

**ANALYSIS OF ECONOMIC EFFICIENCY OF KEEPING DAIRY CATTLE  
IN BABATI URBAN IN MANYARA REGION, TANZANIA**

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AGRICULTURAL EDUCATION AND EXTENSION OF SOKOINE  
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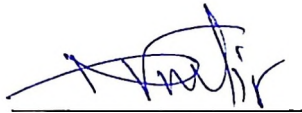
## ABSTRACT

In many urban parts of Tanzania, there is lack of understanding of economic efficiency of keeping dairy cattle. To achieve the economic efficiency in the urban context, dairy cattle keepers, planners and administrators need to be adequately informed and educated about the cost-effective allocation of resources. This study investigated the economic efficiency of keeping dairy cattle. Specifically, the study examined socio-economic factors that influence the number of dairy cattle to keep. Then analyze economic efficiency of urban dairy cattle units in different urban density areas. A cross-sectional research design was used involving a random sample of 129 respondents. Data was analyzed by using descriptive statistics, multiple linear regression and Benefit-Cost Ratio analytical techniques. The findings revealed that, dairy cattle kept in BU were influenced by a combination of factors including the socio-economic (age, marital status, education, income, food, employment, land, finances, markets), cultural (status quo, inheritance, milk preference), psycho-social (curiosity of being, casual labour, savings, informal motivating, technical support), environmental (brownses, forages, open spaces, weather for crop farming, farm and agro-processing residues). Yet, institutional factors included, technical services, policies, support institutions and provision of social services. Incomes earned were influenced by number of milking cows, lactation period, milk price and management practices. With good dairy cattle management, the high density areas produced more milk and received more annual revenues than in the medium- and low- density areas. The BCR showed that, dairy cattle keepers in BU should economically keep two, four and six dairy cows in high-, medium-, and low- density areas respectively. However, the Babati Urban

Authorities should support the urban dairy cattle keeping promoting the keepers' livelihoods in the council.

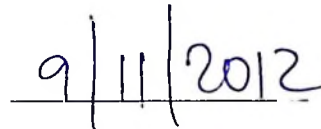
**DECLARATION**

I, **DANIEL LUTHER ANTHONY**, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work done within the period of registration and that has neither been submitted nor being concurrently submitted in any other Institution.



Daniel Luther Anthony

(MSc Candidate)



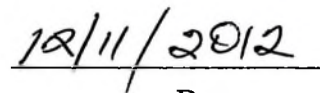
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Prof. M. R. S. Mlozi

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**DEDICATION**

To my lovely children, Diane Kagemlo and Abednego Mjuni who always prayed, loved and encouraged me during the execution of this study.

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### LIST OF ABBREVIATIONS

ALES	Agricultural and Livestock Extension Services
ASDP	Agricultural Sector Development Programme
ASDS	Agricultural Sector Development Strategy
BCR	Benefit-Cost Ratio
BTC	Babati Town Council
BU	Babati Urban
CARE	Canadian Relief Everywhere
CAST	Council of Agriculture Science and Technology
CBD	Central Business District
CBOs	Community Based Organizations
FAO	Food and Agricultural Organization
FIDE	Friends in Development
FSSA	Food Security and Sustainable Agriculture
HPI	Heifer Programme for International
ILRI	International Livestock Research Institute
KMC	Kinondoni Municipal Council
LES	Livestock Extension Services
M&E	Monitoring and Evaluation
MAFC	Ministry of Agriculture, Food and Co-operatives
MLFD	Ministry of Livestock and Fisheries Development
MMC	Mbeya Municipal Council
NGOs	Non-governmental Organizations

NSGRP	National Strategy for Growth and Reduction of Poverty
O&OD	Opportunities and Obstacles for Development
PMO- RALG	Prime Minister's Office – Regional Administrative and Local Government
PRIDE	Promotion for Rural Initiatives Development
RUAF	Resource Center on Urban Agriculture and Forestry
SACCOS	Saving Accounts for Credits and Co-operative Society
SD	Standard Deviation
SE	Standard Error
SNAL	Sokoine National Agricultural Library
SPSS	Statistical Package for Social Sciences
SUA	Sokoine University of Agriculture
TALDO	Town Agriculture and Livestock Development Officer
TDV	Tanzania Development Vision
TSPs	Town Strategic Plans
UA	Urban Agriculture
UPA	Urban and Per-urban Agriculture
URT	United Republic of Tanzania
WAEOS	Ward Agricultural Extension Officers
WEOs	Ward Executive Officers

## CHAPTER ONE

### 1.0 INTRODUCTION

#### 1.1 Background Information

Urban agriculture (UA) has existed in various forms and places for a long time worldwide (Egziabher *et al.*, 1994; Christensen, 2007; FAO, 2004). Study findings in many urban centres reveal that UA activities occur on the outskirts and in the heart of the urban centres (i.e. along roadsides, flood plains, along railway lines, in parks, along rivers, along oceans, lakes shores, under power lines and non-built parts or entire plots) (Sawio, 1994; Egziabher *et al.*, 1994; FAO, 2004, 2010). Indeed, all kinds of open public spaces provide for crop farming, grasses and browse for livestock (Ayaga *et al.*, 2004; Daodu and Babayemi, 2009). Due to rapid urbanization in most of the developing countries, there is a competition between UA and housing on the use of urban land and other resources (Rao *et al.*, 2009). Housing has a higher economic return while UA activities are perceived as essentially temporary, transitory and concomitant land uses to subsidize people's livelihoods (Robert, 2008). In general, 20 - 30% of all the UA produce provide household food supply and the rest boosts household income (Sawio, 1993a, b).

According to Foeken and Owuor (2005), livestock keeping has often been part and parcel of UA and often regarded as problematic, inefficient and environmentally hazardous. Of recent, policy makers have recognized it as a positive activity in urban areas. Livestock production systems are an important component in local economies at both the national and household levels whereby cattle constitute the main livestock species as revealed by Tuvana, (2004). Indeed, livestock production has a variable

and controversial, but often essential, role to play in and for urban areas (Rao *et al.*, 2009). Keeping dairy cattle is one of the important UA activities which in recent years has gained popularity (Mlozi *et al.*, 1992; Mlozi, 2005; Foeken *et al.*, 2004), and has been a trustworthy source of urban food security, employment opportunities and household income (Thys *et al.*, 2005).

The legal situation of UA is unclear and most urban dwellers assume it an illegal activity (Lee-Smith, 2004; Foeken, 2005). However, a look at the Local Government and Public Health Acts, as well as the Urban Authorities Bylaws, indicate that urban farming may be practiced under certain restrictions (FAO, 2005). A number of studies worldwide reveal that, if urban and peri-urban agriculture (UPA) is legalized and well regulated, the beneficial effect of farming in the urban areas can be for the provision of better nutrition, poverty alleviation and employment creation are always signified (Lee-Smith, 2004; Rao *et al.*, 2009; Foeken, 2005).

In Tanzania, the agricultural sector is the foundation of national economy, and some of its people in urban areas depend on UA (Mosha, 1991; Mlozi, 2005). A substantial number of urban dwellers undertake UA as an informal activity but of varying forms (Mlozi, 2003, 2005; Foeken *et al.*, 2004). For instance, in Dar-es-Salaam urban farming is the second largest employer after petty trade and labour, and 74 percent of urban farmers keep livestock (Mlozi, 2004, 2005; Foeken *et al.*, 2004). According to Urassa and Raphael (2003), UA is conducted for subsistence and employment. Foeken *et al.* (2004) revealed that the desire to generate more income and food motivates urban dwellers to continue keeping dairy cattle despite of the diminishing resources due to rapid urbanization. In Tanzania, like in other developing countries,

keeping dairy cattle is an important avenue for poverty alleviation due to its contribution in income generation through sales of milk, milk products, live animals and manure (FAO, 2005; Mlozi, 2005; Foeken, 2005; Fleury *et al.*, 2006; IFAD, 2005; Msuya, 2008; Cicek and Tandogan, 2008; Bayer and Kapunda, 2006; Elias and Mdoc, 2003). Likewise, in Babati Urban (BU), UA has been carried out as a source of food, employment and income generation (BTC, 2008). Among the UA activities that urban dwellers do, include dairy cattle keeping where by water and pasture are brought to the animals. There is a competition between UA and housing in the course of using urban land as housing takes place both in the open and reserved areas (BTC, 2008). Despite the depletion of natural resources (land, pastures, underground water, vegetation) more urban dwellers keep dairy cattle as a survival strategy for increasing household incomes and social security. Apart from the rise in the number of dairy cattle kept, dairy production is dynamic in many urban areas of developing countries and there is considerable inefficiency in terms of productivity and profitability (Ma *et al.*, 2007; Hertog, 2006).

