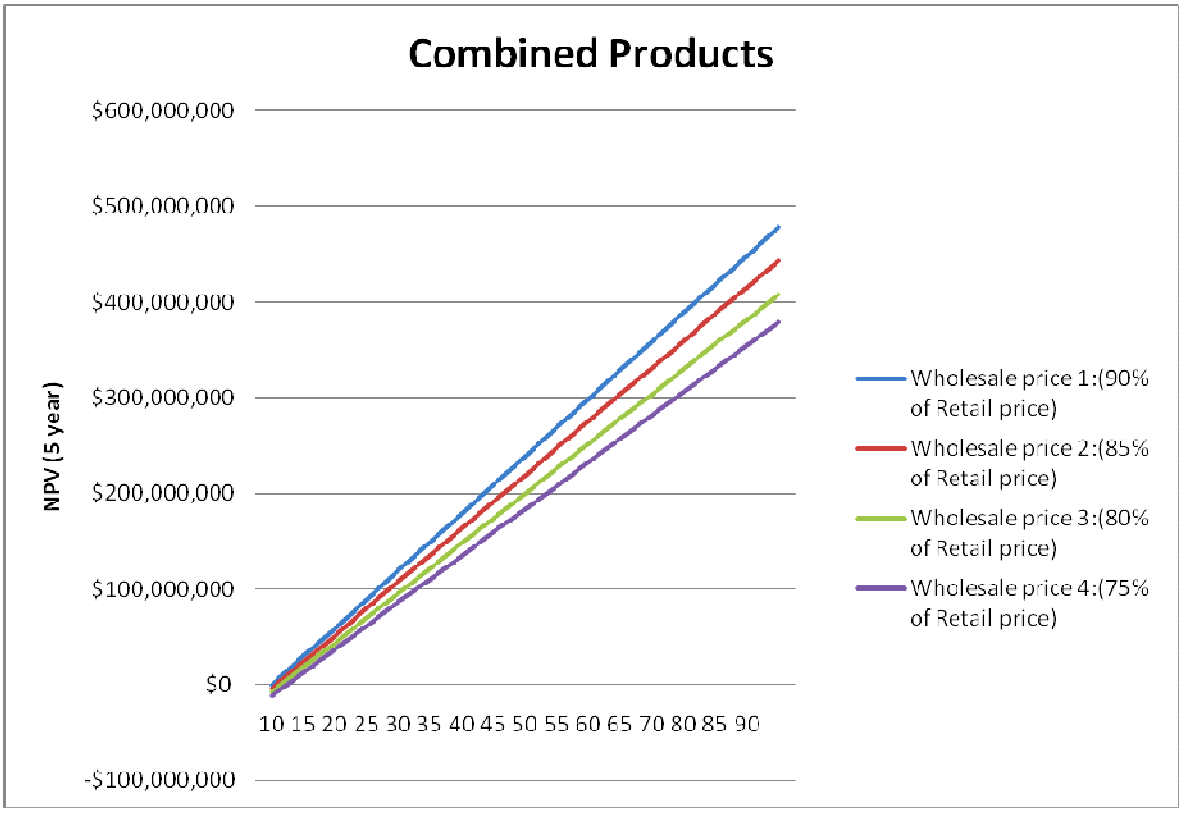

Figure 4.3: NPV of processing a combination of dairy products

This is mainly done to meet the demand of dairy products in Namibia. Processed products such as these can be marketed in urban markets where there is a constant demand for dairy products. Figure 4.3 shows that the NPV values are substantially positive; meaning that for the input invested in the processing of products, the centre will generate income. At the lowest milk intake 10% (400 litres/ day) the centre tends to breakeven at the 90% of retail price, but are marginally viable at the other wholesale prices. At 15 % capacity utilization the centre is at breakeven point at all the prices and then it start making profits. Selling at a lower price at onset will be of an advantage to the centre, for building a name and allowing the people to know the product. These findings are not surprising since value addition is known to increase profit margins due to the high value of the products. Bennett (2006), Maphosa (2006) and Begg (2001) stated that other products such as yoghurt, cheese can bring higher profits than the production of pasteurised fresh milk or that of cultured milk. Apart from the market and revenue associated with processing different products, Bennett (2006) continued to state other benefits such as off farm employment creation, improved safety, lowered risks of zoonoses transmission a nd longer product shelf life, e.g. butter oil, has a shelf life of up to 8 months. Consumers put a high value to it and they are willing to pay an extra cost to have it. As stated earlier price of dairy product have bearing on the demand of the product and it is one of the key determinants of the choice to buy or not to buy.

One key reason for the profitability of such as scheme is because of the full utilization of the equipments. As commonly known the fixed costs of a firm are constant and does not fluctuate as the variable costs, therefore whether operating at full capacity or below these costs will be the same, these makes it more beneficial to produce at the highest possible capacity. This is somehow affected by the milk available, and therefore the amount of milk intake of the centre is a major determinant of economic viability of any dairy enterprise.

4.4 CONCLUSIONS

The Zimbabwe smallholder dairy centres based on Nyarungu centre were economically unviable due to the high costs of production, limited milk intakes and poor product marketing and promotion. This was clearly shown by the negative GM over the period of one year. However the Otjinene scheme was economically viable and profitable, since its projections was based on high value added products such as yoghurt, butteroil, as superior product than butter due to its keeping quality in warmer climates like Namibia. Other products also included pasteurised milk and cultured milk products, all these products are in demand in the Namibian market as they form the basis of the children diets in most regions of the country. Another added advantage to the centre in Otjinene is the ability to sale the products at a wholesale price up to a 20% off retail price and still make profits. The aim of the centre is not to market the products locally as in the case of Zimbabwe but it is to process these high value products and take them to markets that are further that Otjinene settlement where they can fetch a better price and where there is a demand.

This study provides a model of the data needed to make capital investment decisions, and a forecasting model of production levels, income streams, and expenditure relationships by various center utilization and dairy product categories. Results of capital investment analysis are summarized in Appendix 3.

Three centre types based on the product (pasteurized milk, yogurt, and combined products) were studied at different capacity utilization using NPV. Pasteurized milk processing alone was economically not viable and depended mainly on economies of scale and the NPV was substantially negative Processing of yoghurt is an economically viable option since most of the NPV was substantially positive even at low levels of plant utilization. The combined products

are viable options for dairy processing scheme as the addition of value to the milk increases the revenue bases and renders the scheme viable even at less than 30% capacity utilization. Thus DDP like schemes for smallholder farmers must put emphasis on producing s wide variety of high value products if they are to quickly become viable and commercially profitable. This is a lesson that evaded Zimbabwe and are which Namibia should strive to achieve.

