

**ECONOMIC ANALYSIS OF MILK PRODUCTION, PROCESSING AND MARKETING  
IN KADUNA STATE: A CASE STUDY OF THE MILK COOPERATIVE  
PRODUCERS' ASSOCIATION LIMITED (MILCOPAL).**

**By**

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**JUNE, 2006.**

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AHMADU BELLO UNIVERSITY, ZARIA  
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**JUNE, 2006**

# DECLARATION

I declare that the work in the thesis entitled 'Economic Analysis of Milk Production, Processing and Marketing in Kaduna State. A Case Study of the Milk Cooperative Producers' Association Limited (MILCOPAL)' has been performed by me in the Department of Agricultural Economics and Rural Sociology under the supervision of Professor A.O. Ogungbile and Dr. J.F. Alamu.

The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this thesis was previously presented for another degree or diploma at any university.

Sani, Isiaku

June 13, 2006

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Name of student

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Signature

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Date

## CERTIFICATION

This thesis entitled “ECONOMIC ANALYSIS OF MILK PRODUCTION, PROCESSING AND MARKETING IN KADUNA STATE. A CASE STUDY OF THE MILK COOPERATIVE PRODUCER ASSOCIATIONS LIMITED (MILCOPAL)” by Sani Isiaku meets the regulations governing the award of the degree of Master of Science of Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

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## **DEDICATION**

This thesis is dedicated to my late parents.

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All praise is to Allah, lord of the world, who taught man by the pen. May the mercy and blessing of Allah be on his Prophet.

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June, 2006.

## **Abstract**

This study analysed the economics of milk production, processing and marketing under the smallholder Milk Cooperative Producers' Association Limited (MILCOPAL). It is a contribution to knowledge in the area of pastoral milk cooperatives in Kaduna State. The specific objectives of the study were, to describe the socioeconomic characteristics of the pastoralists milk producers and suppliers in the smallholder dairy cooperatives, determine the efficiency of resource-use and profitability of milk production, describe the method of milk procurement and processing. The study also determined the efficiency of resource-use, marketing margin and profitability of yoghurt production by the MILCOPAL and identified the problems associated with milk production, processing and marketing under the smallholder Milk Cooperative.

A field survey was conducted in Kaduna state from January 2004 to May 2005. The analytical techniques used for the study were the descriptive statistics, production function analysis, net farm income analysis and marketing margin analysis. Also, four hypotheses were tested.

The results revealed that, pastoralists in the programme were grouped into milk producers and suppliers. The results of the socioeconomic characteristics of the producers revealed that their average age was 48 years, with an average herd size of 61 animals and up to 35 years cattle rearing experience. Results of the socioeconomic characteristics of the milk suppliers, revealed their average age as 30 years, 51% supplied less than 10 litres of fresh milk weekly and they all sold their milk to MILCOPAL at N30.00 per litre.

With respect to the resource-use efficiency and profitability in pastoral milk production, the "Cobb-Douglas" regression results showed that three variables - number of lactating cows, feed and labour were significant at 1% level of probability. Also the F-ratio was significant at 1% level. This led to the rejection of the hypothesis of the study, which stated that there is no relationship between milk production and inputs used.

All the inputs used in milk production were inelastic, because their elasticities of production were less than one. Returns to scale for all the inputs was 0.997, which implied that there was almost an equal increase in output from an equal increase in the inputs (constant returns to scale). The efficiency ratio was less than one for all the variables, which implied over utilization of resources. Profitability analysis of small scale milk production, showed a gross margin of ₦3, 951.82 and a net farm income of ₦2, 985.74 per week from an average of 30 lactating cows. The hypothesis of the study – milk production was not profitable was rejected based on the results of the test of significance of the differences between revenues and costs used in milk production.

Procurement officers usually leave for the various collection centres in the morning, where milk suppliers converged with milk for measurement and necessary tests. The amount supplied by each woman recorded; ₦30.00 was paid per litre of milk and ₦2.00 paid as commission to the cooperative association. The milk was then transported to the plant for processing into yoghurt and other dairy products.

With respect to efficiency of resource-use in milk processing into yoghurt, the “Cobb-Douglas” regression results showed that the variables (milk, labour and culture) included in the model were statistically significant at 5% level of probability, sugar was not significant. All the inputs used in yoghurt production were inelastic, because their elasticities of production were less than one.

The marketing margin of yoghurt was 60.81%. The gross margin per week was ₦257, 994.46 and the net farm income was ₦199, 762.21. The null hypothesis of the study, yoghurt production was not profitable, was rejected based on the test of significance of the differences between the revenues and costs involved in yoghurt production.

Problems associated with milk production, collection, processing and marketing, range from insufficient supplementary feed during the dry season and its expensive nature, low producer prices for milk, insecurity, high prices of drugs and vaccines, problems of low milk yield. Problems of MILCOPAL include; poor road network, high cost of transportation, fresh milk adulteration, seasonality of demand and production, diversion of milk when supply was lean, high cost of production, power failure, lack of modern processing and storage equipments.



# TABLE OF CONTENTS

	<b>PAGE</b>
TITLE PAGE	ii
DECLARATION	iii
CERTIFICATION	iv
DEDICATION	v
ACKNOWLEDGEMENTS	vi
ABSTRACT	vii
TABLE OF CONTENTS	ix
LIST OF TABLES	xiv
LIST OF FIGURES	xv
<b>CHAPTER ONE</b>	<b>1</b>
1.0 INTRODUCTION	1
1.1 IMPORTANCE OF MILK IN NIGERIAN DIET.	2
1.2 HISTORICAL BACKGROUND OF DAIRY DEVELOPMENT IN NIGERIA	3
1.3 PROBLEM STATEMET	4
1.4 OBJECTIVES OF THE STUDY	7
1.5 JUSTIFICATION OF THE STUDY	8
1.6 STUDY HYPOTHESES	8
1.7 ORGANIZATION OF THE THESIS	8

<b>CHAPTER TWO</b>	10
2.0 LITERATURE REVIEW	10
2.1 DAIRY DEVELOPMENT IN NIGERIA	10
2.2 MILK PRODUCTION FROM THE TRADITIONAL HERDS	10
2.3 THE FULANI HERDING SYSTEM	12
2.4 THE PASTORAL FULANI SEASONAL CALENDAR	15
2.4.1 END OF WET SEASON (OCTOBER TO DECEMBER)	15
2.4.2 THE HARMATTAN SEASON (JANUARY TO FEBRUARY)	15
2.4.3 THE BEGINNING OF THE HOT SEASON (MARCH TO APRIL)	15
2.4.4 THE END OF THE HOT SEASON (MAY TO JUNE)	16
2.4.5 THE RAINY SEASON (JUNE TO SEPTEMBER)	16
2.5 MILK COLLECTION SCHEMES IN NIGERIA	16
2.6 THE SMALLHOLDER DAIRY COOPERATIVES: THE ANNAND PATTERN	17
2.7 SMALLHOLDER DAIRY COOPRATIVES: THE NLPD'S EXPERIENCE.	18
2.8 YOGHURT AND YOGHURT PRODUCTION	20
2.9 DAIRY PRODUCTS MARKETING	22
2.9.1 TRADITIONAL (RURAL) MARKETS	23
2.9.2 URBAN MARKETS	23
2.10 REVIEW OF ANALYTICAL TECHNIQUES	24
2.10.1 PRODUCTION FUNCTION ANALYSIS	24
2.10.2 FARM PROFITABILITY ANALYSIS	25.
2.10.3 RESOURCE PRODUCTIVITY	25
2.10.4 THE CONCEPT OF EFFICIENCY	26

2.10.5 MEASURES OF EFFICIENCY	26
2.11 STRUCTURE CONDUCT AND PERFORMANCE OF MILK MARKETING	26
2.11.1 MARKETING MARGIN ANALYSIS	27
<b>CHAPTER THREE</b>	28
3.0 METHODOLOGY	28
3.1 THE STUDY AREA	28
3.2 SAMPLING PROCEDURE	28
3.3 DATA COLLECTION	28
3.4 ANALYTICAL TOOLS	30
3.4.1 DESCRIPTIVE STATISTICS	30
3.4.2 PRODUCTION FUNCTION ANALYSIS	30
3.4.3 RESOURCES-USE EFFICIENCY	31
3.4.4 MARKETING MARGIN ANALYSIS	32
3.4.5 NET FARM INCOME ANALYSIS	33
3.5 HYPOTHESES TEST	33
<b>CHAPTER FOUR</b>	35
4.0 RESULTS AND DISCUSSION	35
4.1 SOCIOECONOMIC CHARACTERISTICS OF THE PASTORALIST MILK PRODUCERS AND SUPPLIERS IN THE SMALLHOLDER DAIRY COOPERATIVES	35
4.2 PRODUCTION FUNCTION ESTIMATION AND	

RESOURCE-USE EFFICIENCY FOR MILK PRODUCTION BY THE SMALLHOLDER PASTORALISTS	40
4.2.1 PRODUCTION INPUTS IN SMALLHOLDER MILK PRODUCTION	40
4.2.2 PRODUCTION FUNCTION ESTIMATION AND RESOURCE- USE EFFICIENCY FOR MILK PRODUCTION BY THE SMALLHOLDER PASTORALISTS	44
4.2.3 RESOURCE-USE EFFICIENCY FOR MILK PRODUCTION	45
4.2.4 NET FARM INCOME ANALYSIS	46
4.2.5 SIGNIFICANCE OF THE DIFFERENCE BETWEEN REVENUES AND COSTS IN MILK PRODUCTION	48
4.3 MILK PROCUREMENT AND PROCESSING UNDER THE SMALLHOLDER COOPERATIVE	48
4.4 YOGHURT PRODUCTION FUNCTION ESTIMATION AND RESOURCE-USE ANALYSIS OF MILCOPAL	52
4.4.1 RESOURCE-USE EFFICIENCY OF MILCOPAL IN YOGHURT PRODUCTION	54
4.4.2 RESOURCE-USE SITUATION IN THE DAIRY PLANT	54
4.4.2.1 LABOUR	55
4.4.2.2 RAW MATERIALS	56
4.5 PROFITABILITY OF YOGHURT PRODUCTION AND MARKETING MARGIN IN THE STUDY AREA	57
4.5.1 NET FARM INCOME ANALYSIS OF MILCOPAL	58
4.5.2 MARKETING MARGIN ANALYSIS	59
4.5.3 SIGNIFICANCE OF THE DIFFERENCE BETWEEN REVENUES	

AND COSTS IN YOGHURT PRODUCTION	60
4.6 PROBLEMS ASSOCIATED WITH MILK PROCUREMENT, PROCESSING AND MARKETING UNDER THE SMALLHOLDER DAIRY COOPERATIVES OF MILCOPAL	60
4.6.1 PROBLEMS ASSOCIATED WITH SMALLHOLDER PASTORAL MILK PRODUCTION	60
4.6.2 PROBLEMS ENCOUNTERED BY MILCOPAL DURING PROCUREMENT	62
4.6.3 PROBLEMS ENCOUNTERED BY MILCOPAL DURING PROCESSING	63
4.6.4 PROBLEMS ENCOUNTERED BY THE MARKETING SECTION OF MILCOPAL	64
 <b>CHAPTER FIVE</b>	 65
5.0 SUMMARY, CONCLUSION, RECOMMENDATIONS AND SUGGESTION FOR FURTHER STUDIES	65
5.1 SUMMARY	65
5.2 CONCLUSION	69
5.3 RECOMMENDATIONS	70
5.4 SUGGESTIONS FOR FURTHER STUDIES	72
5.5 LIMITATIONS	72
REFERENCES	74

## LIST OF TABLES

TABLES	PAGE
4.1 Socioeconomic characteristics of the milk producers	36
4.2 Socioeconomic characteristics of the pastoralists milk suppliers	38
4.3 Drug purchased by each association in the year 2004	42
4.4 Number of animals treated in the year 2004	43
4.5 Estimated double–log production function for smallholder milk production	44
4.6 MPPs, MVPs, MFCs, and efficiency ratio of variables in milk production	46
4.7 Net farm income statement for milk production for 30 lactating cows/ week.	47
4.8 Significance of the difference between revenues and costs in milk production.	48
4.9 Procurement routes, associations involved and their distances from the dairy plant.	50
4.10 Total milk supplied revenue and commission received by the associations.	50
4.11 Estimated Cobb-Douglas production function for yoghurt production.	53
4.12 Resource - use efficiency in yoghurt production.	54
4.13 Fresh milk and powdered milk supplied for yoghurt production at MILCOPAL in year 2004 – April 2005.	56
4.14 Product line of MILCOPAL and their prices in Naira.	57
4.15 Net farm income statement of MILCOPAL per week.	58
4.16 Significance of the difference between revenues and costs in yogurt production.	60

# LIST OF FIGURES

FIGURES	PAGE
Figure 1: Flow diagram for yoghurt production.	22
Figure 2: organizational structure of the dairy plant (MILCOPAL).	55

# CHAPTER ONE

## 1.0 INTRODUCTION

Agriculture plays a key role in the Nigerian economy, employing two thirds of the labour force and accounting for over 40% of the G.D.P (CBN, 1999). The livestock population comprises about 14 million cattle, 34 million goats, 22 million sheep and about 100million poultry (Yahuza, 2001). Other livestock species of economic importance are donkeys, pigs and camels. Cattle represent one of the most economically significant group within the livestock sub-sector.

The livestock sub-sector is dominated by traditional systems of production and marketing. Transhumane pastoralists in the north of the country, rear a very high proportion of the cattle herd and many sheep and goats (Shu'aibu, 1999).

Accurate statistics on livestock production and marketing are not available, to make detailed projections of the supply and demand of the livestock sub-sector. It is clear, however, that over the last two decades the supply of meat, milk and eggs have failed to keep pace with the increasing population (Yahuza, 2001).

Milk accounts for 16% of the total value of all food products from livestock in sub Saharan Africa, estimated at US \$18.3 million in 1986 (FAO, 1986). Despite this contribution, sub Saharan Africa has failed to attain self sufficiency in dairy products. This is particularly true in Nigeria where the growth in livestock production has been insufficient to meet consumption level.

The supply of animal products has been declining over the past years, while demand has been increasing, as a result of increases in population, urbanization and income. Consequently, Nigeria has become a net importer of livestock and livestock products. Recent statistics on the importation of dairy products in Nigeria are not easy to come by. Restrictions placed on imports of animal products and other food stuffs in the 1980s, coupled with the introduction of the Structural Adjustment Programme (SAP), which saw a massive devaluation of the Nigerian currency, initially reduced the importation of meat and dairy products. According to



Danbaba (2001), for Nigeria the largest decline in imports occurred in 1982, which coincides with a substantial devaluation of the Naira.

However, during the period between 1995 and 1999, expenditure on the importation of food and live animals tended to increase from ₦88, 349.90 to ₦103, 489.90 billion (CBN, 1999). Recent ban on the importation of food items by the government however, increased the prices of dairy products and has significantly reduced the importation of milk powder on which the local cottage industries depend. This makes the small holder cooperative dairy production a more suitable alternative for milk production.

### **1.1 Importance of Milk in Nigerian Diet**

The livestock resource survey carried out by the Federal Department of Livestock and Pest Control Services in 1990, put the cattle population in Nigeria at 13.9 million (Resource Inventory Management - RIM, 1990). 13.5 million (96%) of the cattle are in the hands of the pastoral Fulani. This pastoral herd is the most important domestic source of milk in Nigeria. They are characterised by movement of their herds to the south during the dry season in search of feed and water and back to their base in the north during the wet season (Awogbade, 1981, Adesipe, 1986 and Isma'il, 1995).

Milk the "... most nutritious food known to man". (Michael et al 1991) is important in the diet and culture of the Fulani. Fresh, boiled or curdled, milk is consumed by the Fulani and by the rural and urban population. The Fulani women monopolize the local dairy production in Nigeria, although they own only a few of the family's cattle (Adholla-Migot and Little 1980). Pastoral women sell milk and cooked millet balls called *Fura* in Northern Nigeria and Southern part largely settled by the *Hausawa*.