Under this scenario of constrained resource base, a need arises to understand the likely economic efficiency of keeping dairy cattle in BU, which can provide information to UA extension services. Studies in various urban areas of Kinondoni, Arusha, Tanga, Dodoma, Iringa, Mwanza, Mbeya and Morogoro have revealed that the number of dairy cattle and households engaged in keeping dairy cattle activities is increasing, but milk production per cow per day is relatively decreasing (Mlozi, 2004, 2005; Bayer and Kapunda, 2006; Msuya, 2008; Manyama, 2009). This signifies uneconomical resource allocation in milk production.

## **1.2 Problem Statement**

The number of dairy cattle and urban households in BU has been increasing. For example, cattle heads increased from 789 in 2008 to 1,151 in 2009 and cattle keepers from 139 in 2008 to 170 in 2009 (BTC, 2008). The monthly records of milk production indicate that there is a decline on average from 13 to 10 litres per cow per day in 2005, 10 to 8 litres per cow per day in 2008 and 8 to 6 litres per cow per day in 2009 (BTC, 2008). Currently, city planners do not take into account the demands of urban livestock keepers due to lack of awareness (Ayaga *et al.*, 2004). This has led into competition for resources, over-use and uneconomical production since livestock keeping is a survival coping strategy (Guendel, 2002). According to Nkya *et al.* (2007), the reciprocal relationship between inputs and outputs earmarks inadequate awareness and understanding on efficient and effective resources allocation for economic milk production by most of urban dairy cattle keepers. Since keeping dairy cattle will continue for a number of reasons, it calls for an intervention of an information package on the economic efficiency to guide decisions of proper ways of keeping dairy cattle in BU. This is in order to enhance a sustainable balance on the use of available resource base. The number of dairy cows to be kept per household in the urban density areas should be based on an economic efficiency analysis for sustainable UA development.

## **1.3 Justification of the Study**

Understanding the economic aspects in agricultural activities is imperative for improving resources allocation. According to Moffatt (2007), economic efficiency refers to a condition where by the cost of production of a unit of a product is seen to be cost effective. That is, a unit of a product is produced at a minimal possible input

cost. Foeken *et al.* (2004) recommended that the effective dairy cattle keeping require reliable access to resources, facilitative institutional arrangements and favourable household socio-economic and demographic characteristics. To achieve economic efficient dairy cattle keeping in the urban context, the farmers and all urban development practitioners need to be clearly informed and educated about the importance of likely economic efficiency of keeping dairy cattle (Thys *et al.*, 2005). This would enable urban planners, policy makers and urban authorities in the formulation of pro-poor urban livestock legislation.

This study therefore, investigated the economic efficiency of keeping dairy cattle in BU for strengthening the available extension messages. Moreover, the findings provide baseline information on the economics of dairy cattle keeping to the farmers, extension staff and other urban development practitioners, especially planners and administrators. This information was envisaged to be useful in incorporating dairy cattle keeping in land planning and management process in line with local and national development policies and strategies such as TDV 2025 (URT, 2000) and NSGRP 2010 (URT, 2010).

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

##### **1.4.1 General objective**

The overall objective of this study was to investigate the economic efficiency of keeping dairy cattle in BU.

##### **1.4.2 Specific objectives**

The following objectives guided the study

- i. To examine the socio-economic and demographic factors influencing the keeping of dairy cattle in BU.
- ii. To assess the number and type of dairy cattle kept in BU.
- iii. To identify institutional factors influencing the keeping dairy cattle in BU.
- iv. To compare the economic efficiency of keeping dairy cattle in the three density areas of BU.

### **1.5 Hypotheses of the Study**

The hypotheses underlining this study are  $H_{01}$ ,  $H_{02}$ ,  $H_{03}$  and  $H_{04}$  respectively as follows

- $H_{01}$  There is no statistical significant influence of selected socio-economic factors on the economic efficiency of dairy cattle keeping in BU.
- $H_{02}$  There is no statistical significant contribution of selected institutional factors on the economic efficiency of dairy cattle keeping in BU.
- $H_{03}$  There is no statistical significant difference between the economic efficiency of keeping dairy cattle in high-, medium- and low urban density areas of BU.
- $H_{04}$  The UA by-laws do not significantly influence on the number of kept dairy cattle among the dairy cattle keepers in high-, medium- and low density areas of BU.

### **1.6 Scope of the Study**

The study focused mainly on the urban contextual factors influencing dairy cattle keeping in the study area. It investigated the amount of resource base used in dairy

cattle keeping and determined the socio-economic and demographic factors that influence the practice towards achieving an economic efficiency. It also examined the institutional factors that influence the efficient use of the available resources and opportunities in dairy cattle keeping for improving cattle keepers' livelihoods. Furthermore, the study analyzed the economic efficiency of dairy cattle keeping in the three urban density areas involving 129 respondents.

### **1.7 Assumptions of the Study**

The study made the following assumptions

- i. That the respondents would provide the information required frankly.
- ii. That contextual factors affecting milk production in the study period were similar to all the respondents.
- iii. That the researcher would treat the data collected from all respondents equally regardless of their socio-economic status.

### **1.8 Operational Definition of Terms**

The study adopted the following meanings of respective terms

**Socio-economic variables** – refers to the personal characteristics that enable or hinder the ability of an individual or household to decide to engage in dairy cattle keeping or utilize the available opportunities to confront the livelihoods challenges. The variable included such as age, education status, gender, income status, experience and household size.

**Urban context** – refers to the environment or situation of resource base, livelihoods and perspectives of people in the BTC jurisdiction area.

**Availability of resources** – refers to heifers or dairy cow, land, capital, labour, feedstuff, veterinary medication, transportation facilities, extension staff and urban dwellers.

**Economic efficiency** – refers to the state of efficient allocation of resources for profit maximization in the dairy cattle enterprise. It is an element in ensuring that scarce resources are used efficiently, in generating revenue enough to improve living standard among the resource users.

**Milk market performance** – refers to milk marketing firms, milk selling networks and the prevailing milk prices.

**Institutional arrangements** – refers to governmental and or non-governmental legal and policy setup to guide, facilitate, support or motivate the dairy cattle keeping. These include by-laws, credits provision, motivation, extension services provision, technical information and policies.

**Urban density areas** – refers to legally acceptable surveyed plots with sizes defined as high-, medium- and low density as stipulated in the Town and Urban Planning Act No. 8 of 2007 of the Republic of Tanzania.

## **1.9 Structure of the Dissertation**

This dissertation is organized into five chapters. Chapter one covers the background information, problem statement, study justification, objectives, research hypotheses, scopes of the study, research assumptions, operational definitions and structure of the dissertation. Chapter two presents literature review, while chapter three dwells on

research methodology. Chapter four presents results and discussions of the study.

.Conclusions and recommendations of the study are in chapter five.

## CHAPTER TWO

### 2.0 LITERATURE REVIEW

#### 2.1 Concepts and Definition of UA

The contentious definition of UA phenomenon is due to lack of clear line of context in which it takes place, resources involved and who undertakes it (Mlozi, 2004). According to Mlozi (2003), UA activities vary enormously, both within and between countries, as well as throughout urban socio-economic status. Mougeot (2000) recommended that, UA is different from, and complementary to, rural agriculture in local food systems and is integrated into the urban economic and ecological systems. Basing on this definition FAO defined UA as an industry that produces, processes and markets food and fuel, largely in response to the daily demand of consumers within urban areas applying intensive production methods using and reusing natural resources and urban wastes to yield a diversity of crops and livestock products though this does not reconcile aspects of regional health, food security and application of the grassroots organizations (Radstake, 2010).