CHAPTER FIVE

GENERAL DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter summarises key findings from the study on the technical challenges and agribusiness prospects for developing smallholder processing scheme. The milk production potential, the viability and profitability of small-scale processing in Otjinene constituency in the Omaheke region has been identified. This chapter gives answer to the research questions posed in chapter one and in the course of addressing the outlined objectives and hypotheses. The chapter will give the technical and economic challenges faced by the smallholder dairy processing schemes and recommendations on what can be done in order to overcome most of the major challenges.

5.2 SUMMARY OF KEY FINDINGS AND DISCUSSIONS

Livestock farming play an important role in the livelihoods of people living in most developing countries including Namibia. Omaheke region of Namibia is well renowned for cattle production. However the people in the communal areas live in abject poverty due to lack of income, employment opportunities and lack of skills and appropriate technologies to add value to animal by-products such as milk, meat and hides. Poverty can be addressed through sustainable livestock production and marketing as well as economic diversification through the development and strengthening of small scale schemes that add value to livestock. Government policies in Zimbabwe encouraged farmers in the smallholder sector to produce milk on a commercial scale (Mupeta, 1996; Mupunga and Dube, 1992). A dairy development programme

(DDP) was established in 1983, with the objective of increasing incomes for smallholder dairy farmers in Zimbabwe's Commercial, Resettlement and Communal areas.

The people in the Omaheke region are pastoralists, who depend on cattle, as a main source food (meat and milk) and cash income through selling live animals mainly during times of need. This implies that money is only available when there is a sale of cattle. During the times of good rains milk is in abundance and surpluses are exposed through donations to families in towns. Therefore a baseline study was conducted in the Omaheke region in order to determine the potential for milk production, which would support a small-scale processing centre in Otjinene as a means of adding value of dairy products. This is a means of improving the livelihoods of the people in the region by participating in supplying milk to a processing centre for revenue to support families. Since dairying is a means of providing regular (throughout the year) though modest income for the farming communities as compared to other livestock farming (Bennett, *et al.,* 2006).

Most of the people (47%) of the farmers keep between 1 to 50 herds of cattle. The most prevalent breeds are crossbreeds of the Sanga with Brahman, Simmentaler, Bonsmara and the Brahman x Simmentaler cross the, Simbra and this findings are in line with Mendelsohn (2006) and Els (2004). Milk production from these animals was 2.5 liters per day per cattle in this area. The reason is because cattle are mainly kept for beef and milk is mainly for household consumption, since there is no established market for dairy. Otjinene settlement produces 17 liters of milk on daily basis suggesting a potential for milk production. A 32% of the surplus is currently market in the Otjinene settlement. A total of 4000 litres per day can be obtained from 70 farmers within a 40 km distance to Otjinene, in line with Dugdill (2000) who described a small-scale processor as one that processes up to 5000 litres of milk per day. These are substantial amounts of milk that can potentially sustain a processing centre. The study focused

on the 32% that is already on sale which imply that, these farmers are able to overcome the challenges faced in transportation, and marketing of milk to distant markets.

Most of the studies in the area focused on beef production only and therefore no studies were done on dairy production. It is also important to find means of disposing of these surpluses in ways that would improve the livelihoods of the people. Many studies Axtell *et al* (2008), van Vuuren, (2006), (Bennett et al, (2000), Mutukumira (1997) have stated the importance of the smallholder processing schemes and how they aid in improving the lives of the people, by providing jobs, bringing development to the area. Tatsverai (2001) did a study on the viability of value addition of the dairy products in the smallholder sector of Zimbabwe. Venturing in a dairy processing scheme is a costly undertaking therefore it is important to ensure that it is a viable option for that particular area. Most of the dairy centers find it hard to survive due to the many challenges in dairy processing. It was therefore critical to carry out a study on the economic viability of the centre in the Otjinene area.

Lessons were obtained from the Zimbabwe Dairy Development and it was used as a model for the establishment of dairy processing schemes in Otjinene. Using a GMA, according to Francis (2000), Majuru (2009) and studying the cash flows of the Nyarungu centre it was concluded that dairy processing in Zimbabwe was marginally or unviable. However this was attributed to many challenges that occurred in the country that has affected the country and the different processing centers. On a national level the country has been strike by power problems, causing power shortages at the different centers. This somehow has a serious bearing on the processing centers, meaning delayed product processing causing delayed products deliveries that can result in loosing valuable customers. A lot of damages could also result from the shortages of electricity supply, due to the disturbances in the cold chain during storage of the products (DDP, key informants).

The most important of the challenges that affect the viability of the centers are the low milk intakes causing under utilization of resources, such as the equipments, supported by Kitikiti (2007), Maphosa (2006) and DDP key informants (2010). This increases costs of production mainly the fixed cost that remain constant despite the production. The center revenue base was found to be low and therefore it is important for the centre to find means of producing as the lowest possible cost that will not be higher than the selling price. The price of dairy product determines the buying behavior of that product, therefore an increase in price causes a decrease in the product. Problems with the market are also experiences in the smallholder processing schemes in that they are mainly reliant of the local market. The buying power in these markets is limited, due to low incomes, since most of the products are sold in the high density areas like Chitungwisa suburbs and many others. The centers have a limited product range, since they just process cultured milk, naturally fermented milk in most cases which create a lot of losses such as whey. The centre finds it difficult to sell pasteurized milk, since the people prefer to buy raw fresh milk. Since there is no value addition; the income received from this product is very low. The only high value product processed is yoghurt but only at some centers. Yoghurt has an ability to fetch high revenue should a lot of effort goes into improvement and promotion of the product.

This study has identified the Otjinene projected scheme to be economically viable and profitable especially when high value products are processed, since they have a higher revenue base than pasteurized and raw fresh milk. This was assessed using the GMA and NPV as according to Becker *et al.* (2007). The results can be supported by many studies, such as Maphosa (2006) who compared the monthly revenues of different schemes, Nharira showed mean monthly revenues 19% higher than Tsonzo even though milk intakes of Nharira was 40% lower than that of Tsonzo. This is a clear indication of profitability due to value addition. A

processing scheme based on pasteurized milk only is not a viable option since it requires economies of scale to break even.

The projections used product costing to find the revenues for the different products. The most profitable product was found to be yoghurt. However processing a combination of dairy products proved to be viable and commercially profitable. The Otjinene projected scheme proved to be viable even at the different wholesale prices, up to a 75% of retail price, more especially since it was based on processing high value products, which has a high revenue bases. This is a great advantage to the centre since price is a determinant of buying choice for dairy products and that will be an advantage in terms of competition from other dairy products. As stated earlier the Namibian dairy industry faces a deficit of 50% therefore this will be a venture that help in meeting the dairy demand. Dairy products processed in Otjinene will not be limited the local markets of Otjinene communities as is the case with Zimbabwe smallholder dairy processing schemes, but it will be distributed to other urban markets. These markets include Gobabis, which is about 100km from Otjinene and Windhoek, which is about 300km from Otjinene. The advantage is that the cost is able to cover for marketing costs such as transportation and promotions.