The wives of the Pastoralists usually process fresh milk into various traditional milk products. These include: *nono* (sour milk), *Kindirmo* (sour yoghurt), *Manshanu* (local butter) *cuku* (Fulani Cheese) and *Wara* (Yoruba cheese). These products are usually hawked around the local area by women or are sold in specific

locations such as markets in certain towns. The traditional system of production which is the single most important source of local dairy products is faced with problems of product wastage and deterioration in quality due to the scattered nature of the producers and the poor product handling equipments (Isma'il, 1995).

The federal government made several attempts in the past to reduce the problems of dairy production, by establishing dairy plants in different parts of the country. These dairy plants have cattle ranches close to them so that their raw materials for production can be obtained. Most of these dairy plants were closed down due to reduction in the availability of raw materials and their high cost of purchase (Danbaba, 2001).

## **1.2 Historical Background of Dairy Development in Nigeria**

Before independence in 1960, dairying in Nigeria was influenced by the colonial experience, which placed complete reliance on large government farms to meet the growing demands of the cities. Therefore, the then veterinary department set up a milk processing plant at Vom (near Jos) in 1939, originally to produce butter and later to produce cheese (Walker 1981 and Yahuza 2001). A similar scheme was launched at Kano in 1940. After independence, as part of government's strategy to encourage the development of the dairy industry, several dairy-processing plants were established throughout the country. Among these were, Madara Limited in Jos, Plateau State, and Agege Dairy Farm, near Lagos. Other government dairy farms were established at Ibadan, Kaduna, Maiduguri, Minna, Ilorin and Kano.

The dairy industry represents an important component of the agricultural sector of the economy with great economic, nutritional and social implications (Olaloku, 1976 and Yahuza, 2001). The industry provides a means of livelihood for a significant proportion of rural pastoral families in Nigeria. Through their production activities and marketing segments, dairy processing plants, provide employment and value added services to milk. Currently, however, very few of the 63 known milk processing plants are operating at more than 20% of their installed capacity (Yahuza, 2001; 2002). According to Nwoko (1986), Maiduguri dairy plant operates

at 25%, Ilorin plant 10%, Nigeria dairy company Kaduna 18% and Madara limited Jos at 20% of their installed capacity. At present, the market has been taken over by "cottage" outfits that process and market yoghurt and other dairy products in urban areas, using milk powder as a raw material, despite the ban placed on imports by the government (Yahuza, 2001).

Therefore, the dairy industry is facing a serious challenge of meeting the daily nutritional requirement of Nigerians. The gap between supply and demand for dairy products is widening as a result of increase in population, per capita income and urbanization. Imports that used to bridge part of the gap have been declining. Consequently, local collection, processing and marketing of milk is becoming increasingly competitive.

### **1.3 Problem Statement**

Despite the importance of pastoral herd in the provision of the nutritional requirements of Nigerians, the pastoral milk production is still bedeviled with some problems. These problems make it difficult for local production to meet up with demand. Output of milk from the national herd for the period between 2001 and 2003 was 515,291; 535,911 and 557,347 thousand tonnes; this by far is below the nutritional requirements of Nigerians (Yahuza, 2001).

It is difficult to estimate level of consumption of dairy products especially in the rural areas where proper records are not kept or market channels are not followed. However, Nuru (1990) estimated the consumption of dairy products at 10-20 kg/head/year. This implies that about 2 million metric tonnes is required to feed the Nigerian population of about 120 million people. There is therefore, a shortage of supply to meet even the present low level of consumption. Ideally each person should have 115kg of dairy products per year (Nuru, 1990).

There is a need for research to identify the problems associated with the smallholder milk production, which is the single most important source of domestic milk production in the country. This will go a long way towards solving our problem of insufficiency in dairy production.

Among the problems cited in literatures include: Low milk output of Fulani cows. The local *Fulani* cow yields on the average 0.7 litres of milk per day during lactation (World Bank 1993). This value is low compared to what is obtained in other places. In Bangladesh average yield is 1.19 litres (Saha and Haque, 2001) while in Cameroon it is 2.46 litres on average (Njire *et al*, 2001) and in Tanzania it is 2.68 litres on the average (Kurwijila 2001). Less than 3% of the local cattle stock in Nigeria has been artificially inseminated to improve their genotype (Michael *et al*, 1991).

Other problems are poor quality grass especially during the dry season, unsanitary methods of milk handling, inefficient milk collection schemes, competition between itinerant milk collectors and official milk collectors, faulty product pricing, poor management policies and lack of economic incentives from the government hamper the expansion of Nigeria's dairy industry.

Lack of sufficient storage and processing, equipments breakdown of the cooling system, breakdown of processing plants, erratic supply of pasteurized milk by the Fulani producers, adverse markets and bad management hamper the performance of the dairy farms located in some urban centres in Nigeria (Awogbade, 1983; Ismail, 1995; and Yahuza, 2001). Competition with imported powdered and condensed milk is another challenge, which the local dairy industry has to overcome.

Although through research and genetic improvement of the local cow, the Fulani can raise their output, most of the dairy companies who collect milk for processing in the urban areas find it difficult to reach the scattered producers in the rural areas. The dairy farms in Nigeria are not well equipped for door-to-door milk collection from the pastoralists or door to door distribution to consumers.

To bridge the gap between supply and demand for dairy products so that majority of people can have it at affordable prices, the federal government established many research institutions and government parastatals with mandates for livestock production such as: The National Veterinary Research Institute (NVRI)

Vom, National Animal Production Research Institute (NAPRI) Shika and the National Livestock Project Division (NLPD) Kaduna. Despite their efforts toward making Nigeria self reliant in animal products production, the problems enumerated above still exist.

The introduction of the Structural Adjustment Programme (SAP) which requires looking inwards for raw materials for production, coupled with the funding received by the National Livestock Projects Division (NLPD) from the World Bank led to the incorporation of a pilot dairy project in Kaduna state (NLPD, 1992; 2000; World Bank, 1993). The programme mobilized pastoralists to form Village Milk Producer Cooperative Associations Limited (VMPCAL), so that they can pool their milk together for processing in the dairy plant. It was aimed at keeping the pastoralists in one place, providing market for their products and making the products readily available to consumers at affordable prices (Yahuza, 2001; 2002).

The small scale producers, their cooperative associations and the dairy plant of the Milk Producers' Cooperative Association Limited (MILCOPAL) formed the specific area for this study. The reason for choosing this area is to find out whether the cooperative system of milk production, processing and marketing is the solution for our dependence on imported dairy products, as witnessed in the Gujarat state of India under the Annand Milk Union Limited (AMUL) and in the smallholder dairy cooperatives in Tanzania and Bangladesh (Kurup, 2001; Kurwijila, 2001; Saha and Haque, 2001). Economic analysis of the dairy cooperative setting will assist in providing relevant information on better ways of managing them. It will also provide relevant information on how the programme can be replicated in other states of the federation.

This study is, therefore, aimed at studying how resources are used in milk production by the pastoralists that are participating in the pilot dairy programme of MILCOPAL. Such a study is necessary in order to find how the programme has affected the lives of the various members of the cooperative and the consumers of such dairy products.

The questions this study addressed were:

- i) What are the socioeconomic characteristics of the pastoral milk producers and suppliers participating in the dairy cooperatives?
- ii) How efficient are resources allocated in the production of milk by the pastoralists participating in the dairy cooperatives production system?
- iii) What are the methods used in milk procurement and processing in the cooperative system?
- iv) How efficient are resources allocated in the processing of milk into yoghurt by MILCOPAL?
- v) What is the rate of performance and profitability of yoghurt marketing in the study area?
- vi) What are the problems associated with milk production, processing and marketing under the cooperative system?

#### **1.4 Objectives of the Study**

The broad objective of this study was to determine the resource-use efficiency in milk production, processing and marketing under the smallholder dairy cooperative system.

The specific objectives were to:

- i) describe the socioeconomic characteristics of the pastoralist milk producers and suppliers in the smallholder dairy cooperatives.
- ii) determine the efficiency of resource-use in milk production by the smallholder pastoralists.
- iii) describe the methods of milk procurement and processing under the smallholder dairy cooperative system.
- iv) determine the efficiency of resource-use in milk processing into yoghurt by the MILCOPAL.
- v) evaluate the marketing margin and profitability of yoghurt marketing in the study area.
- vi) identify the problems associated with milk production, collection, processing and marketing under the cooperative system.

## **1.5 Justification of the Study**

Milk is the most frequently used cattle product, however; many families cannot get enough milk for daily nourishment (Onor, 1999). Demand for milk and other dairy products can be further increased through measures aimed at reducing cost of production. Such reduction in cost can be attained through the efficient use of resources. This will result in improving the protein intake of Nigerians irrespective of their positions.

This study therefore, aims at contributing to the available knowledge in the area of cooperative formation among the pastoralists using Kaduna state as a case study. The study will provide important information on areas that need be improved in the cooperative system of milk production in the study area. The choice of Kaduna state has some advantages because it harbours a very large proportion of livestock (1.007 million head of cattle) in Nigeria (Danbaba, 2001). It is also the first and only place where the pilot smallholder dairy cooperative production programme is established. Hence, with solutions found to the problems of cooperative dairy production in Kaduna state, productivity of a large population of livestock could be improved. Also experiences from this study could assist in providing needed information to other areas where such cooperative programmes are to be established. This will ensure better profit for the producers and the availability of dairy products to consumers at affordable prices.

## **1.6 Study Hypotheses**

The following null hypotheses were tested based on the stated objectives.

- i) There is no relationship between milk production and inputs used.
- ii) There is no relationship between yoghurt production and inputs used.
- iii) Milk production is not profitable.
- iv) Yoghurt production is not profitable.

## **1.7 Organization of the Thesis**

The thesis is organized into five chapters. The first chapter introduced the study and provided background information on the economic environment of Nigeria and

the role of milk in the Nigerian diet. The chapter also included the statement of the research problem, objectives, justification and study hypotheses.

Chapter two is the literature review and it provides theoretical background to the study. It reviews dairy development in Nigeria, milk production from the traditional herds and the Fulani herding system. The chapter also reviews the various milk collection schemes in Nigeria and in other countries, yoghurt production and marketing, and some tools of analysis used in the study.

The third chapter presents the methodology of the study. It describes the study area, the sampling and data collection procedure as well as the analytical tools employed to achieve the study objectives.

Chapter four presents and discusses the results of the study. The chapter is divided into six sections. The first section describes the socioeconomic characteristics of the pastoralists Milk producers and suppliers in the smallholder dairy cooperatives, while the second section estimates the production function, resource use efficiency for smallholder milk production and profitability of milk production. The third section describes milk procurement and processing under the dairy cooperatives. The yoghurt production function estimation and resource use efficiency for MILCOPAL is presented in the fourth section. Section five evaluates the profitability and marketing margin of yoghurt in the study area. Section six examines the problems associated with milk production, processing and marketing under the smallholder dairy cooperatives of MILCOPAL.

Chapter five presents a summary of the study, conclusion, recommendations and suggestion for further studies. The references and appendices to the study are presented after chapter five in that order.



## **CHAPTER TWO**

### **2.0 LITERATURE REVIEW**

#### **2.1 Dairy Development in Nigeria**

The various activities of the Nigerian dairy industry (viz. Milk production, importation, processing, marketing and consumption) have been going on in the country for over 60 years. These activities are, however, unorganised except for the relatively few processing firms that produce and market reconstituted milk products (Yahuza, 2001). Despite the unorganised nature of the dairy industry, it represents an important component of the agricultural sector of the economy with great economic, nutritional and social implications (Yahuza, 2001).

The industry provides a means of livelihood for a significant proportion of rural pastoral families in the sub humid and semi-arid ecological zones of Nigeria. According to FAO (1988), an estimated 183, 000 rural households derived some income from the dairy industry in 1986. The dairy industry, through commercial dairy processing plants and marketing segments, provide employment and value.

Improvement of the living standard of Nigerians has been the major focus of various national development plans. Consequently, the dairy industry, through which better nutrition can be provided to the citizens was given adequate attention in these national development plans (Danbaba, 2001). In some selected areas, the government established dairy farms with local and imported breeds of cattle. In addition, milk collection centres including mobile collection points were established (Ismail, 1995).

#### **2.2 Milk Production from the Traditional Herds**

Legend says the Fulani originated from the Arabian Peninsula (de St Croix 1945), and migrated south-west to Senegambia. From Senegambia, they moved eastward, crossing several Sahelian and Sudanian zones, to the Red Sea (Frantz 1981). The Fulani of Nigeria are a part of this migrant, ethnic

population having common occupational and biogenetic characteristics. Light-skinned with curly hair, the Fulani have pointed nose, thin lips, and slender stature (Stenning 1959).

The Fulani are endogamous as well as polygamous. Celibacy is uncommon among the Fulani, who marry in their twenties. Divorce is also rare. As a result of polygamy and early marriages, the Fulani have high fertility. Despite high infant mortality, the population of the Fulani is growing fast, although slower than the national average. Household size is about six, with a near balanced sex-ratio. Age distribution is base-heavy, with children dominating. The Fulani are governed by a political structure consisting of the ethnic group, the clan, the lineage, the family, and the Ruga. Leadership among the Fulani is less aristocratic. The family is a herd-owning unit, united by common territory and occupation. Their herding system, involves frequent pastoral movement (Ismail 1995).

The pastoral herd is the most important source of domestic milk in Nigeria. According to Yahuza (2001), five major production systems found in sub Saharan Africa are Pastoralism, agro-pastoralism, mixed farming, intensive dairy farming and peri-urban milk production. However, four major production systems can be identified in Nigeria according to Yahuza, (2001). They include: pastoral systems, usually carried out by the Fulani who control at least 95% of the cattle population. The Fulani are mostly semi settled, moving to locations where seasonal water supplies make pasture available during the dry season. However, some Fulani are nomadic and are constantly on the move in search of water and pasture. They keep large herds and depend on milk and dairy products for sustenance. Some settled Fulanis also exist.

On the basis of cattle population figures for 1990 and an estimated growth rate of 4%, the total cattle population in Nigeria is expected to reach 25.1 million by the end of 2005. Based on the productivity of the cattle population under the traditional system of production (253 kg of milk/ year), it is therefore estimated that domestic milk production in 2005 will reach 606,827,000 tonnes (Livestock sub sector review report, 1992). In addition to the supply of milk from the national herd, an insignificant quantity of milk is supplied by the commercial dairy farms. Several processed dairy products are imported into Nigeria. These include evaporated milk, powdered milk, butter, cheese and cream.

## 2.3 The Fulani Herding System

Having raised livestock for centuries, the Fulani have evolved a herding system that withstands time, weather, social change, and government intervention. The movement of the Fulani over the years has led to a pastoral calendar in which the location and the grazing habits of the Fulani can be predicted.

The name Fulani has become synonymous with grazing and cattle ownership. *Fulbeness*, *pulaaku*, is determined by the extent of Fulani involvement in herding. The primary occupation of the Fulani is herding, followed by farming. Less than a tenth of the Fulani have jobs other than herding or farming. Non-herding jobs are seasonal and opportunistic. For example, during the wet-season, the Fulani take advantage of the abundant rain and manure to plant corn, millet, sorghum, and home gardens in their backyards and engage in bee keeping activities (Ismail 1995). The Fulani use farming to absorb the excess of labour during the wet-season, to reduce dependence on farmers, to counter food shortages during an impending drought, and to get farm stubble for their animals.

The household is the simplest, full-time, cattle-breeding unit. Every member of the household contributes to, and benefits from, raising animals (Stenning 1959). Labour is specialized. By assigning labour to gender and age groups, the pastoral Fulani optimize their production methods (Isma'il 1995). Although the Fulani share the herding task, men's work differs from women's, as adult's work differs from children's. Regardless of age or gender, a member of the household learns all the herding skills.