Mlozi (2001) defined UA as the raising of animals such as dairy cattle, poultry, pigs and goats, and growing of vegetables and field crops in the areas designated urban under the Town and Country planning Ordinance CAP. 378 of 1956 revised in 1991. Dongus (2001) defined UA as the agricultural activities taking place within or in the periphery of a town or city, which include livestock production, forestry, horticulture, aquaculture and floriculture. Earlier on, Egziabher *et al.* (1994) had defined UA as the practice of food production within a city boundary or on its immediate periphery. However, UA includes agricultural production as well as goods

and services delivery by specialized micro enterprises, NGOs and governmental institutions. The Council of Agriculture Science and Technology (CAST) defines UA to include aspects of environmental health, remediation, and recreation as a complex system encompassing a spectrum of interests, from a traditional core of activities associated with the production, processing, marketing, distribution, and consumption, to a multiplicity of other benefits and services that are less widely acknowledged and documented (Fleury *et al.*, 2006).

These definitions explicitly show that keeping dairy cattle is one of major UA components. In support to these definitions Foeken *et al.* (2004) revealed that UA is a common phenomenon in sub-Saharan African towns in which UA activities such as dairy cattle keeping are undertaken. However, massive urbanization in developing countries has created a situation where the absolute poor live in urban areas many of whom have migrated from rural areas, transplant their farming skills and practice UA so to increase household food security and generate income (UN-Habitat, 1996). Other results (Fleury *et al.*, 2006; Ruggieri, 2007; Drechsel and Erni, 2010) have reported UA as a phenomenon that include the concepts of recreation and leisure, economic vitality and business entrepreneurship, individual and community health and well being, landscape beautification, environmental restoration and remediation in its totality. More recently, some forms of UA have been disqualified in some areas of modern cities, but continues to emerge in others and even seems to be growing in importance and scope (Ruggieri, 2007; FAO, 2005a, 2010b). On the other hand, Ayaga *et al.*

(2004) revealed that basic policy issues which are being discussed at the moment worldwide is the legitimate and the role of UA in employment creation and poverty alleviation, health and waste management, food security, land use management, physical planning and legislative framework. Unlike in the rural areas in most of developing countries where agricultural promotion is an integral part of development initiatives and agriculture is excluded from formal urban land-use systems (Hirtum *et al.*, 2005; Hoekstra, 2008; Lee-smith, 2004).

## **2.2 Overview of UA**

UA is an integral part of urban settings (Mougeot, 2000). According to Hirtum *et al.*, 2005; Mlozi *et al.*, 1992 and Hoekstra, 2008, UA is neither a recent phenomenon that is being temporary practiced by the recent rural immigrants to the urban nor fade away overtime after they lose their rural habits as such, UA increases with growth of urbanization as a resultant of its associated challenges such as unemployment, food insecurity, living expenses and the increased differences in the well being among the urban dwellers. Indispensable contribution of UA to urban food security and nutrition, economic impact, social relations, insurance, saving and urban ecology has progressively grown wider and its recognition has been promoted worldwide (Christlensen, 2007). In urbanized areas UA production and marketing tend to be more closely integrated in terms of time and space due to greater geographical proximity and quicker resource flow (Avila and Veenhuizen, 2005; Cicek and Tandogan, 2008; FAO, 2005b).

In the most cities in developing countries, an important part of UA produce is for self-consumption with surpluses being sold for household income (FAO, 2005a) and it provides important opportunity for women and household dependants to be a part of informal economy of urban areas. In this case, UA induces the significance of market orientation both in volume and economic value (Avila and Veenhuizen, 2005). Rapid urbanization taking place in developing countries goes together with increased urban income poverty and urban food insecurity (Ayaga *et al.*, 2004). According to Fleury *et al.* (2006), it is expected that by 2020, 40 – 45% of the poor in Africa will be concentrated in the urban areas and this is because most towns in the developing countries have great difficulties to cope with urbanization rate and are unable to create sufficient formal employment opportunities for the poor. As a result of limited alternatives livelihood options and livelihood insecurity of the increasing urban population, UA remain as the major alternative and ultimate resort to endow complementary strategy to reduce urban income poverty and food insecurity for the majority (Ayaga *et al.*, 2004; Christensen, 2007; Mlozi, *et al.*, 1992; Mlozi, 2005; Mohammad, 2009).

UA is being undertaken for both subsistence and commercial purposes and thus it is regarded as a survival strategy for the urban poor though due to economic imperative high and middle income earners also involve (Foeken *et al.*, 2004). UA also plays an important role in enhancing urban food security at reduced cost since it engage low costs in production and transportation to the consumers (Hirtum *et al.*, 2005). Available information indicates that most of the UA is undertaken by the vulnerable poor who also account for the approximate 50 percent of the urban population living

below the absolute poverty line (Ayaga *et al.*, 2004; Foeken *et al.*, 2004; Muriuki *et al.*, 2001; Mohammad, 2009). UA is a primary economic activity of most urban dwellers of all socio-economic status living in all urban areas (Mlozi, 1997, 2003). In Tanzania, UA is now a common practice in all Tanzanian towns (Mlozi, 2003) and it is recognized, legalized and included in the development plans at various levels (URT, 2010). UA is an important aspect of urban agribusiness where the sector generates important income and attributed in employment opportunities and it expand economic base of urban authorities through production, processing, packaging, and marketing of consumable products (FAO, 2005b). This results in an increased entrepreneurial activities and the creation of job opportunities as well as in food costs reduction and products of better quality (ILRI, 2004; HPI, 2006; FSSA, 2006).

Livestock keeping play an important role in urban societies and use open spaces on the homestead, farm residues, grass from open areas, non-built plots, residues from agro-industry and local mineral bricks while giving multiple products in return, such as meat, skin, milk and milk products, and/ or providing a sustainable source of income (FAO, 2005a), as well, it provides emotional attachment and social stability (Upton, 2004; FAO, 2010b). In spite of a rapid increase in the number of small scale dairy cattle keepers and expanding demand for milk in Tanzania, marketing systems for dairy industry and milk seems to be less organized (Nyange and Mdoe, 2004). In most of the urban areas there is progressive depletion of necessary resources for dairy cattle keeping and thus the concept of economic efficiency becoming very necessary to balance between the costs of inputs and income generated from milk sales (Bayer and Kapunda, 2006).

### **2.3 Dairy Cattle Keeping in Tanzania**

The small-scale urban livestock production in Tanzania is the landless livestock production systems (FAO, 2004; Mlozi, 1996; Elias, 2000; Lyimo, 2006). This category of livestock keeping is undertaken inseparably from peoples' living compounds (Mlozi, 2001, 2005; Foeken *et al.*, 2004, Smith, 2004). Since 1970s, raising dairy cattle in the urban areas has become worthwhile business (Mlozi, 1996). Primarily, the urban dwellers keep improved breeds of dairy cattle including exotic and cross breed herd to get more milk most of which is sold for earning income (Mlozi, 2005; Andersen, 2009; URT, 2008; HPI, 2006). Large part of people involved in the UA is the urban poor (World Bank, 2001).

In order to undertake UA it needs time to get access to urban land, water and other productive resources (Foeken *et al.*, 2004; Mlozi (2005) found that, the milk production in dairy cattle enterprises vary across the urban context. For instance, in Dar-es-Salaam, Morogoro and Mbeya, milk production ranged from one to nine, 10 to 19 and 20 to 29 litres per day respectively with the minimum of one litre and maximum of six litres per cow per day. And, according to Bayer and Kapunda (2006), the average yield of improved dairy cows throughout the study area in the southern highlands ranged from 2500 to 3000 litres per cow per lactation and the crossbreds is produced in the range of 2000 to 2500 litres per cow per lactation under adequate feeding and regular treatment against ticks.

### **2.4 Policy, Legal settings and Strategy on UA in Tanzania**

An increase in unemployment has forced many people to resort to extreme strategies for their survival and the survival of their households (Foeken, 2005; Foeken *et al.*,

2004; Mlozi, 2005; Ayaga *et al.*, 2004). Urban livestock production plays a substantial role in the food security and provision on employment opportunities of urban dwellers and yet urban livestock keepers are still receiving little attention in terms of institutional policy and technical supports targeted at their needs (Ayaga *et al.*, 2004; FAO, 2005b). In Tanzania, UA is legally (Mlozi, 2003) and supported under national policies such as the Agricultural Development Policy of 2007, the Livestock Development Policy of 2007 and the Agricultural Sector Development Strategy (ASDS) of 2001 (URT, 2000). These policies are under the MAFC, MLFD, PMO-RALG and other agricultural sector lead ministries. Under Act No. 8 Section 298 of 1982 (Urban Authorities), all Urban Authorities are obliged to establish and enforce farming by-laws to regulate and control UA.