5.3. GENERAL RECOMMENDATIONS

Smallholder dairy farmers require unique support that should come from sources such as government departments, industry stakeholders and non-governmental organizations (NGOs). This kind of support would require a clear government policy on dairy development. At present, Namibia does not have such a policy. It is therefore encouraged that the policy makers in the country consider this sector as a poverty reduction strategy and develop a policy framework that targets smallholder dairy production.

Co-operatives are crucial in fostering dairy development in the smallholder sector primarily by providing a stable market environment and delivering services to farmers, stable agricultural knowledge systems for uptake of improved technology and increased management skills among farmers. Most of the smallholder dairies in Zimbabwe are mostly run as co-operatives; this is a lesson Namibia can adopt. This will be more beneficial to the farmers in the region as it will be able to increase income for a number of farmers as compared to it being an individual undertaking. Formation of co-operatives can help farmers combat risk aversion through improved information flow and mutual support.

According to phase II of the DDP operations focus was on fodder production, conservation and utilization, breeding efficiency and value addition through milk processing and marketing. These were done to improve the efficiency of the smallholder dairying, since these are the cornerstones for the success of the dairy projects. It is therefore vital that Omaheke take up this strategy for it to be a success. Milk production requires adequate feed supply to the animal supplying milk. Omaheke region is affected by sporadic rains which limit the availability of feeds during the dry seasons, it is recommended that farmers harvest enough feeds during the rainy season, processed and conserve for use throughout the year.

Breeds in Omaheke region are mainly the local and exotic beef breeds which are low in milk production. Improvement of these breeds would therefore increase milk production and hence the technical viability of the project.

5.4 AREAS FOR FURTHER RESEARCH

The study was carried out during the rainy season when milk production peaks. However milk production tends to fluctuate with regard to season, it is therefore recommended that similar assessments should be done during the late summer and the dry season in order to estimate the potential milk supply surpluses or shortfalls in different seasons.

The purchasing behaviour or attributes that determine product choice of milk and milk products should be studied in areas such as Gobabis and Windhoek which are the projected market.

The chemical and microbial quality of the milk and milk products produced by the local Herero people in the Omaheke region should be studied to identify the types of products that can be produced and the level of quality control required to ensure processing of products that are wholesome and safe for human consumption.

5.5 CONCLUSIONS

The global livestock sector is changing rapidly; increased urbanization and growing incomes are creating a dramatic increase in the demand for meat and milk in the developing world. This increasing demand creates opportunities for the reduction of poverty among poor households with a good potential in livestock production. Livestock development has thus been assigned a dual role of satisfying the rapid rising demand of the expanding global population for meat and milk, and helping to meet the MDG1 in poverty reduction (IFAD, 2004).

There is potential for milk production that can sustain a commercially viable smallholder processing scheme. The center will be able to receive over 4000 liters of milk per day. This is mainly a result of the amount of cattle owned by the pastoralists' farmers and not an activity of efforts to increase milk production. However as farmers realizes the incentives and benefits of supplying milk to the centre, more milk will be scheduled to the centre than giving away to relatives and just consuming due to lack of opportunities as stated by some respondents during the survey.

Dairy processing is a highly competitive business, and good production planning is needed to control expenditure and reduce product costs, in order to maintain or increase a company's profitability. It is important to be located were sufficient amounts of milk with acceptable quality can be obtained. This one of the reason for the competitive advantage of the dairy center in Otjinene, that it is able to obtain sufficient amounts of milk. Milk intake at the center has proven to be number one reason for the success of any dairy processor. Milk intakes determine the success of any business in terms of full utilization of staff and machinery to reduce costs and increase productivity as well as the revenue.

Processing a variety of products has shown to be a more profitable option than any other product based on the positive present values. Accurate costing is important as it enables the owner to find out which products are most profitable and would benefit the business by expanding their production or cutting the costs. The marginally viable value-adding technologies found in Zimbabwe's' smallholder dairy sectors are viable and economically profitable options for commercializing dairy production and processing in the Omaheke community of Namibia.

LITERATURE CITED

Adelman, P. J., and A. M. Marks. 2001. Entrepreneurial Finance for Small Business. 2nd ed. Prentice Hall, New York.

Africa Now.2000. Technical manual for establishing a small-scale dairy centre and cultured milk production. Africa Now (Zimbabwe). Zimbabwe

Aregheore, E. M. 2006, Country Pasture/Forage Resource Profiles Zambia II. Available: http://www.fao.org/ag/AGP/agpc/doc/Counprof/zambia/zambia2.htm. Accessed, June, 15, 2010.

Axtell B., P. Fellows, L. Gedi, H. Lubin, R. Musoke, P. Oti-Boateng and R. Zulu. 2008. Opportunities in food processing Setting up and running a small-scale dairy processing business. Technical Centre for Agricultural and Rural Cooperation (CTA), Wageningen, Netherlands.

Banda, J. W., R. K. D. Phoya, F. C. Chilera, Q. A C. Mvula and C. L. K. Chiwayula. 2000. Smallholder Dairying in Malawi. Proceedings of the UZ/RVAU/DIAS/DANIDA/-ENRECA project review workshop held in Harare.

Becker, K. M., R. L. Parsons, J. Kolodinsky, and G. N. Matirut.2007. A Cost and Returns Evaluation of Alternative Dairy Products to Determine Capital Investment and Operational Feasibility of a Small-Scale Dairy Processing Facility. Journal of Dairy Science. 90:2506–2516

Begg, M.M. 2001. Market Research on the Viability of Yoghurt and Flavoured Milk production in Zimbabwean market. Zimbabwe.

Bennett, A., F. Lhotse J. Crook and J. Phelan. 2006. The Future of small scale dairying. In FAO, Livestock Report: p 45-55. Rome, Italy.

Bille, P. G. and M. J. Kandjou. 2008. Chemical and Sensory Quality of Omaze Uozongombe (ghee), Butter Oil Made by Smallholder Herero Farmers In Namibia, *African Journal of Food Agriculture Nutrition and Development*. 8 (1) 17-27

Birthal, P., P. K. Joshi and A. Gulati. 2005. Vertical coordination in high-value food commodities: Implications for smallholders. Washington D.C., USA, International Food Policy Research Institute.

CBS and NPC. 2008. A Review of Poverty and Inequality in Namibia. National Planning Commission, Republic of Namibia.