The management of the herd devolves on the men, but children, in their capacity as apprentices, also contribute to the labour-force. Men, who ensure the corporate existence of the family, are the primary household providers. They protect the animals from carnivores and raiding tribes or thieves. They take the animals to long-distance pasturelands. Men also find fodder, dig wells, and make weapons such as guns, knives, swords, herding sticks, and bows and

arrows. Among the Fulani, the adult males find the grazing-sites, build the camps and the fences, and perform soil and water tests (Riesman, 1977; Fricke, 1979; and Michael *et al* 1991,).

Culinary responsibility falls on the women who process and cook the food. Girls and women weave mats, spin cotton into thread, make household decorations, and collect herbs and vegetables. They buy food from the market, churn the milk, make the butter, sell milk and butter, and do craft work such as decorating calabashes (Riesman 1977 and Fricke 1979). Women also grow vegetables, and raise poultry and non-ruminant stock. Women and girls clean the compound. They look after the disabled animals, fetch water, collect firewood, collect wild-food, help in making temporary shelter, and bear and nurture the children (de St Croix 1945; Vengroff 1980; and Awogbade 1983).

Without a specific retirement age, most Fulani continue herding well past the middle age. When a pastoral Fulani man becomes old and incapable of performing the rigorous herding task, he relinquishes the responsibility to his sons (Fricke 1979). He then settles in the camp and acts as the chief adviser on family and herding matters. His wealth of experience makes him the trainer of the emerging household heads. An important function of the elderly in the Fulani society is making decisions about grazing movement.

The Fulani movement varies according to individual circumstances, dictated by the seasonal distribution of grass and water. Mobility is necessary because pastoral resources are non-static and access to them requires movement. The pastoralists move to avoid harmful insects, abominable weather, livestock thieves, tax assessors, and hostile social environment (de St Croix, 1945; Gulliver, 1952; Konczacki, 1978; Fricke 1979; Salzman, 1980 and Awogbade, 1983).

Animals raised under sedentary conditions are more likely to be hit by natural or artificial disasters. To avoid the transmission of epizootic diseases among the herds, the Fulani steer clear of the herds suspected of carrying diseases (Riesman 1977; Sandford 1982; Meir 1987; and Ellis and Swift 1988). By

extensive spatial grazing, the pastoralists optimize spatial resource use, allow the soil to rejuvenate, and prevent permanent land damage (Bennet 1990).

Migration starts with a reconnaissance by the household head or his appointee, who, in deploying the herd, primarily considers water, grass, market, safety, diseases, access to roads, and socioecological conditions, though not necessarily in that order (Niamir 1990). It is not, however, uncommon for a pastoralist to base his choice of a location or migratory route on triviality such as closeness to a suitor (Stenning 1959). For collective security, the Fulani man will also consult his neighbours, relatives, and close friends from several camping groups before he moves (Gulliver 1952; and Waters-Bayer *et al* 1986).

The weather dictates the actual time of departure, but an imminent danger can hasten the out-migration. As the day of the exodus nears, the Fulani women start washing the pots, mortars, pestles, calabashes, and beds and bedding. The Fulani men begin packing household goods, dismantling the makeshift camps, and preparing the pack bulls. A team is sent to the new site to build the stockades, tithe poles, and beehive huts. Sometimes, the team also digs a well.

Early in the morning, on the day of moving, the Fulani load the household utensils on the backs of the pack bulls. The elderly, the children, the disabled persons, and the sick animals with a chance of recovery ride on the bull's back (Fricke 1979). The eight-kilometre-an-hour foot journey begins.

Using a cane, sign language, and verbal command, the Fulani drive the animals to the new camp. During the journey, the Fulani instruct their animal to lie, slow, swim, sleep, or stand still (de St Croix 1945). With faster animals occupying the front row, a migrating herd comprising of several family units move in a column of up to five meters wide and two kilometers long. By the time this column passes a given point, everything that stands at that point is destroyed (Fricke, 1979 and Vengroff 1980).

Although many pastoral families migrate together, herds from different families never mix or get lost during migration. A Fulani man can identify his animal by

its name, colour, hair, spots, patches, twist of the horn, or shape of breast (de St Croix, 1945). Because they breed their animals in different ways, the Fulani cattleman easily recognizes an animal from another man's stock.

Herding is a monumental task for the Fulani who are always trying to get the best grazing condition for their animals. At sunrise, the Fulani free the animals from the tether and take them out to graze until sunset. Throughout the night, the pastoral Fulani must keep vigil on the animals, protecting them from night marauders. Daily herding tasks vary according to seasonal changes.

## **2.4 The Pastoral Fulani Seasonal Calendar**

### ***2.4.1 End of wet-season (October to December)***

October to December marks the end of the wet-season and the beginning of the dry-season. Relative humidity is low; so is insect population. The dry soil allows the animals to move without becoming stuck in the mud. Some water and grass in isolated places are present for pastoral use. The Fulani begin their southward migration or start moving along the rivers and stream valleys.

### ***2.4.2 The Harmattan Season (January to February)***

January to February is the Harmattan season. Relative humidity nears zero, and the tsetse population is reduced by extreme dryness. During the dry period, fodder quality and quantity fall, compelling animals to intensify bush-stubble grazing. Bushfires that destroy extensive pasturelands are common. Water becomes scarce and animals lose weight. Uncertainty of food and water necessitates longer grazing hours, splitting of the herd, and frequent visits to permanent water sources. Southward migration increases.

### ***2.4.3 The Beginning of the Hot-season (March to April)***

March and April are the hottest and toughest months for the Fulani. The condition of the bovine is at its sub-optimal level. The Fulani are in their southernmost locations. Widespread fires in the range worsen the pasture

situation. Herds no longer select grass but make do with what is available. Because of insufficient rains, animals' urine and feces 'burn' the soil, further reducing the amount of forage (Riesman 1977). Excessive ambient heat compels the Fulani to graze early in the morning, late in the evening and sometimes at night.

#### *2.4.4 The end of the hot-season (May to June)*

May to June is the end of the hot season and the beginning of the rainy season. Vegetation begins to appear. The cattle stop eating the old, dry grass. The Fulani start moving northward, with the cloud. The rate of reappearance of the grass determines the northward movement. Herders take precaution against animals wandering in the crop field.

#### *2.4.5 The rainy-season (June to September)*

June to September is the peak of the rainy-season. The Fulani reach their northernmost homes in July. A resting period for the Fulani, this is also the cattle-breeding season. The herders engage in shorter grazing hours. The Fulani get the highest milk yields in this period.

## **2.5 Milk Collection Schemes in Nigeria**

These began in the late 1920's when the Veterinary Department set up units in Northern Nigeria to which pastoral women brought fresh milk for cream separation and processing into clarified butter fat (CBF). The women were paid only for the cream while the skim milk was returned to them (Yahuza, 2001). The various governments of the then Northern region encouraged the establishment of milk collection and cooling units. The butter fat collection scheme was established to encourage the pastoralists to keep their cattle in one place throughout the year, offering them an immediate market for all the milk they could produce (National Archives 1934-48).

The collection scheme was primarily set up to export clarified butter fat to England, where it was used to make toilet soap (National Archives 1934-48).

Other private enterprises, including United Africa Company (UAC), entered the export business, offering higher prices than the government to encourage middlemen to collect more butter from the pastoralists, this increased butter export from 10 tonnes in 1933 to 2,400 tonnes in 1939 (Walker 1981).

The delivery of milk for cream separation demonstrated the possibilities of whole milk collection. Therefore, the then Veterinary Department set up a milk processing plant at Vom (near Jos) in 1939, originally to produce butter and later to produce Cheese (Walker 1981). Some milk came from the Vom dairy herd kept by the department, but mostly it came from Fulani women through a network of collection centres. A similar scheme was launched in Kano in 1940.

Growth of the dairy industry in Nigeria could be attributed to wartime (World War II) restrictions on dairy produce imports and a ban on Butter fat exports (Yahuza 2001). For these reasons, the annual output of the Vom Dairy for 1949-50 was 123,800 kg of butter, 50,882 thousand kilogramme of clarified butter fat and 36,700 kg of Cheddar type cheese to suit the taste of expatriate customers (Buchanan and Pugh 1955).

The dairy plant at Vom eventually closed in 1954, with the lifting of restrictions after World War II. This was due to the availability of imported butter of higher quality in urban markets (Walker 1981). The West African Milk Company is now renting the site of its farm and has stocked it with Friesian X White Fulani Crosses. A small processing plant has also been established at the site, to produce pasteurized fresh milk, Yoghurt, butter and cheese (Yahuza, 2001).

## **2.6 Smallholder Dairy Cooperatives: The Annand Pattern**

According to Kurup (2001), the milk producers' co-operative movement of India started in Annand, Kaira District of Gujarat in the mid forties, set up by the milk producers and their enlightened leaders, as an alternative to the highly exploitative and unfair milk trade foisted on them by middlemen and private dairy companies in Annand and Bombay. The spectacular success of the Annand Milk Union Ltd (Amul), its rapid growth and democratic management



set up, made it an ideal model for rural milk production and marketing for the rest of Gujarat. It enabled the milk producers to gain direct access to far flung urban milk markets; earn a lion's share of the consumer rupee for their products, eliminating middlemen.

The management structure of the union comprises the board from among the primary members nominated by the District Cooperative Societies (DCSs) and a chairperson elected from among the board members. Professionals manage the union under the guidance and control of the board. The tenure of the chairperson is one year and a new chairperson is elected each year, even though the incumbent chairperson is eligible for re-election and is often re-elected for continuity and to support long-term development of the union. Elected boards from among the primary members of the society also govern the DCSs; and they in turn elect a chairperson from among them. The paid secretary of the DCS and his staff, work under the supervision and control of the board.

Milk collection in the Annand Pattern Co-operative set up through village dairy co-operative societies in all major villages in the district, organised along viable milk collection routes. The DCSs collect milk from their members twice a day, test it for fat content and pay a quality based price to the members, twice daily. The milk collected is picked up by the route milk trucks or tankers twice a day and is delivered to the dairy plant or chilling plant of the union for processing or storage or marketing. Starting with 11 DCSs and an opening volume of some 5000 litres per day, the Mehsana Milk Union now covers the entire district, and has some 1078 dairy co-operative societies and, by 1999, a daily average milk collection volume of 1.13 million kg; and some 415,212 tonnes annually (Kurrup, 2001).

## **2.7 Smallholder Dairy Cooperatives: NLPD's Experience**

The National Livestock Project Division (NLPD) was established in 1974 as Livestock Project Unit (LPU), under the Federal Department of Livestock and Pest Control Services of the Federal Ministry of Agriculture. It was given the

responsibility for the implementation of the first and second World Bank assisted livestock projects. During the mid term review of the Second Livestock Development Project (SLDP), a pilot dairy programme was added to the SLDP in order to collect, process and market milk on behalf of pastoral Fulani (Isma'il, 1995, Danbaba, 2001 and Yahuza, 2001).

The programme according to Shu'aibu (1999), is fashioned after the "Annand Pattern" of dairy development programme implemented in India. A small-scale dairy development unit was established by the NLDP and given the responsibility for the implementation of the programme. According to Yahuza (2001), a spearhead team was established and sent to the National Dairy Development Board (NDDB) of India for a short training in farmer organization and development, following the Annand pattern. On the return of the team, a mobilization drive was initiated. The mobilization team comprising of the following specialists: Veterinarian, Sociologist, Economist, Animal nutritionist and Cooperative officer was constituted and given the responsibility for mobilizing pastoralists and organizing them into associations. The mandate of the team was to identify producers, mobilize and organize them into Village Milk Producer Cooperative Associations (VMPCA). According to Yahuza (2001), this was done through formal and informal contacts/visits with relevant government agencies, traditional institutions, Fulani *Ardos* and the cattle owners.

The programme started at Kachia grazing reserve where pastoralists have been settled and provided with infrastructure under the SLDP. The first Village Milk Co-operative Association (VMCAL) was established at Kachia grazing reserve in 1991. Today there are 36 identified associations with about 2000 members spread across Kaduna state. Special milk collection routes were identified and the sensitized milk producers were urged to supply milk to collection centres on the identified routes. Each society has an elected chairman and an appointed secretary. The secretary, act both as administrator, of the society and as record keeper for the milk supplied by members of his society. The secretary is paid from the commission that the federation pays to each society (on per litre basis) for the quantity of milk supplied. With the officials in place, an association is ready to commence milk procurement activities while the spear team's

responsibilities ceases except for supervision and the provision of extension and veterinary services.

As the number of associations increased, an apex organization solely responsible for the procurement, transportation, processing and marketing of milk supplied by the association was established. Thus, the Kaduna Federation of Milk Producers' Co-operative Association Limited (MILCOPAL) was born. The federation now trades under the name MILCOPAL.

To enable the processing of the milk collected by the federation, the approval of the Kaduna state government was obtained for the use of the defunct Kaduna Dairy Plant (Shu'aibu, 1999). The NLPD through the World Bank loan carried out some repairs so that minimal level of operation was made possible. As the operation expands, the need to control the dairy plant and secure unlimited access was discussed. The World Bank provided a grant through the loan for the purchase of controlling shares at the Nigerian Dairy Company Limited (NDC), the owners of the Kaduna Dairy plant. According to Yahuza (2001), the federation now owns 55% of the Kaduna Dairy Plant.

The NLPD, through the World Bank project, provided the vehicles for procurement and marketing of milk collected. It also provided the initial seed capital for milk procurement and operation. The management of MILCOPAL was also provided from the staff of the NLPD. With the exception of veterinary drugs and supplementary feeds that are on full cost recovery basis, all developmental activities of the Federation are funded by NLPD, while commercial activities (milk procurement, transportation, processing and marketing and operating staff salaries) are funded directly by the Federation.

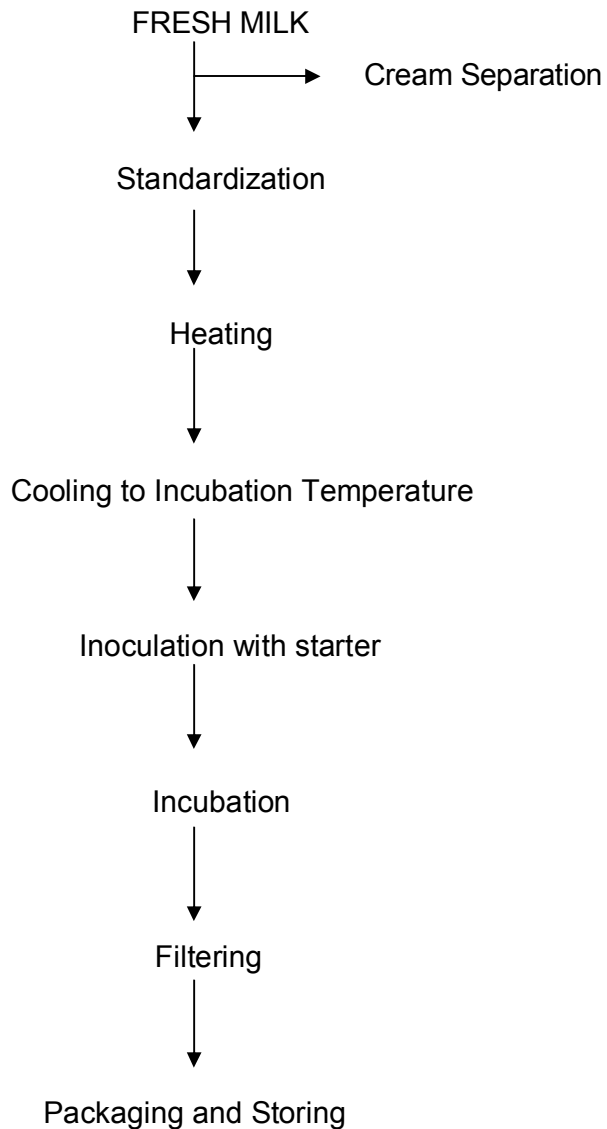
## **2.8 Yoghurt and Yoghurt Production**

Yoghurt has been known to be the traditional form in which milk is consumed in central and Southern Europe (Kon, 1972). It is a nutritious, tasty and stable product obtained from milk subjected to a number of controlled fermentation.