However, in Tanzania UA is practiced in a generally favourable political and legal context, that during the 1970s and 1980s, the national government issued policies encouraging people to undertake UPA as a strategy to tackle urban food insecurity and households' income poverty (Mlozi, 2003). Also, the Urban Farming Regulations of 1992 endows guidelines which together with others, it limits the maximum number of dairy cattle to be kept per herd and restrict to zero-grazing system (Mlozi, 2003). Under Act No. 8 Section 298 of 1982 (Urban Authorities), specific by-laws and regulations put restrictions on the number, type, extent and farming systems for both crops and livestock production in the designated urban areas depending on the respective urban settings (Mlozi *et al.*, 1992; Mlozi, 2003; Foeken, 2005). These by-laws guide the number and practices of undertaking the dairy cattle keeping regardless of individuals' socio-economic situation (Foeken *et*

*al.*, 2004; FAO, 2005b). In Tanzania, a number of policies, laws, regulations and strategies have been put in place which guide and control the scope of UA activities and practices without taking care of the local needs under their situations (FAO, 2005a) instead they rely on technical experiences and ecological and urban planning standard requirements. Even though, by-laws regulating UA exist in all Tanzanian towns, most of the urban dwellers remain unaware of what are right and what so not instead they decide to do whatever is right for improving their livelihoods (FAO, 2005b).

## **2.5 Factors Influencing UA in Tanzania**

The reasons for keeping urban livestock in town are mixture of economic survival strategy, need for food security and livelihoods improvement (Mlozi, *et al.*, 1992; Mlozi, 2003; URT, 2008; Andersen, 2009; De haan *et al.*, 2003; Shah, 2003; Anthony *et al.*, 2006; HPI, 2006; FAO, 2005a). Smallholder dairy farming assist farmers to make some idle resources like crop residues enter the human food chain utilizing marginal form of resources (Ngongoni *et al.*, 2006; FAO, 2010a, 2010b; ILRI, 2004; Lyimo, 2006; FAO, 2005b). According to Mlozi (2003) empirical findings to provide answers to Mlozi's (1995) model shown that most of the rationale that push urban dwellers to raise livestock (including dairy cattle) in Tanzanian urban areas reside at the individual or household level. UA provides a complementary strategy to reduce income poverty, nutrition and food insecurity, unemployment and enhance sustainable management of urban ecology (Foeken *et al.*, 2004; Mlozi, 1996, 2003, 2005). Unlike the rural inhabitants whom livelihoods mean more of food security, for the urban dwellers the income aspect is more important (Sawio, 1993a,

b, 1994; Tuvana, 2004; Foeken *et al.*, 2004). Besides these direct needs, there are several circumstances creating a favourable context for keeping livestock in town, the poor national economy, low wages, the presence of foundation stock, feeds, extension services and markets and the generally positive attitude toward UA shown by the authorities and the reluctance to enforce by-laws and regulations put in place to control farming practices in towns (Mlozi, 2001, 2005).

## **2.6 Constraints Facing Urban Dairy Cattle Keepers**

Urban farmers face close to similar problems as those facing the rural farmers (Flynn, 2005; Ally, 2007). However, more specifically related to the urban context and confront in particular those who zero-graze the dairy cattle include death of animals, lack of adequate capital for establishing appropriate structures, poor infrastructures, neighbourhoods conflicts (due to nuisance, and inadequate milk production (Foeken *et al.*, 2004; Rao *et al.*, 2009). Further, other results (Shimbe, 2008; Msuya, 2008; Nkya, *et al.*, 2007; Manyama, 2009; Bayer and Kapunda, 2006; Kivaria, 2006) have indicated that urban livestock keepers face shortage of feeds, high input costs, poor management skills, low price of milk and other products, diseases, animal theft and low reproductive performance.

The report on Food Security and Sustainable Agriculture (FSSA) (2006) indicated that, dairy sector is hindered by the lack of infrastructure for input and output markets, poor flow of information, restricted access to credit and limited supply of dairy cattle. Inadequate market infrastructure centres to link milk production and major milk consumers results large price differential between rural and urban

indicating insufficient milk supply and constitutes the inefficient utilization of present opportunities in promoting the dairy sector (FSSA, 2006; Kivaria, 2006).

According to Mlozi (2005), urban livestock keepers are constrained by shortages in feeds, poor housing and presence of disease, shortages of capital and shortages of technical information. Other results (Ruggieri, 2007; Nkya *et al.*, 2007; Foeken *et al.*, 2004) revealed that because of inadequate sector supporting agency, and adverse policy and legal framework there is inadequate performance by the UA. While UA constitutes a critical food security strategy for low income urban farming households, yet it lacks access to efficient credit and investment support services (Mlozi, 2005; Foeken, *et al.*, 2004; Kayumbu, 2008). However, the agro-based industries are playing an important role in the promotion of UA, which can be enhanced by organized farmers' society and favourable government policy environment (Ruggieri, 2007).

## **2.7 UA and Environmental Issues**

Livestock-environment interactions cannot be properly addressed without taking into account numerous negative and positive impacts that livestock have on the environment (Thys *et al.*, 2005; Nkya *et al.*, 2007; Mlozi, 2003; Lee-Smith, 2004). In most of the urban areas, people raise domestic animals (dairy cattle, chickens, pigs, and goats) in the household's compounds that could easily transmit zoonotic diseases (Mlozi, 2003, 2005; Msuya, 2008; Shimbe, 2008; Manyama, 2009; Robert, 2008). Manure is used as the fertilizer for crops and fodder production and the crop residues and crop by-products are part of the animal feeds (Luoga, 2002; Hertog, 2006; Muriuki, 2001; Drechsel and Erni, 2010). In addition, manure return organic matter

to the soil helping to maintain its structure as well as its water retention. According to Thys *et al.* (2005), urban livestock results in pollution due to the generation of urine, excrements and dead animals which may attract flies and contaminate both soil and ground-water. However, most of the livestock owners perceive exploiting the resources within their reach, is the prime of their willingness to increase livestock numbers for profit maximization from the environment (Mlozi, 2003, 2005).

In Tanzanian urban areas, raising of livestock differ based on cultural, socio-economic conditions, production resources, location, size of towns and their populations (Mlozi, 2003). Others include availability of markets, infrastructure, agriculture and livestock extension services, animal clinics, sources of labor, size of plots, and quality and sources of animal feed (i.e. forage, concentrates, and medications) (Nkya *et al.*, 2007; Mlozi, 2003). These factors determine the type of livestock to raise the production system and its intensity (Mlozi, 2003; Bayer and Kapunda, 2006). In Tanzanian towns, urban dwellers are spinning urban areas into rural-like places by practicing UA (Mlozi, 2003) especially dairy cattle keeping.

## 2.8 Multiple Linear Regression Analysis

The multiple linear regression models are used to study the relationship between dependent variable and one or more independent variables.

The generic form of the linear regression model is

$$Y = f(X_1, X_2, \dots, X_K) + \varepsilon = X_1\beta_1 + X_2\beta_2 + \dots + X_K\beta_K + \varepsilon \dots\dots\dots(1)$$

where  $Y$  is the dependent or criterion variable and  $X_1$ ,  $X_2$  and  $X_k$  are the independent or predictors or explanatory variables. One's theory will specify  $f(X_1, X_2, \dots, X_k)$ . In this model,  $Y_i$  is the regressed and  $X_i$  is the regressor or covariate. The multiple linear regressions model assumes a linear relationship between independent variables and the dependent variable(s) (Cohen, 2003; Richard *et al.*, 2008).

The relationship should be linear, otherwise the regression analysis will misjudge the true relationship which may result into increased type II error for dependent and type I errors (over-estimation) that contribute to variance with that independent variable (Richard *et al.*, 2008). The data are collected from a random sample of population and the errors are statistically independent from one another. The expected value of the errors is always zero, independent variables are not strongly collinear, the independent variable is measured precisely, the errors are normally distributed and hypothesis tested by using t- and F- tests (Cohen, 2003).