Chimboza, D. and E. Mutandwa.2007. Measuring the determinants of brand preference in a dairy product market. African Journal of Business Management. 1(9) 230-237 Available: http://www.academicjournals.org/AJBM. Accessed on July 05, 2010.

Chinogaramombe, G. N. C., V. Muchenje, C. Mapiye, T. Ndlovu, M. Chimonyo and L. Musemwa. 2008. Challenges for improving smallholder dairy production in the semiarid areas of Zimbabwe.

DEES, 2003. Baseline Survey of the impact of Agricultural Extension services in Omaheke Region: Ministry of Agriculture, Water, and Rural Development, Gobabis, Namibia. Available:www.agristatsnamibia.org/docs/AESOmahekeOct2003.pdf Accessed Sept.15, 2009.

Delgado, C., M. Rosengrant, H. Steinfeld, S. Ehui, and C. Courbois. 1999. Livestock to 2020: The Next food Revolution. Food and Agriculture and the environment IFPRI/FAO/ILRI Discussion Paper 28:83.

de Pauw, E., Coetzee, M.E., Calitz, A.J., Beukes, H. & Vits, C. 1998. Production of an agro-ecological zones map of Namibia (first approximation), Part II: Results. Agricola: 33-43.

Dugdill, B. 2000. Directory of small scale milk and milk products processing equipment Animal Production and Health Division FAO, Rome.

DVS. 2007. Annual Report 2007. Ministry of Agriculture, Water and Forestry, Republic of Namibia, Windhoek, Namibia

Eita, J. H. and D. Daisy Mbazima. 2007. Shortage of Dairy Products. Nepru Viewpoint: Quarterly Economic Review. Windhoek, Namibia

Els, J. F. 2004. State of Farm Animal Genetic Resources, Draft Country Report: Namibia, Windhoek.

Emongor, R. A. 2008. Policy Brief, Re-governing Markets: Namibia: Trends in growth of modern retail and wholesale chains and related agribusiness. Department of Agricultural Economics, Extension and Rural Development, University of Pretoria, Republic of South Africa.

Emongor, R. A. 2007. The Impact of South African supermarkets on agricultural and industrial development in the Southern African Development Community. Draft PhD Thesis. Department of Agricultural Economics, Extension and Rural Development, University of Pretoria, Republic of South Africa.

Erba, E. M., R. D. Aplin, and M. W. Stephenson. 1997. Labor productivities and costs in 35 of the best fluid milk plants in the US. Cornell Program on Dairy Markets and Policy. Cornell University, Ithaca, NY.

FAO and IDF. 1998. Dairy Development Newsletter. Issue No.3

FAO. 2004. Employment generation through small-scale dairy marketing and processing. Experiences from Kenya, Bangladesh and Ghana. FAO Animal Production and Health Paper 158, Rome.

Fellows, P. and A. Rottger. 2005. Business management for small-scale agro-processors: AGSF Working Document.FAO, Rome.

Francis, J. 2001. Analysis of intergarted crop-livestock farming systems in Nharira Lanchashire smallholder dairy farms in Zimbabwe through farmer participation. MPhil Thesis, University of Zimbabwe

Francis, J. and S. Sibanda. 2001. Participatory action research experiences in smallholder dairy farming in Zimbabwe: Livestock Research for Rural Development. 13 (3): 1-6: Available: http://www.cipav.org.co/lrrd/lrrd13/3/fran133.htm. Accessed, Feb. 21, 2010

Halhead, P. 2010. Is dairy beef the sustainable future? Available: http://www.thedairysite.com/articles/2416/is-dairy-beef-the-sustainable-future Accessed Jun, 20, 2010

Hanyani-Mlambo B. T., S. Sibanda and V. Østergaard. 1998. Socio-economic aspects of Smallholder dairying in Zimbabwe 10 (2)

Available: http://www.lrrd.org/lrrd10/2/cont10_2.htm. Accessed, Feb. 21, 2010.

Howick, S. C., G. K. Criner, and S. L. Jacobs. 1993. Milk processing and distribution costs: Maine. Department of Resource Economics and Policy, University of Maine, Orono.

IFAD. 2004. Livestock services and the poor. International Fund for Agricultural Development, Rome, Italy

Karunaratne, G. and H. Wagstaff. 1985. Income and employment from dairy development. In: Milk production in developing countries (Editor: A J Smith). Edinburgh University Press. Edinburgh 73-90.

Katjiua, M. and D. Ward. 2007. Pastoralists' perceptions and realities of vegetation change and browse consumption in the northern Kalahari, Namibia. *Journal of Arid Environments* 69: 716–730

Katjiua, M. L. J. and D. Ward. 2006. Cattle diet selection during the hot-dry season in a semi-arid region of Namibia. *African Journal of Range and Forest Science*. 23:1 59-67 Available: www.informaworld.com/index/915527518.pdf Accessed, May. 13, 2010.

Kitikiti, N. 2007. Dairy pricing for economic viability of the dairy industry. The Zimbabwe National Dairy Symposium, 5-6 July 2007, Harare, Dairiboard Zimbabwe. Available: http://www.dairibord.co.zw/download_documents/Kitikiti%20S.ppt. Accessed, July/20/ 2010

Kruger, B. and L. Lammerts-Imbuwa. 2008. Livestock Marketing in Namibia. Namibia National Farmers Union Training Manual.

LID (Livestock in Development) (1999) Livestock in Poverty-Focused Development. Livestock in Development, Crewkerne, UK

Majuru, A. T. 2009. Economics of Smallholder Dairy production under incomplete markets: The case of Wedza District, Zimbabwe. MSc Thesis, Department of Agricultural Economics and Extension. UZ, Harare, Zimbabwe.

Mano, R. 2009. Dairy Economics and Marketing Principles and Applications: Course notes, Department of Agricultural Economics and Extension, University of Zimbabwe, Harare

Maphosa, O. 2006. An economic analysis of value addition of dairy products at selected smallholder dairy processing centre in Zimbabwe.

Masanje, A. P. 1995. Milk production and marketing in Tanzania. Regional Exchange Network for Market Oriented Dairy Development. Zimbabwe Dairy Herd Improvement Association and FAO. 4-8 Dec.1995, Zimbabwe, Harare.

Mendelsohn, J. 2006. Farming Systems in Namibia. Research & Information Services of Namibia (Raison), Windhoek.

Mendelsohn, J. A., C. Jarvis, C. Roberts and T. Robertson. 2002. Atlas of Namibia: A portrait of the land and its people. David Philip Publishers, Cape Town, South Africa.

Mbogoh, G. S. and M. Okoth. 1995. Technical and Economic Considerations in the Establishment of a Milk Collection and Cooling Centre. Department of Agricultural Economics, University of Nairobi, Kenya.