According to Fox (1967) and Kosikowski (1982), Yoghurt is preferred to fresh milk because of its hygienic safety, better flavour and texture and therapeutic effects.

Yoghurt according to Van Den Berg (1988), originated from the inability of the milk producers to control the quality of fresh milk over time. The name yoghurt is used for products manufactured by cultures consisting exclusively of *streptococcus thermophilus* and *lactobacillus bulgarius*. These cultures give rise to different forms of fermented products available in the market.

The method of yoghurt production as described in literature is similar except for one or two additions along the production line. The milk is heated to 90°C for 15-30minutes, cooled to 40-45°C, inoculated with 2% mixed culture of *lactobacillus* and *streptococcus* bacteria. It is held at this temperature (40 - 45°C) for 3-4 hours this is known as incubation process. The product is then cooled to 5°C for packaging. This production process can be presented in a flow diagram as illustrated by O'Connor (1995) and Yakubu (2003) in figure 1.



**Figure 1: Flow diagram for yoghurt production.**

Good quality yoghurt according to Arthurton (1987), should have body with a relatively high viscosity. It should be firm and cohesive with a "gelatin" consistency. It should also have a clean sharp acid flavour.

## **2.9 Dairy Products Marketing**

Marketing of dairy products involves a large number of individuals, including the pastoralists, processors, milk product distributors and retailers. The marketing

systems follow the production pattern, which distinguishes between traditional producers, who operate mainly in the rural or semi-urban markets and the reconstituted milk product producers and milk product importers who operate in the urban markets.

### *2.9.1 Traditional (Rural) Markets*

Unlike the marketing of animals, traditional dairy products (milk, cheese/butter and yoghurt) marketing is widespread among the Fulani maids. The traditional pastoral sector is noted for the production of milk. Therefore, marketing of milk is one of the most important economic preoccupation of the Fulani maids. Milk is important in the diet and culture of the Fulani. Fresh, boiled, or curdled, milk is consumed by the Fulani and by the rural population. The Fulani women monopolize the local dairy production in Nigeria, although they own only a few of the family's cattle (Isma'il, 1995). Pastoral women sell milk and cooked millet balls called *Fura* in northern Nigeria and in other areas settled by the Hausas. The milk products are carried on the women's heads, in calabashes as they walk to sale points such as rural markets, road side settlements and urban areas. Every Fulani man must give his wife or wives enough milk to sell or risk his marriage. Proceed from dairy sales are kept by the women, which they use to buy cooking ingredients such as cooking oil, seasonings and flavourings.

### *2.9.2 Urban Markets*

Processing of milk in to various dairy products by urban processing plants, has introduced a new dimension into the marketing of milk. Fresh or powdered milk is converted in to yoghurt considered to have a longer shelf life and high acceptance among the people than raw milk. The urban milk and milk product markets are dominated by the processors, distributors, wholesalers, depots, retailers, bicycle boys and other retailers. The dairy products marketed include: evaporated milk, powdered milk, baby formula, butter, ice cream, cheese and yoghurt. Yoghurt is marketed in the cities under refrigerated conditions to preserve its quality. It is sold in shops, restaurants, along major roads and on low gravity bicycles in all the major cities of Nigeria.

## 2.10 Review of Analytical Techniques

There are significant studies on economics of production, but little has been done specifically on yoghurt production, under the small holder dairy cooperative of the NLPD. Therefore, studies in other aspects of production will be reviewed.

### *2.10.1 Production Function Analysis*

In a production process, inputs are converted into output. In agriculture, the physical inputs with which we deal are land, labour, capital and management. These resources can be organized into a producing unit, whose objective may be profit maximization, cost minimization or the maximization of satisfaction.

The production function stipulates the technical or physical relationships between inputs and outputs in any production process. It helps in the estimation of marginal productivity of inputs and their efficiency in the production process. The units to adopt in expressing the input – output relationships and the criteria for selection of functional forms have been a problem and a subject of controversy among researchers. The problem arises from the heterogeneity of most variables (inputs and outputs) and lack of common physical unit of measurement. For computational convenience, some forms of aggregation and measurement in value were suggested by Heady and Dillon (1964). Three commonly cited approaches to this area of aggregation are the use of money, calorie equivalent and the use of grain equivalent. Money is used for measurement of output from mixed cropping (Mijindadi, 1980).

Heady and Dillon (1964), outlined some useful principles for selection of appropriate functional forms. These include:

- i) The consistency of the chosen function with the study objectives.
- ii) Knowledge of the relationship that exist between variables.
- iii) A consideration of the existing theories of the sciences.

Olayide and Heady, (1982) suggested choice of functional form based on economic criteria. These criteria are:

- i) The goodness of fit, which is determined by the magnitude of the coefficient of multiple determination ( $R^2$ ).

- ii) Statistical significance of the regression coefficients.
- iii) Correctness of the signs of the regression coefficients.

### *2.10.2 Farm Profitability Analysis*

Cost-return analysis usually forms the basis for farm productivity analysis. According to Osifo *et al* (1977), monetary values should be used as basis for measuring all inputs and outputs in costs and returns analysis. According to Wermer (1993), profitability is measured as the difference between value of yield and cost of production, and net returns is measured as the difference between values of yield and cash input cost including hired labour.

The major problems of cost returns analysis are:

- (i) It does not indicate the relative importance of each of the resource in production and
- (ii) It is location bound and specific in applicability

In spite of these limitations, it is a useful tool in enterprise comparison and indicating a profitable pattern of aggregate input use.

### *2.10.3 Resource Productivity*

Productivity according to Olayide and Heady (1982), is the index of the ratio of the value of total farm output to the value of the total inputs used in the production. It is a measure of economic progress. It helps in solving problems such as:

- i) Distribution of income.
- ii) Allocation of resources.
- iii) The relation between stocks and flows.
- iv) Measurement of efficiency or productivity.

Thus resource productivity can be defined in term of individual resource input or in terms of their combination. Maximum resource productivity signifies an efficient utilization of resources in the production. Therefore, productivity and efficiency are synonymous in this context.



#### *2.10.4 The Concept of Efficiency*

According to Olukosi and Erhabor (1988), efficiency is the quantity of output per unit of input used in the production process. It is concerned with the relative performance of the process used in transforming given inputs into outputs (Mijindadi, 1980). Economic theory distinguishes between two types of efficiency: allocative and technical efficiencies. The degree to which allocative and technical efficiencies are achieved is commonly referred to as production efficiency (Olomola, 1991). According to Onyenweaku (1991), technical and allocative efficiencies are parameters used in measuring economic efficiency. This implies that both production and economic efficiencies are the same and can be used synonymously. Allocative efficiency refers to the concept of in which resources are allocated in the profit maximizing sense so that the marginal value product of the products are equal to their input prices, while technical efficiency is the ability to obtain the highest amount of output with given amounts of factor inputs (Onyenweaku, 1991 and Olomola, 1988).

#### *2.10.5 Measures of Efficiency*

Different methodological approaches used in measuring efficiency are:

- i) measures of farm business performance;
- ii) the average production function;
- iii) the frontier production function;
- iv) the profit function.

Each of these methods has its peculiar problem. The choice of any one of them depends on the nature of available data, resources and facilities available and the functions which the result of the research would serve (Ekele, 1982).

### **2.11 The Structure and Conduct of Milk Marketing**

The structure of market describes how the market is organised and its effect on the competition of the market. Consequently such parameters as number of firms, product differentiation, entry and exit condition as well as the degree to which market information is available to all participants will be used to determine the nature of the market competition.

### 2.11.1 *Marketing Margin Analysis*

Tomek and Robinson (1981) defined marketing margin as the price of a collection of marketing services. The marketing services in this study are in form of commissions paid to cooperatives, transportation, processing, storage, distribution and packaging costs as well as wages to employees of the dairy plant.

Marketing margin shows the fraction of the consumer's expenditure on a commodity that is received by the producer and each of the marketing agencies (Olukosi and Isitor, 1990). The technique was used to give a closer approximation of the market performance.

It is expressed in percentage as thus:

$$\text{Marketing margin} = \frac{\text{selling cost} - \text{cost of purchase}}{\text{selling cost}} \times \frac{100}{1}$$

## **CHAPTER THREE**

### **3.0 METHODOLOGY**

#### **3.1 The Study Area**

This study was conducted in Kaduna state, which lies within the sub-humid agro-ecological zone of north central Nigeria. Different types of crops are grown and the area is conducive for animal production due to its relatively high rainfall, which supports the growth of pasture.

The smallholder dairy project, which consists of the pastoralist, their cooperative associations and the dairy plant, which produce and market dairy product under the name of MILCOPAL (Milk Producers Cooperative Association Limited) formed the study area. The choice of this study area was based on the fact that it is the only project that deals with Fulani cooperative in the whole federation.

#### **3.2 Sampling Procedure**

A sample of 40 male pastoralists (milk producers) from a population of 403 and 60 female pastoralists (milk suppliers) from a population of 592 was randomly selected, from 3 designated milk collection routes. The routes selected were Kagarko/ Kuse, Joga /Kaban and Bango/ Maje. The registered cooperatives sampled were Janjala, Maganda, Iche, Kuse, Joga, Kaban, Bango and Maje. Also one peri-urban producer that is participating in the smallholder programme was selected for the study.

#### **3.3 Data Collection**

Three sets of questionnaires were administered by the researcher with the assistance of the cooperative officials, using interview schedules. Primary data were collected from the pastoralists (males and females) and from the village cooperative association officials in the three routes to enable the researcher analyze the economics of small-scale dairy production under the cooperative

system. Also primary and secondary data were collected from MILCOPAL and NLPD officials at the dairy plant.

The first set of questionnaire comprised information from the pastoralist milk producers and suppliers, concerning mainly their:

- i. Socioeconomic characteristics such as: age, sex, marital status, number of children, occupation, educational background, herding experience, membership of cooperative society and name of cooperative society.
- ii. Production and marketing information such as the scale of production (herd size), production system, number of cows in the herd, number of lactating cows, daily milk off take per cow, calving interval, labour used in grazing, watering, milking, supplementary feeding, drugs and vaccines, source of production inputs, price per litre of fresh milk sold, amount of milk consumed at home, how the milk is sold, equipments used in production, processing, and marketing of milk, mode of payment for milk purchased by MILCOPAL, who controls proceeds from milk sales and the amount realized from milk sales.

The second set of data comprised information obtained through interview of officials of the various village milk producers' association. Information collected include: name of cooperative association, location or area of operation, membership size, date registered, litres of milk supplied weekly to MILCOPAL, quantity of milk supplied to MILCOPAL since formation, methods of milk procurement, mode of payment for milk supplied and commissioned received by the association services rendered to members, .

The third set of data comprised information obtained from the dairy plant. Data collected include: production and marketing information such as quantity of milk procured per week, number of cooperatives registered to supply milk, price per litre of milk procured, mode of payment, transportation cost, labour cost, production inputs, plant installed capacity, achieved output, amount of water, sugar culture and fresh milk used in yoghurt production, electricity consumed, storage facilities, packaging materials cost of providing marketing services and price per litre of yoghurt produced.

Other information collected from the dairy plant includes: services rendered to the cooperatives/pastoralist, problems encountered in the process of procurement, processing and marketing. Data collection covered the 2004/2005 seasons.

### 3.4 Analytical Tools

The tools of analysis used for this study were:-

#### 3.4.1. Descriptive statistics

Statistical tools such as percentage, frequency distribution table, arithmetic means, ratio, and standard deviation were used to achieve objectives (i) (iii) and (vi).

#### 3.4.2. Production Function Analysis:

According to Olayide and Heady (1982) it indicates the technical relationship that exists between inputs and outputs in any production process. Four forms of production function (Linear, Semi-log, Cob Douglas and Quadratic) were used. They were used because they may give result close to that of a typical classical production function.. The signs of the coefficients, the significance of the t-value and the coefficient of multiple determination were used in selecting the lead equation.

For milk production, the dependent variable milk output in litres was specified as a function of three independent variables: Quantity of supplementary feed in Kg/week, Labour in man- hours/week and Number of lactating cows in a herd. This was used for the pastoral milk production. The Cobb-Douglas (double log production) production function was selected for milk production because its coefficient of multiple determination ( $R^2$ ) provide the best fit and it has the highest number of significant variables. The explicit form of the model used in its estimation was:

$$Y = a x_1^{b1} . x_2^{b2} . x_3^{b3} . U$$

In double–log form, the function is

$$\text{Log } y = \text{log } a + b_1 \text{ log } x_1 + b_2 \text{ log } x_2 + b_3 \text{ log } X_3 + \text{log } U$$

Where, Y= milk output in litres per week

$X_1$  = number of lactating cows in a herd

$X_2$  = labour in man–hours/ week

$X_3$  = quantity of feed in kg/week

U = error term

a = constant

$b_1$ – $b_3$  = regression coefficients

This was used to achieve objective (ii)

For yoghurt production, the dependent variable yoghurt output in litres/ week was specified as a function of four independent variables: Quantity of milk procured in litres/week, labour in man hours/week, amount of sugar in Kg/week and culture used in litres per week. The Cobb-Douglas production function was selected because its coefficient of multiple determination ( $R^2$ ) provided the best fit and it has the highest number of significant variables. The explicit form of the model used in its estimation was:

$$Y = a x_1^{b_1} \cdot x_2^{b_2} \cdot x_3^{b_3} \cdot x_4^{b_4} \cdot U$$

In double–log form, the function is

$$\text{Log } y = \text{log } a + b_1 \text{ log } x_1 + b_2 \text{ log } x_2 + b_3 \text{ log } X_3 + b_4 \text{ log } x_4 + \text{log } U$$

Where Y = output of yoghurt in litres/week

$x_1$  = quantity of milk procured in litres/week

$x_2$  = labour in man hours/week

$x_3$  = amount of sugar used in kilograms/week

$x_4$  = amount of culture used in kilograms/week

$b_1$ – $b_4$  = regression coefficients

a = constant terms

U = error term

This was used to achieve objective (iii).

### 3.4.3 Resource Use Efficiency

Efficiency is the quantity of output (Y) per unit of input (X) used in the production process. It is the average physical product (APP). It is measured as

$$APP = \frac{Y}{X}$$

Where APP = Average Physical product

Y = output

X = input

Also efficiency ratio (r) will be used to determine whether resources are efficiently utilized, under utilized or over-utilized.

The ratio is given as

$$r = \frac{MVP}{MFC}$$

Where r = Efficiency Ratio

If r = 1, it implies that resources are most efficiently utilized.

r > 1, it implies that resources are under utilized.

r < 1, it implies that resources are over utilized.

MVP = Marginal Value Product

MFC = Marginal factor Cost (Cost/unit input)

MVP<sub>x</sub> can be obtained from

$$MVP_x = MPP_x P_y$$

$$MPP_{xi} = \frac{dy}{dx_i} = \frac{b_i \bar{Y}}{\bar{X}_i}$$

Where  $\bar{Y}$  = arithmetic mean of output

$\bar{X}_i$  = arithmetic mean of inputs  $i^{\text{th}}$

$b_i$  = estimated regression coefficient of the  $i^{\text{th}}$  input

$MPP_{xi}$  = marginal physical product of input  $x_i$

$P_y$  = unit price of the output

This was used to achieve objectives (ii) and (iv) of the study.

### 3.4.4 Marketing Margin Analysis

The marketing margin analysis shows the percentage of consumers spending that goes to the producer. It is calculated as follows:

$$\text{Marketing margin} = \frac{\text{Selling cost} - \text{Cost of purchase}}{\text{selling cost}} \times \frac{100}{1}$$

The tool was used to achieve objective (v) of the study.