According to Richard *et al.* (2008) and Cohen (2003), beta values ( $\beta$ ) which are the partial regression coefficients (as optimal linear estimators of the dependent variable (s) reflect the weight to be applied to the independent variables when one or more specified independent variables are included in the model. The SE  $\beta$  (standard error of beta) is the sampling variability of partial regression coefficients. The students' test values signifies the departure of the partial regressions coefficients of independent variables from zero and they are compared to the unstandardized regression coefficients ( $b^*$ ) values and yields the levels at which the observed t-values are statistically significant (Cohen, 2003).

## **2.9 Benefit Cost Ratio (BCR)**

Benefit Cost Ratio (BCR) means a ratio attempting to identify the relationship between the cost and benefits of a proposed project (Johnson, 2010). This ratio is used to measure both quantitative and qualitative factors since sometimes benefits and costs cannot be measured exclusively in financial terms. The benefit-to-cost ratio is a financial term that describes the comparison of the amount of money made through the production of an item versus the costs incurred during the production process (Johnson, 2010). Enterprises must evaluate the benefit-to-cost ratio to make sure that production is profitable. If the costs outweigh the benefits, then it is no longer profitable for a company to produce the item under the same set of circumstances (Johnson, 2010).

## **2.10 Theoretical Framework of the Study**

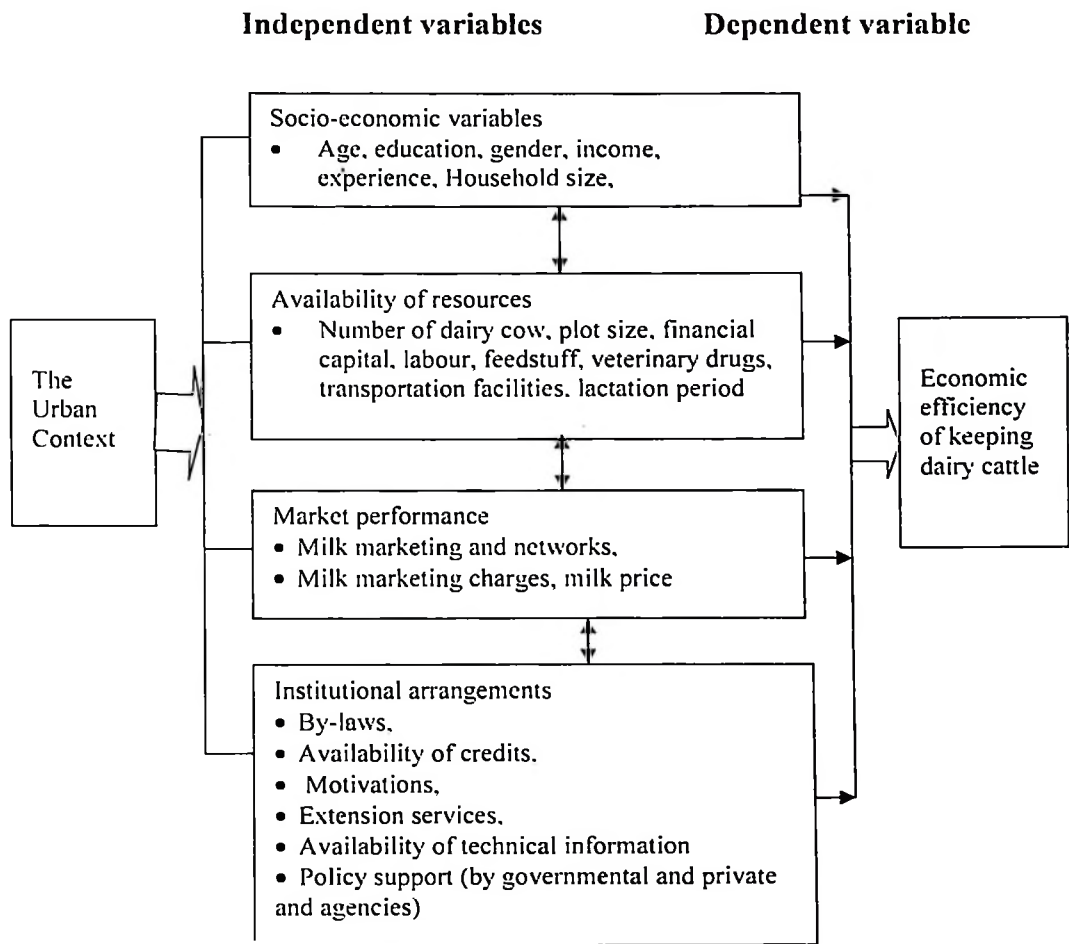
Economic efficiency is basically the relationship between scarcity, choice and management of an activity in ensuring that scarce resources are used with noticeable profitable output. Economic efficiency describes how well a system generates desired output with a given set of inputs and available technology. Efficiency is improved if more output is generated without changing inputs (Economic efficiency theory). Contrary to Thunen's traditional location theory of one-area-one-crop, the practical theory which actually pays special attention to effectively allocation and management of resources under personal characteristics, present technological expertise and institutional factors in the urban context is considered. Economic efficiency is therefore the product of technical and allocative efficiency (Scarborough and Kydd, 1992). Technical efficiency refers to the efficiency with which resources are used in

physical input and output ratio (Amoza *et al.*, 2006). Allocative efficiency refers to the effective allocation of resources to produce a level of output at a least combined cost of inputs (Moffatt, 2007). According to Foeken *et al.* (2004), both available resources and opportunities in the urban settings determine the sustainable invest in livestock keeping but also it is very important to include the management factor between the two. The management factor is what brings in the allocative efficiency in the profit making urban firms where the resources are progressively scrambled (Moffatt, 2007).

Economic efficiency in urban dairy cattle keeping is eliciting the theoretical model that seeks the profitable allocation of scarce resources. Some of the underlining principles are such that; maximum output that can be produced from given quantities of factor inputs with the firm's existing technological expertise and institutional settings. The profit maximizing firms choose the factor proportions and quantities, and output levels given the prices of factor inputs, and products at the Least-Cost Combination of Inputs. The production factor need inputs to be effective allocated in the production process. These theoretical perceptions, underline the cost-effective combination of inputs and enterprises' outputs in the dairy cattle keeping. In this study economic efficiency is used as the technique to investigate the level of welfare economics in attempting to measure social welfare by examining the dairy cattle keeping as an economic activity of the households that engage in it (Moffatt, 2007). Under these definitions, the analysis of economic efficient will base on the extent to which socio-economic variables and institutional factors influence cost-effective input – output relationship.

### **2.11 Conceptual Framework**

The conceptual framework (CF) of the present study is based on the relationship between the resource base and the opportunities under the context of BU. Both opportunities and availability of resources determine the involvement and performance of urban livestock keeping that change with time and circumstances. Household characteristics (age, income, education, gender, experience and household size); availability of resources (dairy cattle, land, financial capital, labour, feedstuff, and other physical productive resources); institutional arrangements (By-laws, credits support, motivations, extension services, policies of enterprise support and milk marketing channel (availability of marketing fora and market infrastructures), are independent variables influencing economic efficiency in keeping dairy cattle as dependent variable (Fig. 1).



**Figure 1: Conceptual framework for analysis of economic efficiency of dairy cattle keeping in BU**

## CHAPTER THREE

### 3.0 RESEARCH METHODOLOGY

#### 3.1 Description of the Study Area

##### 3.1.1 Location, climate and topographical

BU is the administrative and commercial headquarters of Manyara region. It is located at a junction approximately equidistant from Arusha, Singida and Dodoma. It is situated at a distance of about 168 kilometres from Arusha City and 700 kilometres from Dar-es-salaam City and 650 kilometres from Mwanza City. It is one of the six local authorities forming Manyara region. Others are Mbulu, Hanang, Simanjiro, Kiteto and Babati Rural District Councils. BU lies between latitude  $4^{\circ}4'$  S and Longitude  $35^{\circ}45'$  E at an elevation ranging from 1000 to over 2000 metres above sea level. BU is characterized by hills, flood plain, mountains covered by the reserved forests and the Lake Babati surrounded by swampy areas and ground waters.

The BU is divided into two climatic zones namely the highland and low land zones and its main topographic features are associated with the rift valley characteristics. Its mean annual temperature is  $23^{\circ}\text{C}$ , and the coldest month is July with an average temperature of  $15^{\circ}\text{C}$  while the warmest month is December with an average temperature of  $34^{\circ}\text{C}$ . The town receives short rainfall from November to January and long rains from March to May. The area has the mean annual rainfall of 1200mm. Soils are dark brown characterized with layers of black cotton soils which make them extremely vulnerable to soil erosion. The town is the catalyst of Socio- economic development derived from its rich physical and environmental resources for UA opportunities and businesses.