Mupeta, B. 1996. Development and Opportunities for Market oriented smallholder dairy production in Zimbabwe–Nharira/ Lancashire case study. In Regional Exchange Network for Market Oriented Dairy Development. Zimbabwe Dairy Herd Improvement Association and FAO. Harare, Zimbabwe.

Mupeta, B. 2000. Studies on the potential of ram press sunflower cake (Helianthus anus) as a source of protein for moderate milk production in crossbred (*Bos Taurus and x Bos Indicus*) cows in the smallholder dairy sector of Zimbabwe. PhD Thesis, UZ. Harare.

Mupunga, E. G. and D. M. J. Dube. 1992. Smallholder development programme in resettled and communal areas in Zimbabwe. Proceedings of a Workshop on the Future of livestock Industries in East and Southern Africa, ILCA, Addis Ababa, Ethiopia: 165-172. Available: http://www.fao.org/Wairdocs/ILRI/x5485E/x5485e0q.htm Accessed Apr, 19. 2010.

Mushendami, P. and M. Gaomab II. 2008. Unleashing the Potential of the Agricultural Sector in Namibia: BoN Occasional. Paper Bank of Namibia Research Department, Windhoek

Mutukumira, T. N. 1997. Expansion Prospects for the Nharira/Lancashire dairy project in Chikomba District, Mashonaland East Province, Zimbabwe.

Ngongoni, N. T., C. Mapiye, M. Mwale and B. Mupeta. 2006. Factors affecting milk production in the smallholder dairy sector in Zimbabwe. Livestock Research for Rural Development 18(05) Available: http://www.lrrd.org/lrrd18/5/ngon18072.htm Accessed, Feb, 21. 2010.

NPC. 2004. Namibia Vision 2030: Policy Framework for Long-Term National Development. Office of the President, Windhoek, Namibia.

O'Connor C. B. 1995. Rural Dairy Technology, ILRI Training Manual International Livestock Research Institute. Addis Ababa, Ethiopia.

Redda, T. 2001. Small-scale milk marketing and processing in Ethiopia. In Proceedings of South-South Workshop on Smallholder Dairy and Marketing Constraints and Opportunities. Anand, India. Available: http://www.ilri.org/InfoServ/Webpub/Fulldocs/South_South.theme4_3.htm. Accessed, Feb, 16. 2010.

Republic of Namibia. 2003. 2001 Population and Housing Census. National Report: Basic analysis with highlights. Windhoek: National Planning Commission.

Republic of Namibia. 2005. 2001 Population and Housing Census. Omaheke Region: Basic analysis with highlights. Windhoek, National Planning Commission, Namibia

Republic of Namibia. 2006. Regional Poverty Profile: Based on Village-Level Participatory Poverty Assessments in the Omaheke Region, National Planning Commission, Windhoek, Namibia.

Rethman, C. and J. Acidri. 2008. Report on the National Namibia Livelihood Zoning: Namibia Vulnerability Assessment Committee, Republic of Namibia.

Somano, W. 2008. Dairy marketing chains analysis: The case of Shashemane, Hawassa and Dale District's milk shed, Southern Ethiopia. M.S.c Thesis. Haramaya University, Ethiopia.

Staal, S., Nin Pratt, A. and M. A. Jabbar. 2006. Dairy development for the resource poor: A comparison of dairy policies and development in South Asia and East Africa. Report prepared for the FAO Pro-Poor Livestock Policy Initiative, Rome, Italy. 214pp

Staal, S. J. and B. I. Shapiro. 1996. The economic impact of public policy on smallholder peri-urban dairy producers in and around Addis Ababa. ESAP Publication 2. ESAP (Ethiopian Society of Animal Production), Addis Ababa, Ethiopia. 57 pp.

Strohbach, B. J., M. Strohbach, T. Katuahupira and H. D. Mouton. 2004. A reconnaissance survey of the landscapes, soils and vegetation of eastern communal areas (Otjozondjupa and Omaheke Regions, Namibia). Windhoek: National Botanical Research Institute.

Sweet, J. and A. Burke. 2006. Country Pasture/Forage Resource Profiles: Namibia Available: http:// www.fao.org.ACP/AGPC/doc/pasture/forage/htm. Accessed 22 Feb, 2010.

Tangka, F., E. A. Ouma and S. J.Staal. 1999. Women and the Sustainable Development of market- Oriented Dairying: Evidence from the Highlands of East Africa. ILRI, Nairobi, Kenya.

Tatsverai, S. 2001. Potential of milk processing in Smallholder Dairy Farming: A case of Honde Valley Dairy development Project. (Unpublished Undergraduate Thesis). Zimbabwe.

Thapa, T. B. 2000. Small Scale Milk Processing Technologies: Other Milk Products. Dairy Consultant, Animal Production and Health Division. Food and Agriculture Organization of the United Nations, Rome: Italy.

Thorpe, W., H. G. Muriuki, A. Omore, M. O. Owango and S. Staal. 2000. Dairy development in Kenya: the past, the present and the future. Paper prepared for the Annual Symposium of the Animal Production Society of Kenya, Kari Headquarter. Nairobi. Kenya.

Unknown. 2009. Annual Report 2009. Ohlthaver and List Finance and Trading Corporation Limited, Namibia.

van Rooyen, P. H and P. Reiner. 2009. The History of Gobabis. Available: http://www.gobmun.com/history.htm Accessed, May, 03. 2010

van Vuuren, R. J. 2006. The smallholder dairyman's role in Africa. Dairymail Africa.

Walshe, M. J, J. Grindle, A. Nell and M. Bachmann. 1992. Dairy development in sub-Saharan Africa. Technical Paper 135. World Bank, Washington, DC, USA. pp. 94

Wouters, A.P. and J. van der Lee. 2009. Smallholder dairy development; drivers, trends and opportunities, UR Livestock Research, Wageningen.

APPENDICES

Appendix 1: Questionnaire

District: _____

Village _____

Name of Enumerator: _____

Date of Interview: _____

Guiding information to the enumerator:

1. **Brief introduction of self.**
2. **Purpose of the interview**

This questionnaire serves as a tool for obtaining information on the livestock production systems, herd size and structure, breeding and growth performance indicators, milk production yields, lengths of lactation, milk consumption patterns and methods of handling and processing on the farm, costs involved in cattle rearing, returns obtained from cattle rearing and farmers opinions on the establishment of the small-scale dairy. Findings of this project will help us understand if organized small-scale milk production, has a potential to contribute to the development of formalized milk collection, processing and distribution system.

3. **Reason for selection**

Your household has been randomly selected from all households in the area. The farmers' responses will be treated confidentially and there will be no identification that you gave this information. All information given will be used for the compilation of the thesis.