### 3.4.5 Net Farm Income Analysis

The net farm income shows the total sales less the total cost of production (variable and fixed cost). Calculated as follows:

Net Farm Income (NFI) = Gross Income (GI) - Total cost (TC).

The model for its estimation is

$$NFI = Y.P_y - \sum PX_i X_i - \sum FK$$

NFI = Net Farm Income

Y = Total product or output

P<sub>y</sub> = Price Per unit of product

X<sub>j</sub> = Quantity of variable inputs used

P<sub>xj</sub> = Price per unit of variable inputs

FK = Cost of fixed inputs

Σ = Summation sign

This was used to achieve objectives (ii) and (v) of the study.

## 3.4 Hypotheses Test

The first two hypotheses- there is no relationship between milk production and inputs used and there is no relationship between yoghurt production and inputs used- were tested based on the significant value of 't-cal.' and F-ratio obtained from the regression analysis, while the last two hypotheses – milk production and yoghurt production are not profitable - were determined as follows:

$$t = \frac{Ra - Ca}{S.E}$$



Where

Ra = average revenue,

Ca = average cost,

S.E = standard error.

The standard error was calculated using:

$$S.E = \sqrt{\frac{S^2r}{n_1} + \frac{S^2c}{n_2}}$$

Where:

S<sup>2</sup>r = variance of revenue

S<sup>2</sup>c = variance of cost

n<sub>1</sub> and n<sub>2</sub> = sample sizes of revenue and cost respectively.

## **CHAPTER FOUR**

### **4.0 RESULTS AND DISCUSSION**

Chapter four presents and discusses the results of the study. The chapter is divided into six sections. The first section describes the socioeconomic characteristics of the pastoralists Milk producers and suppliers in the smallholder dairy cooperatives, while the second section estimates the production function, resource use efficiency for smallholder milk production and profitability of milk production. The third section describes milk procurement and processing under the dairy cooperatives. The yoghurt production function estimation and resource use efficiency for MILCOPAL is presented in the fourth section. Section five evaluates the profitability and marketing margin of yoghurt in the study area. Section six examines the problems associated with milk production, processing and marketing under the smallholder dairy cooperatives of MILCOPAL.

#### **4.1 Socioeconomic Characteristics of the Pastoralists Milk Producers and Suppliers in the Smallholder Dairy Cooperatives**

The pastoralists in the cooperatives are classified in to two by MILCOPAL. The first category which consists of the male pastoralists is called the milk producers. This is because they own the cows or the means of production. The second category consists of the females or wives of the pastoralists are called the milk suppliers. This is simply because they own the milk produced by the family and control the proceeds generated from its sale.

The socioeconomic characteristics of the pastoralists milk producers are summarized in Table 4.1

Table 4.1: Socioeconomic characteristics of the milk producers

S/No	Characteristics	Frequency	Percentage
1.	<u>Age (Years)</u>		
	21 – 30	2	5.0
	31 – 40	5	12.5
	41 – 50	19	47.5
	51 – 60	9	22.5
	Above 60	5	12.5
	<b>Total</b>	<b>40</b>	<b>100%</b>
2.	<u>Number of Wives</u>		
	1	4	10.0
	2	23	57.5
	3	11	27.5
	4	2	5.0
	<b>Total</b>	<b>40</b>	<b>100%</b>
3.	<u>Number of children</u>		
	0 – 5	11	27.5
	6 – 10	17	42.5
	11 – 15	9	22.5
	16 – 20	3	7.5
	<b>Total</b>	<b>40</b>	<b>100%</b>
4.	<u>Education</u>		
	Qur'anic Education	40	100.0
	Adult Education	4*	10.0
	Primary education	2*	5.0
	<b>Total</b>	<b>46*</b>	<b>115* %</b>
5.	<u>Membership of Association</u>		
	Maganda/Kagarko	5	12.5
	Kuse	5	12.5
	Iche	5	12.5
	Janjala	5	12.5
	Kaban	5	12.5
	Joga	5	12.5
	Maje	5	12.5
	Bango	5	12.5
	<b>Total</b>	<b>40</b>	<b>100%</b>
6.	<u>Herd Size</u>		
	20 – 50	14	35.0
	51 – 80	19	47.5
	81 – 110	6	15.0
	111 – 140	1	2.5
	<b>Total</b>	<b>40</b>	<b>100%</b>
7.	<u>Years of cattle rearing experience.</u>		
	0 – 15	19	47.5
	16 – 30	7	17.5
	31 – 45	4	10.0
	46 -60		
	<b>total</b>	<b>40</b>	<b>100%</b>

Source: field survey data 2004/2005.

\*Multiple responses n>40.

**Age structure:** Age distribution of the respondents ranges between 29 and 65 years. 82.5% of the respondents were above the age of 40 years while the remaining 17.5% were below 40 years. This shows that more than half of the respondents are of old age (above 40 years age); they therefore require a lot of extension work to accept innovations that will improve performance of their animals.

**Sex:** The male respondents were the producers. They own the cows (means of production) that were used in the production of milk and beef.

**Marital status:** The entire males interviewed were married with about 80% having more than one wife. They also have children ranging from 2 and 19 in number. 70% of the male respondents have less than 10 children, while only 30% of the respondents have more than 10 children. This implies that the Fulanis have fairly large families for labour supplies on the field and it serves as a measure of prestige among the Fulanis.

**Educational level:** All the respondents interviewed have Islamic or Qur'anic education. Only the secretaries to the village milk producers cooperatives limited (VMPCL) attended primary schools or adult literacy classes. This represents only 15% of the respondents; there is therefore low level of literacy among the pastoralists.

**Membership of cooperative societies:** All the 40 respondents belong to their village milk producers association. The associations should serve as avenues through which the pastoralists can be contacted.

**Herd size and structure:** The number of animals in a herd ranges between 22 and 135. Average herd size 61 animals per herd. The breeds of cattle mostly kept are the white Fulani. The herd composition on the average consists of 50% lactating cows, 24% calves, 15% heifers, 10% breeding and working bulls and 1% castrates. This implies that the Fulanis in the study area are interested in the production of more calves and milk in their herds. Increase in the herd size is one of the motives behind keeping large number of cows and heifers.

**Years of cattle rearing experience:** Cattle rearing experience ranges between 16 and 50 years, with an average of about 35 years. 25% of the respondents have less than 15 years of cattle rearing experience, while the remaining 75% have more than 15 years rearing experience. This implies that majority of them are experienced cattle producers.

The socioeconomic characteristics of the pastoralist milk suppliers are presented in table 4.2

Table 4.2: Socioeconomic characteristics of the pastoralist milk suppliers

S/No	Characteristics	Frequency	Percentage
1.	<u>Age (Years)</u>		
	11 – 20	8	13.33
	21 – 30	26	43.33
	31 – 40	13	21.67
	41 – 50	9	15.00
	Above 50	4	6.67
	<b>Total</b>	<b>60</b>	<b>100%</b>
2.	<u>Marital status</u>		
	1. Unmarried.	15	25.00
	2. Married.	45	75.00
	<b>Total</b>	<b>60</b>	<b>100%</b>
3.	<u>Education</u>		
	Qur'anic Education	60	100.00
	Primary education	2*	3.33
	<b>Total</b>	<b>62*</b>	<b>103.33* %</b>
4.	<u>Membership of Association</u>		
	Maganda/Kagarko	8	13.33
	Kuse/Iche	8	13.33
	Janjala	12	20.00
	Kaban	8	13.33
	Joga	8	13.33
	Maje	8	13.33
	Bango	8	13.33
	<b>Total</b>	<b>60</b>	<b>100%</b>
5.	<u>Weekly milk supply in litres</u>		
	2 – 10	31	51.67
	11 – 20	18	30.00
	above 20	11	18.33
	<b>Total</b>	<b>40</b>	<b>100%</b>

Source: field survey data 2004/2005.

\*Multiple responses, n > 60.

**Age structure:** Age distribution of the respondents ranges between 11 and 58 years with an average age of 30 years. 56.66% of the sample were below 30 years, while 43.34 were above 30 years. The suppliers are younger than the producers.

**Sex:** The females (Fulani maids) are called the suppliers because they own the milk supplied and control the proceeds from its sale.

**Marital status:** About 75% of the females interviewed are married with about 25% unmarried.

**Educational level:** All the respondents interviewed have Islamic or Qur'anic education. Only 2% attended nomadic primary school.

**Membership of cooperative society:** All the 60 suppliers belong to their village milk producers association.

**Weekly milk supply, Marketing and control of proceeds from the sale:** This is done by the women or suppliers. A husband must give his wife the milk or risk his marriage. Non married women obtain milk from their parents. From table 4.1 about 51% of the respondents supplied less than 10 litres of milk weekly, while the remaining 49% supplied more than 10 litres per week. What the women realized from the sale of milk is used in buying cooking ingredients such as salt, cooking oil and other house needs. The women also buy the containers in which they carry the milk. The most commonly used containers are calabashes of various sizes, plastic buckets and metal bowls.

Milk collected is usually sold to The Milk Cooperative Producer Association Limited (MILCOPAL), hence no processing is required. Milk is only processed into butter, sour milk or boiled, on the days when procurement officers are not available. The women are paid N30.00 per litre of milk supplied to MILCOPAL, at the collection centres.

## **4.2 Production Function Estimation and Resources-Use Efficiency for Milk Production by the Smallholder Pastoralists**

### *4.2.1 Production Inputs in Smallholder Milk Production*

*Labour Inputs:* Labour is a very important input in small holder pastoralist system. Labour is required for the following: grazing, watering, milking, supplementary feeding, security and medication.

The number of hours spent for any of the activities listed above depends largely on the size of the herd and the time of the year. The average number of hours spent for grazing and watering during the rainy season is about 8 hours per day, while during the dry season it is about 10.5 hours. The number of people allocated to a herd depends on the size of the herd and the season. One person can take out 40 cows for grazing during the dry season, while two people are required during the rainy season for that number because of their closeness to farms then. Livestock production requires a higher amount of labour in the months of July to November because the herd requires a great deal of supervision to prevent crop damage at this time.

During the dry months of March to May, there is an increase in cattle labour because of the need to water the animals from wells or far away streams and to graze them farther away from the compounds.

Children do almost all the herding (92%) as reported by 80% of the respondents. About 15% of the respondents use a combination of hired and family children labour while 5% use mainly hired labour.

At six to seven years age, a child becomes a full-time herder beginning with small stock. Children start herding calves, by eleven years. Children particularly boys, start herding cattle initially as apprentices to an older herder. Normally cattle herding is a supervisory activity as the animals know the way and set the pace. Herders follow the animals keeping them from straying and watching for predators.

Girls also do more small stock and calf herding and less cattle herding than boys. The survey shows that some children attend nomadic schools. They only participate in grazing activities during the weekends or when schools are on break. In families where there are many children, they share the grazing days. While some are on duty others are off.

The pastoralists using hired labour are those who do not have enough male children to do the grazing or those who send their children to qur'anic or nomadic schools. Amount paid for hired labour varies. The usual practice by the pastoralist is to pay wages in kind. The hired labourer is paid at the end the year with a 2 year-old bull, free accommodation and feeding. The bull can be averagely sold for ₦ 15,800.00. The males do milking in the morning, which lasts for about an hour. Supplementary feed is given in the morning before the animals are taken out for grazing during the dry season. The adult males in the family provide security for the animals during the night hours.

Other inputs required in the production of milk include: Ropes, fencing wire or stick, calabash or plastic containers, sticks and pegs.

*Source of capital for production:* None of the respondents reported ever obtaining loan from any bank. They however, reported obtaining production input such as cotton seedcake during the dry season on credit basis from MILCOPAL. Their source of capital is from the sale of livestock such as chickens, goats, sheep, eggs, cows and grains, which they produce.

*Veterinary drugs and supplies:* The pastoralists in most cases source for veterinary drugs in the open market while some patronize the farmer organization of MILCOPAL. The total cost incurred by a pastoralist per annum for treatment of his animal depends on the disease condition of the herd. On the average, cost incurred for treatment of a herd is about N23, 840.00 per annum. However, the animals are being vaccinated every year by the various local government authorities and MILCOPAL. The most commonly reported cases of disease are worm infestation, trypanosomiasis, mastitis, Kirchi and Brucellosis. The vaccines used are Black Quarter Vaccine (BQV). Tissue Culture Rinderpest Vaccine (TCRV) and Contagious Bovine Pluero Pneumonia (CBPP).



Cost of deworming an animal is ₦80.00, antibiotic (L.A. injection), ₦60.00, BQV and CBPP are ₦40.00 per animal.

There are more reported cases of sickness in the rainy season than during the dry season. The NLPD usually provides emergency mobile clinic services wherever there is a case of disease outbreak.

During the year 2004, veterinary drugs worth N142, 250.00, salt lick worth N6, 000.00 were sold to the association members and private individuals by MILCOPAL. Table 4.3 shows the drugs purchased by each association in the year 2004.

**Table 4.3: Drug purchased by each association in the year 2004**

Association	Veterinary drugs	Dose	Amount ₦/association
Gwaraji	Dewormer, sulphur drugs	279	18,250.00
	Minerals salt lick	6 blocks	1,200.00
Joga	Trypanocide, dewormer	788	43,500.00
	mineral salt lick	3 blocks	600.00
Amana	Dewormer, trypanocide, antibiotic	291	15,350.00
Kaban	Mineral salt lick	4 blocks	800.00
	Trypanocide, dewormer	712	41,200.00
Gadangayan	Mineral salt lick	16	3,200.00
	Trypanocide, dewormer	blocks	2,100.00
Bango	Antibiotic, ectoparasiticide	41	9,350.00
	Trypanocide, dewormer, antibiotic	133	4,200.00
Maje	Mineral salt block	110	200.00
Kuse	Trypanocide, dewormer	1 block	8,300.00
	antibiotic	178	
Total		2,532	142, 250.00
		Dose	
		30 blocks	6,000.00

Sources: quarterly reports of the dairy unit, 2004.

Also in the year 2004, ambulatory services were carried out by the dairy unit for the treatment of 2,532 cattle of association members at Kuse, Gadan Gayan, Bango, Joga, Kaban, Gwaraji, Maje and Amana. The dairy unit also embarked

on enlightenment campaign on grazing management, feed supplementation, milk hygiene, tick control and deworming in the year 2004.

Table 4.4 shows the number of animals treated per association under the animal health and extension programme of the NLPD in 2004.

**Table 4.4: Number of animals treated in the year 2004.**

Association	Cattle treated
Gwaraji	279
Joga	788
Amana	291
Kaban	712
Gadan Gayan	41
Bango	133
Maje	110
Kuse	178
<b>Total</b>	<b>2532</b>

Source: quarterly reports of dairy unit, 2004.

*Livestock supplementary feed:* The result of the study shows that all the respondents give supplementary feeds to their animals only during the dry season. Only very old and sick cows that cannot graze receive some supplementation during the rainy season. Supplementary feeds given include, cotton seed cake, crop residue, potash, maize bran and in some cases salt lick. During the year 2004, 43.48 tonnes of cotton seed cake, worth ₦ 784,100.00 were purchased by the associations for their members. The pastoralists also purchase some of the feeds from the local markets around. Level of supplementation is very low among the pastoralists. On the average they give about 2kg per day of supplementary feed per animal against the standard of giving animals 3% of their body weight (a matured white Fulani cow averagely weighs 250kg, hence it requires about 8kg supplementary feed per day).

The average cost of supplementary feed per pastoralists in the dry season is about ₦48, 512. Only animals on production (lactating or in their last stage of gestation) are given supplementary feeds in the morning before going for grazing or in the evening when they return. Reasons advanced for this is to ensure survival of the calf as well as revenue from the sales of extra milk produced.

#### 4.2.2 Production Function Estimation and Resources-Use Efficiency for Milk Production by the Smallholder Pastoralists

Production function analysis is used to determine the productivity of the individual factors of production. This section examines the extent to which the independent variables explain the variability of the dependent variable (output). The result of the regression analysis for the small-scale pastoralists shows that, the double-log equation fit well for their system of production.