### **3.1.2 Ethnicity, population and administration**

The main ethnic groups in BU are Iraqw, Chagga, Pare, Rangi, Nyaturu and Meru. Others such as Asi, Masai, Yao, Nyakyusa, and Nyamwezi are the minority. According to the 2002 Population and Housing Census, the town had a population of 64,684 with the annual growth rate of 2.7%. On the basis of the 2008 social and environmental survey, it was found that the population of BU was 137 970 people. The population had been increasing at an annual growth rate of 5.6%. This population constituted 70 365 (51%) males and 67 605 (49%) females (BTC, 2008). Administratively, BU is comprised of two divisions; Babati and Gorowa which are divided into 8 wards namely Bagara, Babati, Bonga, Nangara, Singe, Sigino, Maisaka and Mutuka. These have further been subdivided into 35 sub wards (Mitaa) and 13 villages with 54 sub-villages (Vitongoji). Bagara and Babati wards are currently forming the Central Business District (CBD) and Bonga, Sigino, Mutuka and part of Maisaka wards are still the peri-urban areas (BTC, 2008, Fig. 2).

### **3.1.3 Economic activities**

Based on the 2008 social and environmental survey of BU (BTC, 2008), about 60% of the total urban labour force is engaged in UA. The economic activities in BU include crop production, fisheries, livestock keeping, small to medium scale industries and non-agricultural business activities. UA and UPA activities include aquaculture, horticulture, crop farming and livestock keeping. The typical crops in the area include sun flowers, pigeon peas, maize, bananas and beans. As with crops, most of the livestock in Babati town are raised by smallholder farmers and include improved dairy cattle, pigs, goats, sheep and poultry.

The two systems of rearing livestock are zero-grazing and free range. Zero-grazing is common in the built-up areas around the town centre, and is used mainly for improved dairy cattle and goats. The system involves keeping the animals indoors on a permanent basis and feeding them with forage that is cut outside the town centre and then transported to the compound. The free-range system is mainly practiced in the peri-urban areas. The remaining proportion is engaged in mixed activities including trading, non-agricultural business activities and public service sector in the government, religion, non-governmental organizations (NGOs) and Community Based Organizations (CBOs) activities. Other agro-forestry activities include tree planting, beekeeping and fish farming (BTC, 2008).

### **3.2 Research Design**

The study employed the cross-sectional research design whereby data on various variables collected at a single point of time as recommended by Kothari (2004). The design was efficient, economical and useful with the constrained time, fiscal, personnel and facilities. The collected data were adequate for the purpose of answering the study objectives.

### **3.3 Study Population and Sampling Frame**

The study population was enlisted through the preliminary survey in the four wards namely Bagara, Babati, Nangara and Singe. These wards are within the urban area of the council in which households keeping improved dairy cattle under zero-grazing were found. The key informers were the ALES responsible for the purposively

selected wards. In the preliminary survey, a sampling frame which consisted of a list of households keeping dairy cattle in the four wards was developed (Table 1).

### 3.4 Sampling Techniques

A multi-stage sampling method was employed to obtain the study locations and samples depending on the abundance of dairy cattle activities. Study wards, sub-wards and key informants including the Agricultural and Livestock Extension staff (ALES) were purposively selected. Finally, the simple random sampling using non replacement random picking of number cards was administered to obtain a study sample of 129 households of which 35 households, 40 households and 54 households were sampled from high, medium and low density areas respectively. The density areas were identified depending on the plot sizes in which the study households were living and carrying out the dairy cattle keeping such that high density area was  $\leq 400\text{m}^2$ , medium density area was  $401 - 1200\text{m}^2$  and low density area was  $\geq 1201\text{m}^2$ .

### 3.5 Sample Size (n) Determination

A sample of 129 dairy cattle keeping households was obtained by summing up the sample proportion basing on the size of their sampling frame (Israel, 2009) (Table 1).

**Table 1: Sample size by density area**

Density area	Plot size (m <sup>2</sup> )	Number of dairy		
		cow keepers	Proportionate	Sample size
High	$\leq 400$	59	0.27	35
Medium	401 – 1200	68	0.31	40
Low	$\geq 1201$	91	0.42	54
Total		218	1.0	129

### 3.6 Reliability of the Instrument

Reliability is the measure of consistency of the survey instrument. The measure is considered reliable if it gives the same results over and over. Reliability is measured in terms of Cronbach's alpha reliability coefficient ( $\alpha$ ). Acceptable ( $\alpha$ ) is 0.7 and thus for reliable measure ( $\alpha$ ) ranges between 0.7 and 1 (William, 2006). In the case of this study the Cronbach's alpha coefficient was estimated by calculating correlation coefficient ( $r$ ) of the inter-item observations during the pre-tested 10 questionnaires. The Cronbach's alpha reliability coefficient ( $\alpha$ ) was estimated using the Cronbach's

formula: 
$$\alpha = \frac{k r}{1 - (k-1)} \dots\dots\dots (2)$$

Where;  $\alpha$  = Reliability coefficient (i.e.  $k/k-1$ ),

$r$  = Correlation coefficient of the inter-item observations

$k$  = number of items in the questionnaire (measure).

From this formula the reliability coefficient obtained was 0.82 which was within the acceptable range of Cronbach's alpha coefficient. This indicated that the measure was quite reliable for use in this study.

### 3.7 Validity of the Instrument

Validity of the survey refers to the degree the instrument actually measures what it is intended to measure. The instrument contents were reviewed by the research supervisor and other research experts to ensure relevance, completeness, logical and meaningful data collection. However, necessary corrections were incorporated prior to actual administration of the questionnaire.

### **3.8 Data Collection Techniques**

#### **3.8.1 Primary data**

Primary data were obtained from the respondents through structured interviews and personal observations. A Structured interview schedule (questionnaire) with both open- and closed survey questions was used to elicit information on socio-economic variables of respondents, dairy cattle enterprises, institutions and other related information from a total of 129 respondents. Interviews were conducted by the researcher assisted by three trained enumerators during the main survey.

#### **3.8.2 Secondary data**

Secondary data on study area, area density, agricultural sector, urban dairy cattle production were collected from various sources including the Town Agricultural and Livestock Development Officer (TALDO), Town planning office, Sokoine National Agricultural Library (SNAL), internet, UA magazines, research reports, and articles.

### **3.9 Data Processing and Analyses**

The primary data were verified, coded, compiled and analyzed using the Statistical Package for Social Science computer program (SPSS version 16 for windows) to yield descriptive statistics such as frequencies, and means. Cross-tabulations of different variables were performed to investigate if there were any statistically significant influence between variables. The Multiple Linear Regression Model was used to determine the magnitude and direction in relationship between the dependent and selected independent variable(s) and finally, Benefit/cost ratios (BCR) were calculated to determine the levels of profitability of dairy cattle enterprises in order to

establish the economically efficient UA dairy cattle unit in the three density areas of BU (Table 2). Data obtained from analyses were presented in tables and figures according to the SUA formats.

### **3.10 Ethical Clearance**

An approval letter from the Vice Chancellor of Sokoine University of Agriculture was used as introduction letter in seeking permission from the Town Director's office. A permit was sanctioned and channeled to the Ward Executive Offices and other local administrative leaders of the four wards that were involved in the survey. During preliminary survey, the researcher made informal visits to meet both local leaders and agricultural and livestock extension service (ALES) agents for logistical matters. The ALES agents were collaborated and made appointments for visits with household heads two days in advance. During data collection, the respondents were assured of confidentiality and security of information they were requested to provide. It was clearly explained by the researcher that the information from all respondents would be used for the purpose of this study only and all respondents would remain anonymous.