4. **May you please spare some minutes to complete this questionnaire with me.**

A: Household Demographics
Name of Respondent:
A1. Head of Household: Male [ ]/ Female [ ]
A2. Age of Household Head:
A3. What is the total number of people in the household: Adults [ ] Children [ ]
A4. What is your level of education? 1 Primary 2. Secondary 3. Tertiary 4. None
A5. Do you earn any off-farm income? 1. Salary 2. Profit from own business 3. Pension 4. Other: specify…….
A6. What is the most important on farm income for your family? ……..…….

B: Livestock Production Systems					
B1). Which of the following animals do you farm with and how many?					
(1)Cattle	(2)sheep	(2)goats	(3)chickens	(4)donkeys	(4)Other(specify)

B2. What is the structure of your cattle herd?

1). Cows[ ]

2). Steers/Oxen's[ ]

3). Heifers [ ]

4). Calves: Males [ ]/ Females[ ]

5). Bulls [ ]

B3. Rank the primary importance for keeping cattle.

1. Source of immediate cash ……...
2. Milk ...……
3. Beef …….
4. Hides ….……
5. Status …….
6. Other …….

B4. Which breeds do you keep?

1. Sanga
2. Simmentaler
3. Brahman
4. Bonsmara
5. Simbra
6. Other: Specify……..……...

B5. How do you feed your cattle?

1. Depend on available grazing and licks
2. Grazing and supplementary feeds
3. Other: Specify……

B6. Is there any difference in feeding your cattle during the dry and rainy season?

1. Supplement during dry season
2. Same for dry and rainy
3. Depends on the situation

B7.Where does your animals get water?

1. Village borehole
2. Personal borehole
3. Other: specify…….

B8. Is there sufficient water in you place? Yes[ ] No[ ]

B9. At what time of the year do most of your cattle calve?

……..

B10. How long is the lactation period? [ ]

B11. What are the major diseases that affect cattle in your area?

……

B12. Against which diseases do you vaccinate?

1. FMD
2. Rabies
3. Anthrax
4. Brucellosis
5. Other: specify……

B13. How often do you vaccinate your cattle?

1. Annually
2. Every six months
3. during an outbreak

B14. Where do you get drugs from?

1. Buy own drugs [ ] 2. District vet services [ ] 3. Some own, some vet services [ ] 4. Other: ……

B15. Do you get any training regarding diseases, livestock rearing practices breeding, new technologies etc?

1. Yes 2. No

B16. From where?
1. Veterinary services
2. Extension officers
3. Only sometimes
4. Farmers unions
5. Non-Governmental organizations
4. Other: specify……

C: ANIMAL'S PRODUCTS, CONSUMPTION AND MARKETING

C1. What do you do with the products you get?
1. household consumption
2. sell
3. sent to relatives
4. Other: specify……..

C2. Do you ever sell your cattle?
1. Yes 2. No

C3. If you do sell your cattle, where do you sell them?
1. Auctions 2. Local permit day 3. Local abattoirs 4. Contracts with Meatco 5.Within the community

C4. Which cattle do you sell the most and why?
1. Cows 2. Heifers 3. Steers/oxen 4. Bulls 5. Calves
Why? …….

C5. Do you always get good returns from animal's sales?
1. Sometimes
2. Depends on the condition of the animal
3. Depends on the N$ per kg at time of sale
4. mostly

C6. Do you milk your cows?
Yes 2. No

C7. If your answer is Yes, how many milking cows do you have? [ ]

C8. Do you milk all of your lactating animals at that particular time?
1. Yes, milk all
2. Not all of them

C9. Why do you milk all or some of your lactating cows?
…….

C10. Roughly how many buckets of milk do you get per day? [_____] Buckets/litres

C11. What happens to the milk you get from the cow?
1. Used for household consumption
2. Household consumption, some sold locally and nearby town
3. Sent to families in town
4. Other: specify …..……

C12. How many liters do you consume per day? [ ]

C13. Do you ever produce more milk than you can consume?
1. Yes
2. No
3. Sometimes

C14. What do you do with surplus milk?
1. Sell 2. Give 3. Give to dogs 4. Just consume

C15. If you sell your surplus milk where do you sell? 1.Within the village 2.Town and nearby village
C16. Is there a small scale dairy processing scheme around your area? 1. Yes 2.No
C17. If there was a processing scheme would you be willing to send your milk there for returns. 1. Yes 2. No
C18. If your answer is No, can you explain why? .....
C19. Is there ever a time of the year when you go without getting milk from your cows? 1. Yes 2. Never 3. Other……..
C20. Are there any variations in the amount of milk you get during the year? 1. Yes, rainy season we get more 2. No, it's the same all year round
C21. How do you consume your milk? 1. Fresh from the cow 2. Boil and consume fresh 3. Process into different products 4. Other: specify…….
C22. If you process, what are the different products you process your milk into? 1. Sour milk 2. Butter oil 3. Cream 4. Other: specify……..
C23. If you process your milk how long can you keep your product fresh? …….
C254. Do you think business in dairy can improve the livelihoods of people in this area? A. 1. Yes 2. No
C26. How? ..... …….....

Thank you for your time!

Appendix 2: Income and Expenditure account for Nyarungu dairy scheme (May 2009-2010)

DDP- Nyarungu	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	Total
Intakes	5882.40	8167.40	9868.00	11684.80	11224.00	12078.70	11980.10	11391.50	12320.60	9127.40	9095.30	12801.50	**125621.70**
BB forward	0.00	115.50	76.90	251.40	225.00	272.50	269.40	182.40	552.20	427.00	426.00	200.56	**2998.86**
Total for processing	**5882.40**	**8282.90**	**9944.90**	**11936.20**	**11449.00**	**12351.20**	**12249.50**	**11573.90**	**12872.80**	**9554.40**	**9521.30**	**13002.06**	**128620.56**
Cash Sales (L)													
Amasi	166.00	1440.00	1872.00	2394.00	3996.50	3963.00	3977.50	2656.00	3998.50	2835.00	3023.20	3620.50	**33942.20**
Yoghurt	0.00	0.00	0.00	43.30	162.50	143.70	135.60	127.70	91.60	58.65	105.60	70.95	**939.60**
Naturally sour	147.00	130.00	360.00	240.50	22.00	120.00	61.50	856.20	131.50	152.00	89.00	170.50	**2480.20**
Raw fresh	3436.70	4584.00	6322.20	6294.50	6226.50	4935.50	3700.50	3641.50	3551.50	3180.50	3239.00	2843.00	**51955.40**
Total	**3749.70**	**6154.00**	**8554.20**	**8972.30**	**10407.50**	**9162.20**	**7875.10**	**7281.40**	**7773.10**	**6226.15**	**6456.80**	**6704.95**	**89317.40**
Revenue(Cash + credit)													
Amasi	254.40	1488.00	2612.10	4095.20	5609.35	6137.45	5180.45	4114.15	5863.25	3602.70	4118.85	5793.75	**48869.65**
Yoghurt	0.00	0.00	0.00	185.12	573.75	485.96	462.40	446.02	296.67	241.63	47.25	23.65	**2762.45**
Natural sour	230.40	195.00	552.00	375.25	51.00	217.50	124.75	1293.80	207.15	261.00	139.50	261.75	**3909.10**
Raw fresh	2337.02	3243.40	4120.72	4052.10	3863.30	3302.00	2650.30	2289.90	2349.90	2052.27	2199.12	1872.42	**34332.45**
Total	**2821.82**	**4926.40**	**7284.82**	**8707.67**	**10097.40**	**10142.91**	**8417.90**	**8143.87**	**8716.97**	**6157.60**	**6504.72**	**7951.57**	**89873.65**