**Table 4.5: Estimated double–log production function for smallholder milk production**

Variable	Regression coefficient	Standard error	t-value
Number of Lactating cows $X_1$	0.522	0.130	3.999*
Feed $X_2$	0.276	0.125	2.206*
Labour $X_3$	0.179	0.069	2.587*
Constant	0.570	0.208	2.743*

$R^2 = 0.87$

F= value = 88.20\*

\* = significant at 1% level of probability.

The other production functions tried were rejected based on the fact that the double-log function has a higher  $R^2$  value and the highest number of significant variables. From Table 4.5, the three variables - number of lactating cows, feed and labour are all significant at 1% level of probability. The adjusted coefficient of multiple determination -  $R^2$  indicated the percentage of the variations in the observed dependent value that is explained by the fitted regression equation. The  $R^2$  adjusted value obtained is 0.87. This indicates that the independent variables – number of lactating cows, feed and labour explained, on the average, 87 percent of the variation in the output of milk. The unexplained variation in milk output is obviously due to other inputs not specified in the model.

The F- ratio presented in Table 4.5 measures the joint significance of all the explanatory variables in the model. The value obtained is 88.20, which is significant at 1% level. This implies that, the included explanatory variables

together, significantly explain variation in milk production. This led to the rejection of the null hypothesis, which states no relationship between milk production and the three inputs used.

The regression coefficient with respect to each of the explanatory variables and their t- value are also presented in Table 4.5. The regression coefficients show the extent to which variation in independent variables explains variation in the dependent variable. The t-values are used to test the significance of the coefficients.

The selected equation being a Cobb-Douglas function, it implies that the regression coefficients represent the elasticities of production with respect to its corresponding variable. The regression coefficient and elasticity of production with respect to the number of lactating cows, feed and labour are 0.0522, 0.275 and 0.179 respectively. These values are significant at 1% level. This implies that a 1% increase in the number of lactating cows, feed and labour will increase the amount of milk obtained by 0.522, 0.276 and 0.179 percent respectively. These values are all less than one, which implies that they are all inelastic and a 1% increase in any of the inputs will increase output of milk by less than 1%.

On returns to scale, when all the inputs are changed simultaneously by 1 percent, the sum of the elasticities of production with respect, to all the inputs is 0.977. This implies that there is almost an equal increase in output from equal increase utilization of the inputs (constant returns to scale). There is therefore the need for increase in the utilization of the inputs, since milk production is secondary; the primary motive of production is Beef production and the survival of the calves.

#### *4.2.3 Resource - Use Efficiency for milk production*

Efficiency ratio ( $r$ ) was used to determine whether the resources are efficiently utilized, under utilized or over utilized. Table 4.6, gives the marginal physical

product (MPP), marginal value product (MVP), marginal factor cost (MFC) and the efficiency ratio (r) of the inputs.

**Table 4.6: MPPs, MVPs, MFCs, and efficiency ratio(r) of variables in milk production**

Input	MPP= $b_i \bar{y} / \bar{x}_i$ Litre/unit input	MVP= MPPxPy (₦)	MFC (₦)	Efficiency = MVP/MFC
<b>Number of lactating cows</b>	6.400	192.00	23,350.00	0.0082
Feed	0.180	5.40	11.00	0.5000
Labour	0.152	4.56	4.86	0.9400

A given resource is optimally allocated if its marginal value product is just sufficient to offset its cost. The basic condition that must be satisfied to obtain efficient use of resources is the equality of MVP to MFC. The values of the efficiency ratio for lactating cows, feed and labour are 0.0082, 0.50 and 0.94 respectively. All the values are less than one, which implies over utilization of resources. The result means an increase in extra unit of the inputs will not yield revenue sufficient enough to offset the cost. This calls for reduction in the utilization of the inputs if milk is considered as the only output from the production process.

#### 4.2.4. *Net Farm Income Analysis*

This section gives a summary of the cost and returns of the small-scale pastoralists (milk producers) and consequently the gross margin and the net farm income. The gross margin is obtained by subtracting the variable costs from the total revenue, while the net farm income is obtained by subtracting fixed cost elements from the gross margin.

It is difficult to isolate the cost of milk production in a traditional system of production (Nwoko, 1986). Reasons advanced include: milk is regarded as secondary rather than a primary product, cattle are fed through the free range system or on the stubble of harvested crops which may not necessarily belong

to the owner of the herd and the fixed cost component form a negligible fraction of total costs.

The average values obtained from the descriptive statistic was used to calculate the net farm income. The average number of cows lactating in a herd was 30 cows, average feed used was 607.38kg /week, average labour was 60.50 man hours/ week and milk output was averagely 368.98 litres/ week.

**Table 4.7: Net farm income statement for milk production for 30 lactating cows/ week**

Items	Unit Produced	Price Unit (₦)	Total (₦)
A. Output (fresh milk)	368.98 Litres	30.00	11,069.63
Cost	<b>Unit Used</b>		
B. Variable Cost			
Feed	607.38Kg	11.00	6,681.18
Labour	60.5Manhours	4.86	294.03
Medication			142.60
Total variable cost.			7117.81
C. Fixed Cost			
Calabash			2.50
Stick			0.50
Ropes			15.00
Feeding/watering trough			5.00
Local fencing			20.00
Depreciation on cows			923.08
Total fixed cost.			966.08
D. Total cost = (B+C)			8,083.89
E. Gross Margin GM = ( A – B )			3,951.82
F. Net Farm Income			
NFI = A – (B+C)			2,985.74
Average rate of return			
ARR = NFI/Total Cost			0.37

Source: field survey, 2004/2005.

The net farm income as shown on table 4.7 is ₦ 2,985.74 while gross margin is ₦3, 951.82. The farmer's average rate of return is ₦0.37. Therefore, pastoral milk production is profitable. Variable costs account for 88% of the total cost of production, while the fixed cost component is 12%.

#### 4.2.5. Significance of the Difference between Revenues and Costs in Milk Production

The significance of the difference between revenues and costs in milk production was used in testing null hypothesis (3) of the study – milk production is not profitable.

Table 4.8 shows the difference between revenues and costs in milk and yoghurt production.

**Table 4.8: Significance of the Difference between Revenues and Costs in Milk Production.**

Estimate	Milk production	
	Revenue(₦)	Cost(₦)
Minimum	3,528.00	1,900.00
Maximum	27,300.00	18,900.00
Average	11,069.63	8,083.89
Std. deviation	5,312.72	3,588.19
Std. error	840.02	567.34
Difference (profit)	2985.74	
t – statistic	5.629*	
t – critical	2.426	

Source: field survey, 2004/05

\* Significant at 1% level of significance.

Decision rule: the value of t-statistic (5.629) > the value of t-critical (2.426), hence the null (Ho) hypothesis is rejected. Therefore, pastoral milk production is profitable.

### 4.3 Milk Procurement and Processing under the Smallholder Cooperative

The pastoralists used for this study were mobilized to form village milk producer associations, by the dairy unit of the National Livestock Production Division (NLPD). Thirty-six (36) village milk producer cooperative associations were formed from inception of the programme in 1987 to date. However, at the time of this study the number of associations that sell milk to MILCOPAL are 8 and 1

peri-urban producer. These associations are: Kagarko (Maganda), Janjala, Kuse and Iche all in Kagarko local government area. The rest are Joga, Kaban, Maje and Bango in Igabi local government area. The peri-urban producer is from Sabon Birni also in Igabi local government. Each association has an elected chairman, vice chairman, treasurer and secretary who serve as the administrative head of the association. The secretary being the only paid staff of the village cooperative association receives ₦1, 000.00 monthly from the commission generated. The secretary is responsible for recording the amount supplied by each milk supplier (woman) in his ledger. This helps in the preparation of delivery notes which paves way for payment.

Leaders of the associations also represent their members and decide on their behalf during meetings with MILCOPAL. They also procure inputs and medications from the farmer organization of MILCOPAL for interested members. Other activities carried out by the associations with the commissions generated include: road and culvert repairs, construction of classrooms for their children's education, awareness campaign on acceptance of cooperative milk supply, maintenance of milk hygiene and non adulteration of milk. Some of the secretaries also teach in their nomadic schools and participate in polio vaccination programme.

Fresh milk used by MILCOPAL for yoghurt production is sourced from the pastoralists who were mobilized into groups of cooperative dairy producers association at village level. The procurement department of MILCOPAL usually sends its staff in the morning to the various milk collection routes. Table 4.9 shows the routes usually followed, associations involved and their approximate distances from the dairy plant.



**Table 4.9: Procurement Routes, Associations involved and their Distances from the Dairy Plant**

S/no.	Milk collection routes.	Producer associations involved.	Approximate distance in km
1	Gadan Gayan route	Bango, Maje and Amana	40
2	Kaban/ Joga route	Kaban, Joga and Gwaraji.	80
3	Kagarko/ kuse route	Kagarko (maganda), Kuse, Iche, Janjala and chinka	150
4	Kachia milk route	Kallah, Kajuru and Kachia	135
5	Zaria milk route	Tankarau, Hanwa and B/ yaro.	65
6	Birnin gwari route.	Buruku, Kuriga and B/gwari.	140
7	Sabon Birni route.	One peri-urban producer	35

Source: field survey, 2004/2005.

Gadan Gayan (maje/bango), Kaban/Joga, Kagarko/Kuse and the Sabon Birni milk routes are the most promising routes, because they supply milk throughout the year. Other routes have not supplied milk to MILCOPAL since 2003.

Table 4.10 shows the total milk supplied, revenue received, and commission collected by each association from January 2004 to April 2005.

**Table 4.10: Total Milk Supplied, Revenue and Commission Received by the Associations.**

S/NO	ASSOCIATION	MILK SUPPLIED IN LITRES	Revenue ₦30/litre	Commission ₦2.00/LITRE
1	Kagarko	48,191.50	1,445,745	96,383.00
2	Kuse	24,734.50	742,035	49,469.00
3	Janjala	33,440.00	1,003,200	66,880.00
4	Chinka	5,442.50	163,275	10,885.00
5	Kaban	10,708.00	321,240	21,416.00
6	Joga	11,006.00	330,180	22,012.00
7	Amana	2,367.50	71,025	4,7244.00
8	Bango	6,122.00	183,660	12,244.00
9	Maje	15,006.00	450,180	30,012.00
10	Sabon Birni	2,714.00	81,420	Jan-April
	Total	159,732.00	4,791,960	319,464.00
	Average	15,973.20	4 79,196	31,946.40

Source: - field survey, 2004/2005

From table 4.10, nine associations and one peri-urban producer supplied a total of 159,732 litres of fresh milk; this gives an average of 15,973.20 litres per association. The associations in all received revenue of ₦4, 791,960.00 and a commission of ₦319, 464.00 for the milk supplied. Average revenue and

commission received was ~~N~~479, 196.00 and ~~N~~31, 946.40 per association respectively. The revenue goes to the various association members that supplied the milk, while the commission goes to the association for paying their secretaries and carrying out development programmes in their areas. The price per litre of fresh milk procured is ~~N~~30.00 and a ~~N~~2.00 commission is paid to the village association. To the MILCOPAL, price paid per litre of fresh milk is therefore ~~N~~32.00 (milk cost and commission inclusive).

Procurement staff with the company vans leave as early as 6.00am to their procurement centers. In the dry season, due to relatively lower output of the Fulani cows two vans were used to procure milk while three vans were used in the rainy season. They (procurement officers) spend 6 hours when on the short routes (Gadan Gayan and Sabon Birni routes), and they may have to spend about 9-10 hours on longer routes such as the Kagarko/Kuse and Kachia routes. Fuel consumption by the procurement vehicles is between ~~N~~1, 400.00 for the short route and ~~N~~2, 400.00 for the longer route daily.

The milk suppliers (Fulani maids) converge with their milk at the designated milk collection centres every morning. The federation staff use some measures to ensure that only high quality milk is accepted. The milk is subjected to organoleptic test using sensory organs (eyes, nose and tongue) to test for the presence of dirt, blood cells, odour or smell and sourness of the milk. Lactometer test is also used to check for adulteration, especially where water is added.

Milk supplied by each woman is measured and filtered into the milk collection churn. Each churn takes up to 50 litres of fresh milk. The women are not paid immediately but on weekly basis. They are given a passbook on which the daily milk collected is recorded. The procurement officers also have a ledger on which names of suppliers and amount supplied are recorded. The association secretaries also have their own books for record purposes. It is from these records that delivery notes are prepared for each association to pave way for payment. Milk is collected five times in a week from the pastoralists. On the remaining days, pastoralists' women process their milk and sell in the

neighbouring villages, markets, or to the wholesalers. Prices of dairy products are higher in the markets (N50.00 /litre) than those obtained from the MILCOPAL (N30.00/litre).

Milk procured is then transported to the dairy plant, where alcohol test is carried out to ascertain the suitability of the milk for further processing. Certified milk is then steam heated for about two hours at the plant. For longer routes such as Kagarko/ Kuse, milk is steam heated at Kuse centre to avoid spoilage while on transit. The village cooperative secretary at Kuse carries out the boiling process for a fee.

Immediately after milk procurement, Alcohol test is carried out at the dairy plant to ascertain its ability to withstand heat treatment. After the tests, the milk is passed for pasteurization by raising its temperature to about 75-80<sup>0</sup>c for about 2 hours. It is then cooled to 40-45<sup>0</sup>c to help kill some of the harmful bacteria in it. At this point, some of it is sold as pasteurized fresh milk or further processed into yoghurt. To process it into yoghurt, the pasteurized milk is inoculated with 2% mixed starter culture of lactobacillus and streptococcus bacteria. It is held at this temperature (40-45<sup>0</sup>c) for 3-4 hours, known as the incubation process. The product is then cooled, filtered and sugar is added before packaging or storage.

#### **4.4 Yoghurt Production Function Estimation and Resource - Use Analysis of MILCOPAL**

Production and processing of yoghurt were used interchangeably in this context. Milk is processed into various dairy products (yoghurt, pasteurized fresh milk and butter) by the MILCOPAL, but the most important of the products is yoghurt which accounts for 90% of total output of the plant. The production function analysis was used to determine the productivity of the individual factors of production.

This section, therefore, examined the extent to which the independent variables (milk, labour, sugar and culture) explain the variability of the dependent variable (yoghurt output). The result of the regression analysis for the dairy unit shows

that the Cobb-Douglas equation fit well based on the number of significant variables and its coefficient of multiple determination for the unit.

Table 4.11, presents the regression result from the Cobb-Douglas equation.

**Table 4.11: Estimated Cobb-Douglas Production Function for Yoghurt Production.**

<b>Variables</b>	<b>Regression coefficients</b>	<b>Standard error</b>	<b>t-Value</b>
Milk $X_1$	0.0662	0.028	2.332**
Labor $X_2$	0.273	0.132	2.064**
Sugar $X_3$	0.055	0.043	1.281***
Culture $X_4$	0.559	0.119	4.697*
Constant	1.788	0.130	13.734

$R^2 = 0.84$

F – Value = 217.214\*

\*\*\* =Not Significant.

\*\* = Significant at 5% level of probability

\* = Significant at 1% level of probability

The other production functional forms tried were rejected based on the fact that the Cobb-Douglas production function has a higher adjusted coefficient of multiple determination ( $R^2$ ) and a higher number of significant variables. From table 4.11, two variables – milk and labour are significant at 5%, culture is significant at 1%, while sugar is not significant. The adjusted coefficient of multiple determination  $R^2$  value of 0.84 implies that the independent variables included in the model explained on the average, 84% of the variation in the output of yoghurt.

The F-ratio, also presented in table 4.11 is a measure of joint significance of all the explanatory variables in the model. The value of this ratio is 217.214, which is significant at one percent (1%) level. This implies that, the included explanatory variables taken together, significantly explain variation in yoghurt output, hence the null hypothesis which states no relationship between yoghurt production and inputs used is rejected.