**Table 2: A matrix summary on data analyses**

Specific Objective/ Hypothesis	Independent variables	Dependent variables	Data analysis
To assess the number and type of dairy cattle kept in BU.			Descriptive statistics
Ho <sub>1</sub> : There is no statistical significant impact on selected socio-economic factors to the economic efficiency of dairy cattle keeping in BU.	Socio-economic factors including Age, Education, marital status, Economic status, plot size	Economic efficiency of dairy cattle keeping	Descriptive statistics Chi square test Multiple linear regression
Ho <sub>2</sub> : There is no statistical significant difference in contribution on selected institutional factors to the dairy cattle keeping in BU.	Institutional factors including by-laws, Extension services, Credit support	Economic efficiency of dairy cattle keeping	Descriptive statistics Chi square test
Ho <sub>3</sub> : There is no statistically significant difference between the economic efficiency of keeping dairy cattle in high-, medium- and low density areas of BU.	Input cost and output revenue	BCR	Revenue, cost and BCR analysis
Ho <sub>4</sub> : The UA by-laws do not significantly influence the number of kept dairy cattle among the dairy cow keepers living in high-, medium- and low density areas of BU.	perceptions on UA by-laws and expectations	Numbers of kept dairy cattle	Descriptive statistics Chi square test

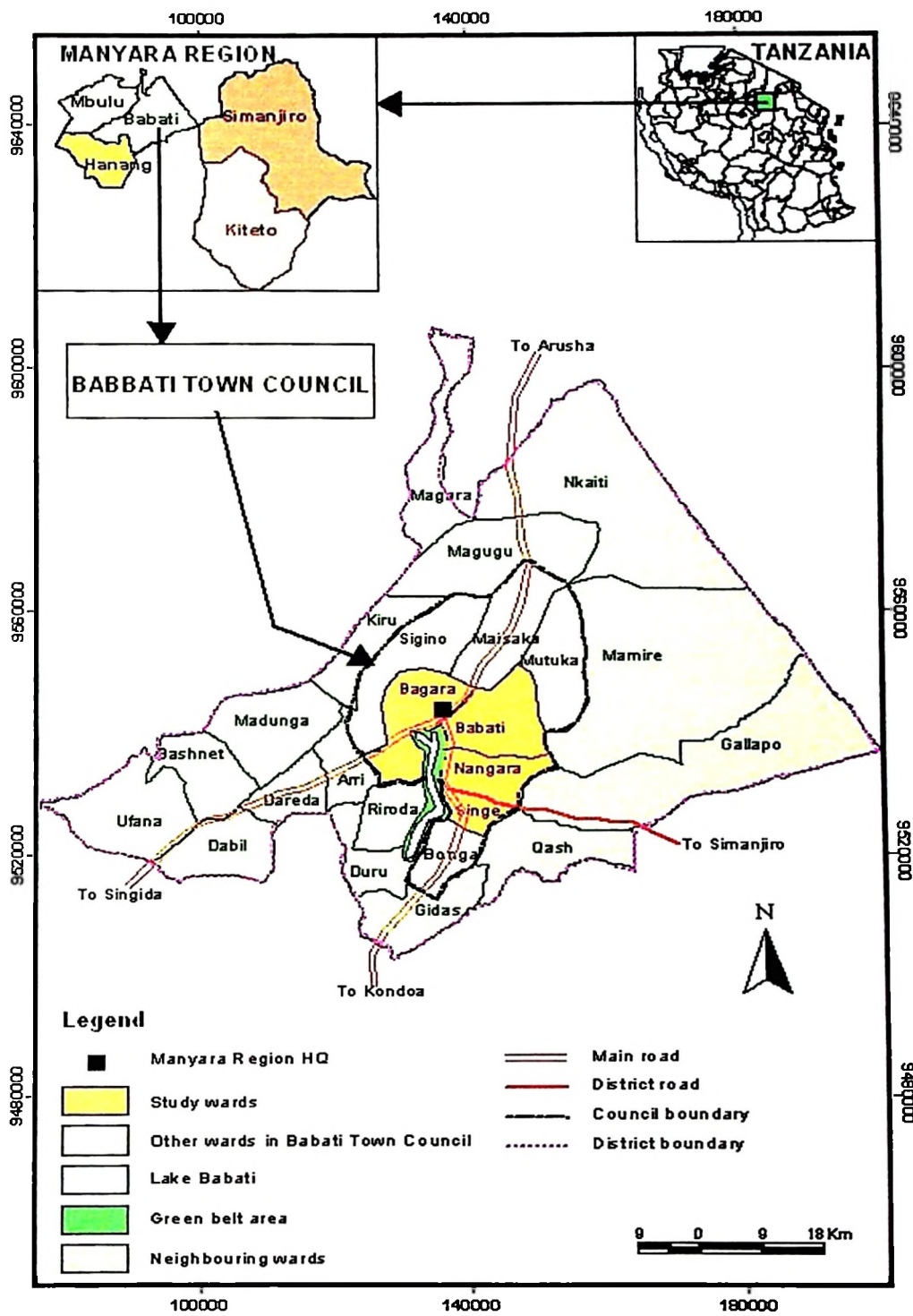


Figure 2: BU map showing the study wards

## CHAPTER FOUR

### 4.0 RESULTS AND DISCUSSIONS

#### 4.1 Demographic and Socio-Economic Status

##### 4.1.1 Sex of household head

Table 3 shows that of the 129 respondents, 98 (76%) comprised of male-headed households of which 38 (29.5%), 28 (21.7%) and 33 (25.6%) lived in high, medium, and low density areas, respectively. In addition, 31 (24%) were female-headed households of which five (3.9%), 12 (9.3%) and 13 (10.1%) lived in high, medium, and low density areas, respectively. The results imply that majority of the respondent household heads were males.

##### 4.1.2 Age of respondents

In the gender analysis, age is a function of knowledge, experience as well as the measure of maturity of an individual as different age groups perform different sets of activities (FAO, 2010b). Study findings on Table 3 show that age of household heads ranged from 21 to 64 years with a mean age of 44 years. More than half, 67 (51.9%) of the 129 respondents were in the category of old age (between 39 to 56 years). Of the old age category, 23 (17.8%), 18 (14%) and 26 (20.2%) lived in high, medium and low density areas, respectively. Of all the respondents, 46 (35.7%) were in the age category of elderly age group (above 56 years) of which nine (7%), 15 (11.6%) and 22 (17.1%) lived in the high, medium, and low density areas, respectively.

However, a few of all the respondents, 16 (12.4%) were found in the youth age category (between 21 to 38 years) and of these, three (2.3%), seven (5.4%) and six

(4.7%) lived in high, medium and low density areas, respectively. The results of age categories in Table 3 show that all the 129 respondents were economically active suggesting sustainability of dairy cattle keeping in the study area. Furthermore, chi-square test results ( $\chi^2 = 4.52$ ,  $df = 4$  and  $p = 0.34$ ) indicated that there was no statistical significant differences between the mean age of the respondents in the three urban density areas. This non relationship may explain that age was not an important determinant in deciding to invest in dairy cattle keeping in the study area.

#### **4.1.3 Marital status of respondents**

The findings on Table 3 also show that 112 (86.8%) of all the respondents were married, and 28 (21.7%), 35 (27.1%), and 49 (38%) lived in high, medium and low density areas, respectively. Of all, nine (7%) were divorced, two (1.5 %) were widowed, four (3.2%) were separated and two (1.5%) were those who never got married. These results suggest that, a large proportion of the respondents were married, which implied that social stability and responsibility at household level compelled people to engage in dairy cattle keeping. Furthermore, it also meant that a dairy cattle keeping was an important income generating activity and a food source for improving livelihoods to most of the households. These findings concur with those of recent studies (Thomas and Alan, 2005; Manyama, 2009; Mlozi, 2005; Shimbe, 2008).

As indicated by the chi-square test results ( $\chi^2 = 21.07$ ,  $df = 6$  and  $p = 0.002$ ) there was a statistically significant difference in marital status among the households in the three density areas. This implied that marital status was an influencing factor towards

the decision making to invest in dairy cattle keeping in the study area. For example, most (86%) of the 129 respondents who were married kept cattle. These results concur with the findings by Bayer and Kapunda (2006) who found out that dairy cattle keeping under zero-grazing improved the relationship between husbands and wives. Also, Foeken *et al.* (2004) in their study in Mbeya and Morogoro regions reported that, in most part of Africa, women often have lower educational levels than men. In view of this, farming may be considered as the only option available to women in instances of unemployment and poverty. Globally, FAO (2010b) reveals that about 40% of labour in agricultural and livestock keeping is being provided by women at the household level.