Variable costs													
Cost of milk ($ 0.66/l)	3882.38	5390.48	6512.88	7711.97	7407.84	7971.94	7906.87	7518.39	8131.60	6024.08	6002.90	8448.99	**82910.32**
Packaging materials	0.00	0.00	0.00	559.00	243.26	361.00	0.00	270.00	757.00	61.00	189.00	726.00	**3166.26**
Culture	0.00	20.00	0.00	24.00	52.00	51.00	115.00	157.00	190.08	189.13	142.00	148.00	**1088.21**
Direct labor	89.39	90.00	87.50	102.40	89.53	116.70	84.15	105.77	427.46	351.17	394.14	440.68	**2378.89**
Other direct costs	0.00	0.00	0.00	75.00	150.00	209.00	56.00	30.00	19.86	0.00	0.00	0.00	**539.86**
Total direct costs	**3971.77**	**5500.48**	**6600.38**	**8472.37**	**7942.63**	**8709.64**	**8162.02**	**8081.16**	**9526.00**	**6625.38**	**6728.04**	**9763.67**	**90083.54**
Fixed costs													
Electricity	50.00	200.00	0.00	70.00	100.00	0.00	24.00	100.00	50.00	50.00	50.00	50.00	**744.00**
NSSA	42.38	62.00	0.00	105.00	0.00	94.00	78.90	94.48	89.00	89.00	89.00	89.00	**832.76**
Totals	**92.38**	**262.00**	**0.00**	**175.00**	**100.00**	**94.00**	**102.90**	**194.48**	**139.00**	**139.00**	**139.00**	**139.00**	**1576.76**
TOTAL COST	4064.15	5762.48	6600.38	8647.37	8042.63	8803.64	8264.92	8275.64	9665.00	6764.38	6867.04	9902.67	**91660.30**
Net Income	**1242.33**	**-836.08**	**684.44**	**60.30**	**2054.77**	**1339.27**	**152.99**	**-131.77**	**-948.03**	**-606.78**	**-362.32**	**-1951.10**	**-1786.65**
GM	**-1149.95**	**-574.08**	**684.44**	**235.30**	**2154.77**	**1433.27**	**255.89**	**62.71**	**-809.03**	**-467.78**	**-223.32**	**-1812.10**	**-209.89**
GM/VC	**-0.29**	**-0.10**	**0.10**	**0.03**	**0.27**	**0.16**	**0.03**	**0.01**	**-0.08**	**-0.07**	**-0.03**	**-0.19**	**-0.16**

Appendix 3: Equipments required for a processing centre in Otjinene

Capital Expenditure N$	**Year1**	**Year3**
Land	70000	
Buildings	103838	
Office Equipments	5000	
Generator		40000
Cold room		70000
Processing Equipments		
1x 1000 kg/d Milk-Pro Pasteurization system comprising: 1x manually-operated sachet filler and sealer 1x chilling tank with 1.5Hp compressor 1x Pasteurizer with 24 sachet holder	100000	
1x 100 liter/hr cream separator (Electric)		15000
Plain white plastic tubing for milk (10,000 x 0.5 liter)	2600	
100 liter butter churn stainless/steel with sight glass		85000
Butter mould, wooden		265
Yoghurt Incubators	20000	
Refrigerators	15000	
Milking cans	20000	20000
Milk pails, cup, rack, processing tables	6000	
Laboratory equipments	20000	
Road freight and installation	30250	12500
Marketing Vehicle	170000	
Capacity building	20000	50000
Total	**582688**	**292765**

Source: Estimates based on market prices from Milk-Pro International and FAO, 2000

Appendix 4: Recurrent costs for proposed milk centre in Otjinene operating at 30 % milk intake.

Recurrent Costs at 30% milk intake (2000liters /day for 300 days)					
360 000 L/Year @ N$6.50/l	**Pasteurized**	**Cult Milk**	**Yoghurt**	**Total/Month**	**Total/Year**
Raw Milk(l)	10800	14400	10800	36000	**432000**
Raw Milk(N$)	70200	93600	70200	234000	**2808000**
Quantity	7200	7200	7200	21600	**259200**
Packaging	14400	14400	14400	43200	**518400**
Milk testing	200	200	200	600	**7200**
Salaries and wages	1320	1320	1320	3960	**47520**
Ingredients	0	300	300	600	**7200**
Consumables	300	300	300	900	**10800**
Water	200	200	200	600	**7200**
Electricity	400	400	400	1200	**14400**
Transport	400	400	400	1200	**14400**
Social Security Contributions	54	54	54	162	**1944**
Administrative costs	100	100	100	300	**3600**
TVC	**105574**	**132874**	**105874**	**344322**	**4131864**
Wholesale price at 90% of retail	13.5	13.5	22.5	49.5	
Wholesale price at 85% of retail	12.75	12.75	21.25	46.75	
Wholesale price at 80% of retail	12	12	20	44	
Wholesale price at 75% of retail	11.25	11.25	18.75	41.25	
Income at Wholesale price at 90% of retail	97200	97200	162000	356400	**4276800**
Income at Wholesale price at 85% of retail	91800	97200	162000	351000	**4212000**
Income at Wholesale price at 80% of retail	86400	91800	153000	331200	**3974400**
Income at Wholesale price at 75% of retail	81000	86400	144000	311400	**3736800**
GM at Wholesale price at 90% of retail	-8374	-35674	56126	12078	**144936**
GM at Wholesale price at 85% of retail	-13774	-35674	56126	6678	**80136**
GM at Wholesale price at 80% of retail	-19174	-41074	47126	-13122	**-157464**
GM at Wholesale price at 75% of retail	-24574	-46474	38126	-32922	**-395064**

Appendix 5: Recurrent costs for proposed milk centre in Otjinene operating at 50 % milk intake (Year 1)