The regression coefficients also represent the elasticity of production with respect to the corresponding variables. The regression coefficients with respect to milk, sugar, culture and labour are 0.0661, 0.055, 0.559 and 0.273 respectively. This implies that they are inelastic and a 1% increase in milk, sugar, culture and labour will increase the output by less than 1%.

#### 4.4.1 Resource Use Efficiency of MILCOPAL in Yoghurt Production

The resource use efficiency measures how proportionate resources are used in production. Table 4.12, shows the resource - use efficiency in yoghurt production.

**Table 4.12: Resource - Use Efficiency in Yoghurt Production**

<b>Inputs</b>	<b>MPP= <math>b_i \bar{y} / \bar{x}_i</math></b> Litre/unit input	<b>MVP= MPPxPy</b> <b>(₦)</b>	<b>MFC</b> <b>(₦)</b>	<b>Efficiency =</b> <b>MVP/MFC</b>
Milk	0.11	13.75	32	0.43
Labour	6.32	790	258.3	3.10
Sugar	0.70	87.5	76	1.15
Culture	6.86	857.5	142	6.04

The result in table 4.12 shows that milk with efficiency ratio of 0.43 is over utilized meaning that the amount being used is probably too much, hence the need to take measures that will improve its utilization. The remaining inputs – sugar, culture and labour with efficiency ratios of more than one are under utilized. This calls for expansion of production through the use of more sophisticated machines, to replace manual operations that currently dominate at the plant.

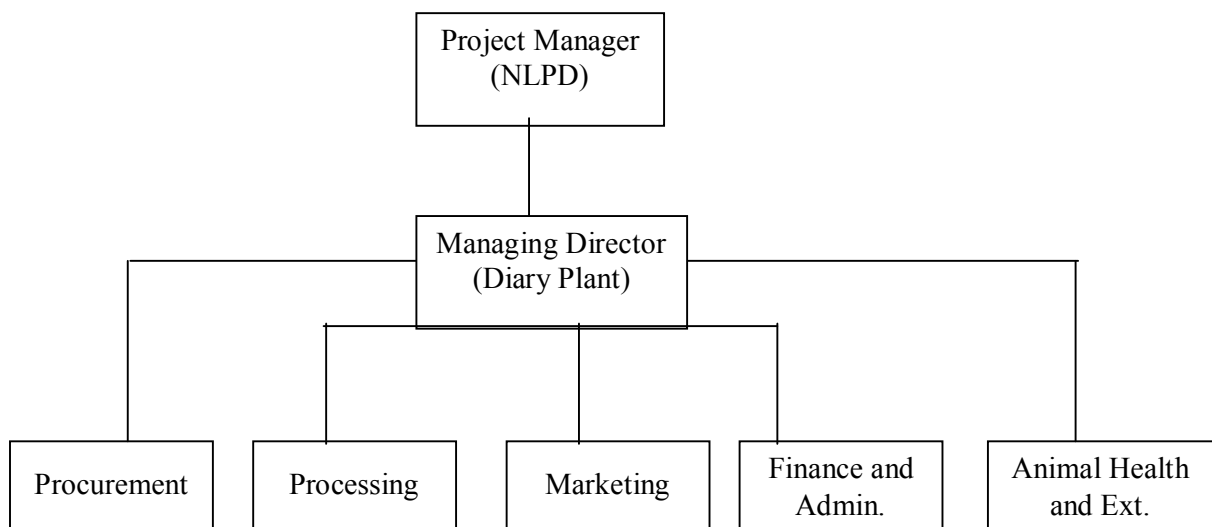
#### 4.4.2 Resource - Use Situation in the Dairy Plant

The Kaduna pilot dairy is essentially a dairy development programme aimed at encouraging the indigenous rural based pastoralists to produce milk above their household consumption requirements, and pool the excess together for collective processing and marketing. This is within a cooperative set up, which is by design, to be owned and operated by the pastoralists themselves. Under the current pilot stage, the staff used in the dairy processing plant are divided

into two categories. The first category of staff are seconded from the National Livestock Production Division (NLPD), while the second category belongs to the Milk Cooperative Producer Associations Limited (MILCOPAL). The first category is the management staff which are under the payroll of the NLPD, while the second are the operational and junior staff under the payroll of MILCOPAL. The plant is divided into the following sections each headed by a manager.

- i. Procurement section
- ii Processing section (quality control and processing)
- iii Marketing section
- iv Finance and administration
- v. Animal health and extension.

Figure 1 presents information on the organizational structure of the dairy plant.



**Figure 2: organizational structure of the dairy (MILCOPAL)**

#### 4.4.2.1 Labour

There are in total 58 staff in the dairy plant. However, in this study, only the actual staff involved in procurement processing and marketing are considered, to give a better picture of the cost and returns analysis. The units concerned are the procurement with 2 staff (procurement officers), processing unit with 5 staff

and the marketing section with 10 staff. They receive an average monthly salary of ₦16, 825.67. The workers directly concerned with milk processing put in on the average, 195 man-hours per week. Therefore a man-hour costs ₦ 21.57.

#### 4.4.2.2 Raw Materials

The major raw material for yoghurt production is fresh milk. It is sourced from the Fulani cooperative associations. Imported commercial powdered milk is used to supplement the reduced amount of fresh milk obtained during the drier months of February to June. The break down of the quantity supplied of fresh milk and powdered milk and their costs is given in table 4.13.

**Table 4.13: Fresh Milk and Powdered Milk Supplied for Yoghurt Production at MILCOPAL in year 2004 – April 2005**

Supply source	Quantity (L)	Mean supply/ Week (L)	Cost in ₦	Percentage (%)
Fulani cooperative	159,067	2,524.87	5,090,144	58.36%
Powdered milk	113,477.75	1,801.23	3,631,288	41.64%
Total	272,544.75	4,326.10	8,721,432	100.00

Source: field survey data, 2005.

A total of 272, 544.75 litres of fresh milk and its liquid equivalent worth ₦ 8,721,432.00, was supplied to the processing plant within the study period. Out of this, 159,067 litres, worth ₦5, 090,144 representing 58.36% was supplied by the local Fulani cooperatives, while 113,477.75 liquid equivalent of powdered milk worth ₦3, 631,288 (41.64%) was supplied from the market. Other inputs like sugar, culture water, and firewood are procured depending on the need.

During the period under review, a total volume of 297,240.87 litres of yoghurt was produced, with an average volume of 4718.11 litres per week. The production process is done with some improvised machines operated manually due to the breakdown of the major processing plant.

Equipment used in production includes: locally fabricated vat (pasteurization vat), sealing machine, cream separator, milk and butter churns, hand plungers, stainless steel buckets, incubator, starter culture spoon and water trough for

boiling milk. The factory has an installed capacity of handling 18,000 litres of milk daily, but due to the obsolete nature of the machines, the only functional part can handle only 1500- 2000 litres of milk per day. Efforts to reactivate the plant was however, put on hold because it will gulp about \$ 2.2m (about N300 million), according to the Danish consultants that initially handled its construction at the sum of ₦700, 000 in 1975.

#### **4.5 Profitability of Yoghurt Production and Marketing Margin in the Study Area**

Yoghurt after production, is passed to the quality control section to ascertain its quality or otherwise. The product is packaged manually in bottles using bottle filler and in sachets using sealing machines. The product line of the MILCOPAL and their various prices is given in Table 4.14.

**Table 4.14: product line of MILCOPAL and their prices in Naira**

<b>Product line</b>	<b>Price (₦)/ litre</b>
330ml yoghurt bottle	50.00
1 litre yoghurt bottle	125.00
2 litres yoghurt bottle	250.00
4 litres yoghurt bottle	500.00
500ml sachet	60.00
Bulk yoghurt	100.00
Pasteurized Fresh milk	90.00
Butter	300.00/kg

Source: field survey data, 2004/2005.

Each yoghurt bottle or sachet has MILCOPAL Logo pasted on it and it comes in different container sizes. The smallest is the 330ml and the biggest is the 4 litres Jar. MILCOPAL sales outlets are four in Kaduna town and environs. They are in Kaduna State Government Secretariat (Independence Way), NLPD headquarters (Yakubu Gowon Way), Unguwar Sarki (Kalanpanzee Road) and at the plant head office (Gidan Madara/ NDC). The dairy plant also has distributors in other areas when demand is low in Kaduna town, especially during the rainy season and during harmattan. Refrigerated vans are used to



reach other states such as: Kano, Yobe, Niger, Katsina and the Federal Capital Territory, Abuja where they have distributors. Occasionally, they attend the Kaduna international trade fair as a promotional strategy. A litre of MILCOPAL yoghurt is sold at N125.00

#### 4.5.1 Net Farm Income Statement of MILCOPAL

The Net farm income statement shows the total cost of production and the profit generated from the sales of a product. It is the gross income from a business less the total cost of production. It helps the entrepreneur to determine the average rate of return from his investment.

Table 4.15, gives the Net farm income for yoghurt production at MILCOPAL.

**Table 4.15: Net farm income statement of MILCOPAL per week**

Items	Unit Prod.	Price (₦)	Unit Total (₦)
<b>A. Output</b>	4,608.65 Litres	125	576,081.24
<b>Cost</b>	<b>Unit Used</b>		
<b>B. Variable Cost</b>			
Milk Used	4,326.11 Ltr.	32	138,435.52
Sugar	373.84 Kg.	76	28,411.84
Firewood	136.20 Kg.	10	1,362.00
Quality Control			6,775.00
<b>Diesel</b>	70.30 Ltr.	60	4,218.00
Maintenance (Plant)			4,405.92
Maintenance (Vehicle)			1,812.00
Fuel	490.5 Ltr.	55	26,977.50
Marketing cost			104,689.00
<b>Total variable cost.</b>			318,086.78
<b>C. Fixed Cost</b>			
Salary			40,968.20
Electricity			2,385.22
Water			1,232.25
Registration (NAFDAC)			1,458.33
Depreciation			12,188.25
<b>Total fixed cost.</b>			58,232.25
<b>D. Total cost = (B+C)</b>			376,319.03
<b>GM = (A - B)</b>			257,994.46
<b>NFI = A - (B+C)</b>			199,762.21
Average Rate of Return ARR = NFI / Total Cost			0.53

Source: field survey, 2005.

From the Net Farm income statement on table 4.15, the Gross Margin per week is ₦257, 994.46 and the Net Farm Income is ₦199, 762.21. This gives the firm an average rate of return (ARR) of 0.53. This implies that for every ₦1.00 invested, there is a return of ₦ 0.53. The variable cost component accounted for 84.53% of the total cost of production, while the fixed cost accounted for only 15.47%.

#### 4.5.2 Marketing Margin Analysis

The marketing margin for yoghurt was calculated using the following:

$$\text{Marketing margin} = \frac{\text{selling cost} - \text{cost of purchase}}{\text{selling cost}} \times \frac{100}{1}$$

From the gross margin analysis on table 4.15, the cost of selling a litre of yoghurt is ₦81.65, while the purchasing cost of fresh milk is ₦32.00. Therefore, the

$$\begin{aligned} \text{Marketing margin} &= \frac{81.65 - 32.00}{81.65} \times \frac{100}{1} \\ &= 60.81\% \end{aligned}$$

The result shows that, the marketing margin is 60.81%. This indicates that 60.81% percent of what the consumer pays goes to the MILCOPAL who process and market the milk supplied by the pastoralists. The village milk producers receive only 39.19% of the consumer's expenditure. The high marketing margin is not unconnected to the fact that, a lot of work in form of procurement, transportation, processing and packaging is carried out on the raw milk to make it available to the consumer at the place, form, time and price he is willing to offer to take possession.

### 4.5.3 Significance of the Difference between Revenues and Costs in Yoghurt Production

The significance of the difference between revenues and costs in yoghurt production was used in testing hypothesis (4) of the study. Table 4.16 shows the difference between revenues and costs in yoghurt production.

**Table 4.16: Significance of the difference between revenues and costs in yogurt production**

Estimate	Yoghurt production	
	Revenue(₦)	Cost(₦)
Minimum	324,282.66	242,826.60
Maximum	744,207.00	452,862.86
Average	576,081.24	376,319.03
Std. deviation	109,131.06	49,118.04
Std. error	14,715.23	6,623.08
Difference (profit)	199,762.21	
t – statistic	22.755*	
t - critical	2.397	

Source: field survey 2004/2005.

\* Significant at 1% level of significance.

Decision rule: the value of t-statistic (22.755) > the value of t-critical (2.397), hence the null (Ho) hypothesis is rejected. Therefore, yoghurt production is profitable.

## 4.6 Problems Associated With Milk Production, Processing and Marketing under the Smallholder Dairy Cooperatives of Milcopal

This section gives an insight into the problems encountered by the milk producers and processors. These problems are discussed based on the sections they were encountered.

### 4.6.1 Problems Associated With Smallholder Pastoral Milk Production

*Feed:* Supplementary feed especially in the drier months of March to May is very difficult to come by. The cost of purchase is exorbitant and milk yield at

that time is very low. Pastoralists spend longer hours, covering longer routes along fadama plains to feed their cattle. They sometimes have to migrate to other areas to search for what their animal can browse on.

*Price:* There are a lot of complaints about the price offered by MILCOPAL for fresh milk. The ₦30 per litre price being offered is considered too low by the pastoralists especially during the dry season. This sometimes forces some suppliers not to deliver their milk at the collection centres. They are requesting for an upward review of prices.

*Security:* The pastoralists are complaining bitterly about insecurity in their areas. Their lives and animals are always threatened by thieves who come in large number to steal their animals. They spend all night guarding and in the day they go herding.

*Drugs and vaccines:* The cost of drugs is exorbitant and the presence of quacks and fake drugs has worsened the situation. Diseases incident especially during the rainy season is posing a serious threat to small holder dairy production. Ticks and worm infestation occur more during the rainy season.

*Breed factors:* Cattle breeds which originate from the tropics generally have a limited genetic potential for milk production and remain mediocre producers with 500-1500 kg (520 – 1560 litres) per lactation. The white Fulani kept by the pastoralists cannot compete with breeds found in other parts of the world in terms of milk yield. This is a serious problem especially where the government is looking inward to encourage local production in place of over dependence on imports.

*Sociological factors:* Herding people are often nomadic. Herds are moved from one location to another. They keep herds for prestige; hence they prefer quantity to quality production. An average, pastoralist is more interested in the number of cows in his herd than the number that can be managed efficiently. In this system of production, the animal has to trek long distances to search for food, which is shared between work (trekking) and productive use. This is a

serious problem to increased productivity. The efforts of the NLPD toward establishing fodder banks and grazing reserves should be strengthened in conjunction with other agencies such as the Poverty Eradication Programme, Ministries of Agriculture and Water Resources as well as states and local governments.

#### *4.6.2 Problems Encountered By Milcopal during Procurement*

*Road Network:* The major challenge facing the procurement officers of MILCOPAL is that of poor road network to the various milk collection routes. This problem is worsened in the rainy season when milk production is at its peak. The pastoralists are scattered in the bush with no access road. In some days, procurement officers have to abandon the milk in some routes especially when there is early morning down pour. The roads lack good drainages and the rivers sometimes over flow their banks. Sometimes pastoralists have to trek to nearby collection centres with their milk or risk its being abandoned. The various local governments in the area need to live up to their responsibility by assisting the joint efforts of the pastoralist in communal road repairs.

*High cost of transportation:* The cost of milk procurement is very high due to increase in prices of petroleum products and related inputs. Every morning, the van has to be fuelled, maintained and sent to the bush for procurement. A minimum of N1, 400.00 fuel is needed to cover the shortest route of about 40km. (maje/bango route). This takes about 6 hours to complete. During the dry months of March to May, an average of 40 to 50 litres is procured daily, which is roughly equal to the amount spent on fuelling the vehicle. This makes procurement unattractive especially during the dry season.

*Product adulteration at producer level:* Some pastoralists are of the habit of adulterating their milk before supplying it to the collection centre, which creates problem while processing. Lack of compliance to laid down procedure for milk handling through addition of water, using unhygienic equipments, mixing fresh milk with a spoilt one and milking of sick animals constitute a serious threat to procurement. The procurement officers sometimes reject milk from non -

complying women to deter others. *Seasonality of production:* The procurement section is also faced with the problem of low supply during the dry season. During this period demand for dairy products is very high, which can hardly be met. On the other hand, there is high supply of fresh milk during the rainy season when demand is very low. This leads to the stretching of facilities for storage with high tendency of product spoilage during the rainy season and underutilization during the dry season.

*Diversion of products by the pastoralists:* This occurs during the dry season when prices are higher in the markets, than what the MILCOPAL is paying. The number of suppliers reduces during this time only for it to increase during the rainy season.

#### ***4.6.3 Problems Encountered By the Milcopal during Processing***

*High cost of production:* The raw materials used in yoghurt production are milk, sugar and culture. The fixed and variable cost components are very high thereby making production cost to be high.

*Power failure:* The main source of power supply to the plant is the National Electric Power Authority (NEPA). The plant experiences a lot of power breakdown during production and while products are in the cold room. Spoilage is very high for yoghurt in the first and third quarters of the year due to power failure. A stand by generator is used to minimize the problem at a very high cost.

*Lack of modern processing equipment:* The plant is currently operating with few improvised equipments, which are mainly operated manually. The plant has since stopped operating with its installed machines due to their breakdown. Therefore manual operations such as steam heating using fire wood for pasteurization of milk and manual packaging predominates. This contributes to product spoilage especially when here is power breakdown. Efforts made by NLPD to reactivate the plant were unsuccessful due to its cost implication. The estimated cost of reactivation as put by the Danish consultants, who handled its

construction is \$2.2 (N300 million), for a factory that was constructed at N700,000 in 1975. This was considered too high for the NLPD to afford. Currently the plant can only handle about 1800 – 2000 litres daily of fresh milk, against the plant installed capacity of 18,000 litres daily. Milcopal has been unable to collect all the milk produced by the pastoralists, especially during the flush season when excess is produced.

#### *4.6.4 Problems Encountered By the Marketing Section of Milcopal*

*Supply and demand:* Milk is a seasonal product, so also is its supply and demand pattern. An average of 400 – 500 litres of dairy products is sold daily during the rainy season, which incidentally is the peak season for the supply of milk by the pastoralists. The resultant effect is stockpiling of product, thereby tying down capital and the associated risk of product spoilage. During the dry season when supply is lean, dairy product demand is as high as 1000 litres per day, while supply of fresh milk is as low as 80 litres per day. This makes it difficult for MILCOPAL to satisfy the market during periods of high demand.

*Storage facilities:* Storage facilities in the dairy plant are far from being adequate. This coupled with poor power supply pose a serious problem to product quality. MILCOPAL yoghurt contains no preservative hence the need for it to be under continuous refrigeration to avoid spoilage.

*Promotional activities:* Promotional activities are very low at MILCOPAL, especially during the flush season. They only occur occasionally during the Kaduna international trade fair and on the few signboards placed in front of their retail outlets.

## **CHAPTER FIVE**

### **5.0 SUMMARY, CONCLUSION, RECOMMENDATIONS AND SUGGESTIONS FOR FURTHER STUDIES**

#### **5.1 Summary**

In the past, different governments have tried to improve milk consumption of the populace, by ensuring steady local supply. Most of these programmes have not yielded the desired result of ensuring local production that will guarantee the minimum dairy products requirements of average Nigerians. This was partly due to the nature of the production system of the pastoralists who are small scale and widespread in the bush. In view of these problems, a World Bank-assisted project - the smallholder pilot dairy project- was added to the Second Livestock Development Programme (SLDP) of the National Livestock Project Division (NLPD), whose sole responsibility was to organize pastoralists into viable producer associations. Kaduna state was chosen and the pilot project was established in 1987. The study examined the economics of milk production, processing and marketing under the smallholder dairy cooperatives of the MILCOPAL, as an attempt to contribute to knowledge in the area of pastoral cooperatives in Kaduna state.

To achieve the objectives of the study, a field survey was conducted in Kaduna state from January 2004 to May 2005. Three categories of respondents were identified. These were the small-scale pastoralist in the various cooperatives, officials of the various cooperative associations and the officials of MILCOPAL and NLPD at the dairy plant. A total of 40 milk producers and 60 suppliers were randomly selected, while officials of the 8 associations were included in the study. Four analytical techniques were used to achieve the objectives of the study. They are the descriptive statistics, production function analysis, net farm income analysis and marketing margin analysis.

The descriptive statistics was used to achieve objectives one, three and six. The production function analysis and resource-use efficiency were used to achieve objectives two and four of the study. The Cob-Douglas production



function was found to be suitable for both pastoral milk production and for yoghurt production. Net farm income analysis was used to achieve objectives two and five of the study. The marketing margin analysis was used to achieve objective five of the study. Four hypotheses were tested from the results and in all the null hypotheses were rejected.

With respect to the first objective, the results of the study revealed that, pastoralists in the programme were grouped into milk producers and suppliers. The socioeconomic characteristics of the producers revealed that their average age was 48 years, all married with large families, only 15% attended primary or adult literacy classes, all belong to village milk producer association, with average herd size of 61 animals and up to 35 years cattle rearing experience. The socioeconomic characteristics of the milk suppliers revealed their average age as 30 years, 75% were married with children, only 2% attended formal school, they all belong to their cooperative associations, 51% supply less than 10 litres of fresh milk weekly and they all sell their milk to MILCOPAL at N30.00 per litre.

Inputs used in traditional pastoral milk production system include: labour, feed, drugs (veterinary drugs and traditional herbs), potash, calabash, sticks, feeding and watering troughs, local fencing materials and buckets. Only lactating cows are given supplementary feed before they are taken out for grazing during the dry season. However, no supplementary feed is given during the rainy season to all categories of animal in the herd.

With respect to the resource-use efficiency and profitability in pastoral milk production (objective two), three variables -number of lactating cows, feed and labour tested were found to be significant in milk production at 1% level of probability. Also the F-ratio which shows the joint significance of the entire explanatory variables in the model is significant at 1% level. This leads to the rejection of the first null hypothesis that there is no relationship between milk production and inputs used.

From the elasticities of production obtained, a 1% increase in the number of lactating cows, feed and labour will increase the amount of milk produced by 0.522, 0.276 and 0.179 percent respectively, hence all the inputs are inelastic. On returns to scale when all inputs are changed simultaneously by 1% there will be increase in output by 0.977%. The efficiency ratio for all the variables is less than one, which implied over utilization of resources. On profitability of small scale milk production, the result shows a gross margin of N3, 951.82 and a net farm income of N2, 985.74 per week from an average of 30 lactating cows. The null hypothesis (3) of the study –milk production is not profitable was rejected based on the test of significance of the differences between the revenues and costs in milk production.

With respect to the third objective, the results revealed that 36 village milk producer cooperative associations were formed from the inception of the programme in 1987 to date. Only eight of the associations and one peri urban producer supply milk to MILCOPAL. Officials of the associations are responsible for organizing the pastoralists into groups of milk suppliers and ensure the payment of money for milk supplied by their members.

The village milk producer cooperatives are paid a commission of N2.00 per litre of milk procured by MILCOPAL which is used for the payment of the secretary's salary of ₦1,000.00 per month. Other activities carried out by the associations with their commissions are: construction of drainages, culverts, road repairs, construction of classroom blocks for their children's education and payment of transport fares for officials on assignments.

There are three major routes for milk collection-Gadan Gayan, Kaban Joga and Kagarko/Kuse. Sabon Birni is the only Peri- Urban producer who joins the cooperatives. These routes are found in three local government areas of Kaduna state, (Igabi, Chikun and Kagarko) with a distance that ranges from between 35 to 150 kilometres from the dairy plant.

There are two procurement officers who collect milk every day from the routes. The milk suppliers converge with the milk at designated centres for

measurement and necessary tests. The amount supplied by each woman is recorded and a passbook is issued to facilitate payment at a later date. N30.00 is paid per litre of milk procured by MILCOPAL. Milk procured is then transported to the dairy plant for processing.

The method of milk processing shows that the milk is subjected to laboratory tests by the quality control section, to ensure its quality and ability to withstand heat treatment. The milk is then pasteurized by raising its temperature to about 90<sup>0</sup>c for an hour. This is then cooled to 40-45<sup>0</sup>c and inoculated with 2% mixed culture of lactobacillus and streptococcus bacteria. It is then incubated at this temperature for 3-4 hours, after which it is cooled, filtered and sugar added before packaging or storage.

With respect to efficiency of resource-use in milk processing in to yoghurt production (objective four) fresh cow milk is the major raw material. Other raw materials used in yoghurt production are sugar, labour, culture and water. Four variables were tested and the regression results show that sugar is not significant; milk, culture and labour are significant at 5%. The F-ratio is significant at 1%, which leads to the rejection of the second null hypothesis that says there is no relationship between yogurt production and the inputs used. The regression coefficients which also represent the elasticity of production for milk, sugar, culture and labour inputs are 0.0661, 0.055, 0.559 and 0.273 respectively. This implies that they are all inelastic; hence their increase will increase output by less than the increment. On the resource-use efficiency, milk has a value of 0.43, meaning it is over utilized while the remaining inputs (sugar, culture and labour) are under utilized.

On the marketing margin of yoghurt (objective five) the result shows that 60.81% of what the consumer pays on yoghurt goes to the processing firm (MILCOPAL), while 39.19% goes to the milk producer. This high marketing margin was as a result of the value added to the product through processing which improves the shelf life of the product and its acceptance by people.

On the profitability analysis, the gross margin per week is ₦257, 994.46 and the net farm income is ₦199, 762.21 with an average rate of return (ARR) of 0.53, meaning that for any ₦1.00 invested there is a return of ₦0.53. The null hypothesis (4) of the study –yoghurt production is not profitable was rejected based on the test of significance of the differences between the revenues and costs in yoghurt production which shows that yoghurt production is profitable.

Problems associated with milk production, collection, processing and marketing (objective six), have been discussed. These problems range from insufficient supplementary feed during the dry season and its expensive nature, low producer prices for milk at village level, insecurity of the animals, high prices of drugs and vaccines, problems of low milk yield of local breeds and their motive of production .

Problems of MILCOPAL include; poor road network to the collection centres, High cost of transportation, fresh milk adulteration by the pastoralists, seasonality of production, diversion of milk by the pastoralists when supply is lean, High cost of production, power failure, lack of modern processing equipments, differences between demand and supply, lack of enough storage facilities and the near absence of promotional activities.

## **5.2 Conclusion**

The main focus of this study was to determine the resource-use efficiency in milk production, processing and marketing under the smallholder dairy cooperative system. Based on the findings of the study, it can be concluded that smallholder dairy cooperative production is quite feasible in the study area. Such an exercise has improved the welfare of the pastoralists and generates employment and affordable dairy products to the masses. An effective dairy cooperative will lower cost of dairy products, improve livestock health through proper extension services and consequently would increase livestock productivity and hence the supply of livestock and livestock products.

### 5.3 Recommendations

Based on the findings and conclusion of study the following recommendations are made. Some of the recommendations involve an appropriate institutional framework necessary for the success of the smallholder dairy cooperative scheme.

a. The pastoral Fulani should be settled. For the pastoralists to settle down in the grazing reserves and form cooperatives for milk procurement, there is the need for coordination of efforts by various organs of government that deal with them. The National Livestock Project should work in collaboration with other agencies such as the Poverty Eradication Programme, Ministries of Agriculture and Water Resources as well as various states and local governments. This collaboration should be in the following areas.

- i. Gazetting of all the grazing reserves should be done by the federal ministry of agriculture and natural resources, to enable the pastoralists, settle there. This will go a long way in reducing conflict between the Fulani and farmers and reduce their movement from one location to another.
  - ii. The ministry of water resource has a role to play in reserves, toward the provision of water for the animals and human consumption. This requires the construction of Dams, sinking of bore hole and wells.
  - iii. The National commission for nomadic education (NCNE) has a role to play through the construction of schools for the education of their children especially those on the grazing reserves.
  - iv. The various state and local governments should provide security of lives and property in the reserves, health clinic and veterinary services, access road to the various milk collection centers and extension services.
- b. The Kaduna state government owns 45% of the share, should fulfill its promise of rehabilitating the plant, so that it can become fully operational. Efforts toward selling the state shares should be stopped.
- c. The pricing of milk should be improved. Currently, ₦30/litre of fresh milk is being paid to the pastoralists by MILCOPAL, as against the local market price of ₦50/litre. The pastoralists have been complaining for an

increase considering the general price level in the economy. The NLPD'S efforts toward creating different price of milk for dry season and rainy season should be encouraged in consultation with the pastoralists.

- d. Rehabilitation of the processing plant to enable the federation collect and process milk during the flush season when the farmers have plenty of milk. Adequate storage facilities to prevent spoilage has to be put in place and the number of procurement vehicles should be increased to cater for areas that are hardly covered during the rainy season.
- e. The road networks are poor: This requires the action of the various local governments especially during the rainy season. Some of the associations need bridges to cross the rivers that separate them with the main feeder road. Lack of these bridges cut-off milk supply and therefore reduce the income of the farmers.
- f. Inputs supplied to pastoralists albeit genuine, appear to be fairly costly. A revolving fund with a substantial amount should be established to allow for adequate procurement of the commodities during the season when they are relatively less expensive so that farmer can enjoy uniform price of these inputs throughout the season of demand. Arrangement should also be put in place to allow pastoralists pay in kind for inputs with their milk.
- g. Genetic improvement of the local cow should be encouraged especially through the establishment of artificial insemination centers. The pastoralists should be educated on how to select good breeds for mating.
- h. Pastoralists need to be educated on the aspect of milk hygiene to reduce contamination at producer level. They should also be trained to identify and avoid milking cows with udder disease; milk adulteration by adding water can be minimized by paying extra for high-grade milk supplied to MILCOPAL.
- i. Fodder banks should be established and the farmers should be given seeds and other inputs to establish their own fodder banks in order to reduce the cost of supplementary feed.

It should be noted however, that the motive of the dairy cooperative enterprise is not purely profit maximization. It is geared towards encouraging pastoralists

to stay in one place, pool their resources together in a worthwhile venture (Danbaba, 2001; and Yahuza, 2001). This is aimed at ensuring steady income to the pastoral families, education for their children, creation of job opportunities, improvement in their living condition and the health of their animals. The programme has therefore affected the lives of the pastoral families in the provision of ready market for their produce, enhancing their religious practice, ensuring steady income and good health of their animals.

The above factors explain why the profit margin of the enterprise is not much. They focus mainly on extension of cattle management practice and formation of cooperative, so that high quality milk products are provided to the people at affordable prices.

Finally, there are positive indications that there are prospects in the small-scale dairy cooperative production and the sky is the limit of investors when their resources are appropriately managed.

#### **5.4 Suggestions for Further Studies.**

Although this study came out with some good results, it should be noted that the data for yoghurt production was obtained from an individual cooperative firm. Therefore general policy statements cannot be made based on these findings on yoghurt production; such statements should be restricted to MILCOPAL yoghurt.

It is therefore suggested that other yoghurt producers, especially those using purely powdered milk should be analyzed to provide basis for comparisons. The proposed Abuja dairy pilot project which is a replication of the Kaduna dairy project should also be studied to find out how far it has gone towards the provision of quality dairy products and impacting on the lives of the pastoralists.

#### **5.5 Limitations of the Study**

This study was constrained by unavailability of comprehensive data from the pastoral Fulani regarding their expenses. Lack of good roads to the various

settlements of the Fulani coupled with their widespread in the thick forest and migratory nature presented another limitation. Also lack of sufficient funds by the researcher limits the amount of data used for the study.



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