Recurrent Costs at 50 % milk intake (2 000liters /day for 300 days)					
600 000 L/Year @ N$6.50/l	**Pasteurized**	**Cult Milk**	**Yoghurt**	**Total**	**Total/Year**
Raw Milk(l)	18000	24000	18000	60000	**600000**
Raw Milk(N$)	117000	156000	117000	390000	**4680000**
Quantity	18000	18000	18000	54000	**648000**
Packaging	36000	36000	36000	108000	**1296000**
Milk testing	200	200	200	600	**7200**
Salaries and Wages	1320	1320	1320	3960	**47520**
Ingredients	0	300	300	600	**7200**
Consumables	300	300	300	900	**10800**
Water	200	200	200	600	**7200**
Electricity	400	400	400	1200	**14400**
Transport	400	400	400	1200	**14400**
Social Security Contributions	54	54	54	162	**1944**
Administrative costs	100	100	100	300	**3600**
TVC	**191974**	**237274**	**192274**	**561522**	**6738264**
Wholesale price at 90% of retail	13.5	13.5	22.5	49.5	
Wholesale price at 85% of retail	12.75	12.75	21.25	46.75	
Wholesale price at 80% of retail	12	12	20	44	
Wholesale price at 75% of retail	11.25	11.25	18.75	41.25	
Income at 90% of retail	243000	243000	405000	891000	**10692000**
Income at 85% of retail	229500	229500	382500	841500	**10098000**
Income at 80% of retail	216000	216000	360000	792000	**9504000**
Income at 75% of retail	202500	202500	337500	742500	**8910000**
GM at 90% of retail	51026	5726	212726	329478	**3953736**
GM at 85% of retail	37526	-7774	190226	279978	**3359736**
GM at 80% of retail	24026	-21274	167726	230478	**2765736**
GM at 75% of retail	10526	-34774	145226	180978	**2171736**

Appendix 6: Recurrent costs for proposed milk centre in Otjinene operating at 50 % milk intake (Year 2)

Recurrent Costs at 50% milk intake (2000 liters /day for 300 days)							
600 000 L/Year @ N$6.50/l	**Butter oil**	**Butter milk**	**Pasteurized**	**Cult Milk**	**Yoghurt**	**Total**	**Total/Year**
Raw Milk(l)	24000	0	12000	12000	12000	60000	**600000**
Raw Milk(N$)	156000	0	78000	78000	78000	390000	**4680000**
Quantity	793	23009	18000	18000	18000	77802	**933624**
Packaging	1586	46018	36000	36000	36000	155604	**1867248**
Milk testing	200	200	200	200	200	1000	**12000**
Salaries and Wages	1320	1320	1320	1320	1320	6600	**79200**
Ingredients	100	0	0	300	300	700	**8400**
Consumables	300	300	300	300	300	1500	**18000**
Water	200	200	200	200	200	1000	**12000**
Electricity	400	400	400	400	400	2000	**24000**
Transport	400	400	400	400	400	2000	**24000**
Social Security Contributions	54	54	54	54	54	270	**3240**
Administrative costs	100	100	100	100	100	500	**6000**
TVC	**185453**	**72001**	**146974**	**147274**	**147274**	**638976**	**7667712**
Wholesale price at 90% of retail	31.5	9	13.5	13.5	22.5	90	
Wholesale price at 85% of retail	29.75	8.5	12.75	12.75	21.25	85	
Wholesale price at 80% of retail	28	8	12	12	20	80	
Wholesale price at 75% of retail	26.25	7.5	11.25	11.25	18.75	75	
Income at 90% of retail	24979.5	207081	243000	243000	405000	1123060.5	**13476726**
Income at 85% of retail	23591.75	195576.5	229500	229500	382500	1060668.25	**12728019**
Income at 80% of retail	22204	184072	216000	216000	360000	998276	**11979312**
Income at 75% of retail	20816.25	172567.5	202500	202500	337500	935883.75	**11230605**
GM at 90% of retail	-160473.5	135080	96026	95726	257726	484084.5	**5809014**
GM at 85% of retail	-161861.25	123575.5	82526	82226	235226	421692.25	**5060307**
GM at 80% of retail	-163249	112071	69026	68726	212726	359300	**4311600**
GM at 75% of retail	-164636.75	100566.5	55526	55226	190226	296907.75	**3562893**

Appendix 7: Recurrent costs for proposed milk centre in Otjinene operating at 75% milk intake

Recurrent Costs at 75% milk intake (3000liters /day for 300 days)							
900 000L/Year @ N$6.50/l	**Butter oil**	**Butter milk**	**Pasteurized**	**Cult Milk**	**Yoghurt**	**Total**	**Total/year**
Raw Milk(l)	36000	0	18000	18000	18000	90000	**900000**
Raw Milk(N$)	234000	0	117000	117000	117000	585000	**7020000**
Quantity	1189	34000	18000	18000	18000	89189	**1070268**
Packaging	2378	68000	36000	36000	36000	178378	**2140536**
Milk testing	200	200	200	200	200	1000	**12000**
Salaries and Wages	1320	1320	1320	1320	1320	6600	**79200**
Ingredients	100	0	0	300	300	700	**8400**
Consumables	300	300	300	300	300	1500	**18000**
Water	200	200	200	200	200	1000	**12000**
Electricity	400	400	400	400	400	2000	**24000**
Transport	400	400	400	400	400	2000	**24000**
Social Security Contributions	54	54	54	54	54	270	**3240**
Administrative costs	100	100	100	100	100	500	**6000**
TVC	**276641**	**104974**	**191974**	**192274**	**192274**	**868137**	**10417644**
Wholesale price at 90% of retail	31.5	9	13.5	13.5	22.5	90	
Wholesale price at 85% of retail	29.75	8.5	12.75	12.75	21.25	85	
Wholesale price at 80% of retail	28	8	12	12	20	80	
Wholesale price at 75% of retail	26.25	7.5	11.25	11.25	18.75	75	
Income at 90% of retail	37453.5	306000	243000	243000	405000	1234453.5	**14813442**
Income at 85% of retail	35372.75	289000	229500	229500	382500	1165872.75	**13990473**
Income at 80% of retail	33292	272000	216000	216000	360000	1097292	**13167504**
Income at 75% of retail	31211.25	255000	202500	202500	337500	1028711.25	**12344535**
GM at 90% of retail	-239187.5	201026	51026	50726	212726	366316.5	**4395798**
GM at 85% of retail	-241268.25	184026	37526	37226	190226	297735.75	**3572829**
GM at 80% of retail	-243349	167026	24026	23726	167726	229155	**2749860**
GM at 75% of retail	-245429.75	150026	10526	10226	145226	160574.25	**1926891**

Appendix 8: DDP product brands