#### 4.1.4 Size of the household

According to Oladoja *et al.* (2008) the households with large number of people are expected to use whatever opportunities and resources around to generate more revenue to meet households' requirements and future reinvestment. Moreover, large household sizes have large demands for funds to meet households' obligations, and the adequate labour helps to take risks in investing into other income generating activities (Oladoja *et al.*, 2008; FAO, 2010a). Table 3 summarizes the household distribution based on the household sizes. It is clearly shown that of the 129 respondents, 41 (31.8%) had four to five people in a household of which nine (7%), 13 (10.1%) and 19 (14.7%) lived in high, medium, and low density areas, respectively. Of all, 74 (57.4%) reported that they lived with six and more people, of which 24 (18.6%), 20 (15.5%) and 30 (23.3%) lived in high, medium, and low

density areas respectively. However, a significantly small proportion, 14 (10.9%) of respondents were found to live with one to three people.

Furthermore, the chi-square results ( $\chi^2 = 4.39$ ,  $df = 4$  and  $p = 0.35$ ) revealed that there was no statistical significant difference between the distributions of household sizes among the three urban density areas.

**Table 3: Demographic status of respondents (n = 129)**

Variable	Density area								p value
	High (n=35)		Medium (n=40)		Low (n=54)		Total(n=129)		
	n	%	n	%	n	%	n	%	
<b>Sex of household</b>									
Female	9.0	7.0	9.0	7.0	13.0	10.1	31.0	24.0	
Male	26.0	20.2	31.0	24.0	41.0	31.8	98.0	76.0	
<b>Age of household head</b>									0.34**
Youth age (21 to 38 years)	3.0	2.3	7.0	5.4	6.0	4.7	16.0	12.4	
Old age (39 to 56 years)	23.0	17.8	18.0	14.0	26.0	20.2	67.0	51.9	
Elderly age (above 56 years)	9.0	7.0	15.0	11.6	22.0	17.1	46.0	35.7	
<b>Marital status of household head</b>									0.002*
Married	28.0	21.7	35.0	27.1	49.0	38.0	112.0	86.8	
Widowed	-	-	-	-	2.0	1.6	2.0	1.6	
Divorced	5.0	3.9	3.0	2.3	1.0	0.8	9.0	7.0	
Others(Never married, separated)	2.0	1.6	2.0	1.6	2.0	1.6	6.0	4.7	
<b>Size of household</b>									0.35**
1 to 3 people	2.0	1.6	7.0	5.4	5.0	3.9	14.0	10.9	
4 to 5 people	24.0	18.6	20.0	15.5	30.0	23.3	74.0	57.4	
6 people and above	9.0	7.0	13.0	10.1	19.0	14.7	41.0	31.8	
<b>Ethnicity of household head</b>									0.41**
Iraqw'	18.0	14.0	19.0	14.7	25.0	19.4	62.0	48.1	
Chagga	6.0	4.7	9.0	7.0	9.0	7.0	24.0	18.6	
Rangi	1.0	0.8	3.0	2.3	4.0	3.1	8.0	6.2	
Pare	3.0	2.3	5.0	3.9	9.0	7.0	17.0	13.2	
Meru	4.0	3.1	3.0	2.3	6.0	4.7	13.0	10.1	
Collective (Nyakyusa, Masai, Nyaturu, Nyamwezi, Manda)	3.0	2.3	1.0	0.8	1.0	0.8	5.0	3.9	

p\* = Statistically significant,

p\*\* = Not statistically significant

This means that the number of people who lived in the respective households was not an important determinant in dairy cattle keeping. However, household members did various home chores including managing the dairy cow enterprises especially in low-income households that could not pay salaries of hired labour.

#### **4.1.5 Ethnicity, area of origin and years of stay**

The respondents were asked about their ethnicity and the area of origin to understand their engagement in dairy cattle keeping activities in the study area. Table 3 shows that over 11 ethnic groups from various regions of Tanzania kept dairy cattle in BU. It was found that of the 129 respondents, slightly less than half, 62 (48.1%) were the Iraqw's who are the natives of Manyara and Arusha regions and of these, 18 (14%), 19 (14.7%) and 25 (19.4%) lived in high, medium, and low density areas, respectively. Of all the respondents, 24 (18.6%) were the Chagga from Kilimanjaro region of whom six (4.7%), nine (7%) and nine (7%) lived in high, medium, and low density areas, respectively. Other ethnic groups included 17 (13.2%), 13 (10.1%) and eight (6.2%) were, Pare, Meru and Rangi respectively. These came from neighboring regions of Kilimanjaro, Arusha and Dodoma respectively.

The results summary in Table 3 indicates that, a small proportion, 5(3.9%) respondents was made up of ethnic groups such as Nyaturu, Nyamwezi, Nywakyusa and Manda who came from Singida, Tabora and Mbeya regions for the purpose of fishing in Lake Babati. In addition, it was also found out that immigration to this area has been very high which culminated into different perceptions and ways of keeping dairy cattle. Moreover, Table 3 shows that the Iraqw's, Chagga and Pare

were the major ethnic groups in all urban density areas and zero grazing dairy cattle keeping was most typical to the Iraqw's who were traditionally pastoralists. This implied that status quo and natural coping strategies in urban areas posed challenges for individuals to change. The results of this study also revealed that of the 129 respondents, 128 (99.2%) had started keeping dairy cattle in BU five years ago of which 35 (27.1%), 39 (30.2%) and 54 (41.9%) lived in high, medium, and low density areas, respectively.

In addition, the findings on Table 3 are somehow similar to (Hertog, 2006; WB, 2001; FAO, 2004, 2010a) whose observations revealed that urban dwellers required a period of time in towns before getting involved in UA. This is due to the fact that UA requires mobilization and acquisition of basic resources such as a plot of land, experience and social capital. Also, Foeken *et al.* (2004) reported that most recent migrants rarely practice urban farming since a person has to be settled and has to have access to various networks to be able to gain access to land for UA. However, the chi-square results ( $\chi^2 = 56.65$ ,  $df = 55$  and  $p = 0.41$ ) revealed that there was no statistically significant difference between the mean distribution of ethnic groups in BU in the three density areas. This implied that ethnicity was not an influencing factor in dairy cattle keeping in BU.

#### **4.1.6 Education level of respondents**

Various studies point out that lack of skills on the use of available resources productively might hinder the access to opportunities of less educated farmers (Amoza *et al.*, 2006; Mwankemwa, 2004). It has also been established that farmers

with better knowledge on innovations, and use of opportunities and resources are likely to be better users of services introduced to them. Table 4 summarizes the results on respondents' education status, occupational status and their sources of incomes. It was found out that over two thirds of the 129 respondents, 83 (64.3%) reported to have completed primary education level. Of the 83 (64.3%) respondents who had attained primary education level, 25 (19.4%), 28 (21.7%) and 30 (23.2%) lived in high, medium, and low density areas, respectively. These findings are contrary to the findings in Dar es Salaam, Mbeya and Morogoro (Mlozi, 2005), which reported that over two third of all respondents were the post-primary graduates.

It is also indicated in Table 4 that the 28 (21.7%) respondents who attained both ordinary and advanced secondary education levels, 5(3.9%), 7(5.4%), and 16 (12.4%) lived in high, medium, and low density areas, respectively. Moreover, of the 129 respondents, 14 (10.9%) had graduated in various tertiary qualifications including certificates, diplomas and postgraduate diplomas. As well, it found out that only 4(3.1%) respondents had not attended any formal schooling. The large percentage of primary school leavers implied that most of the urban dwellers who engaged in dairy cattle keeping could easily adopt innovations. The chi-square test results ( $\chi^2 = 14.67$ ,  $df = 6$  and  $p = 0.023$ ), showed that there was a statistically significant variation in education status among the three density areas in BU.

#### 4.1.7 Employment status

The study findings on Table 4 show that dairy cattle keeping activities were carried out by all socio-demographic groups. Of the 129 respondents, 37 (28.7%) were formally employed in various disciplines such as teaching, agriculture, office attendants, accountants, health staff, natural resources, administration and technicians. Over half of all the respondents, 92 (71.3%), indicated to have never been formally employed which implies that they entirely depended on self-employment. Of these, 25 (19.3%), 32 (24.8%) and 35 (27.1%) lived in high, medium, and low density areas, respectively. Furthermore, of the 37 (28.7%) formally employed respondents, 11 (8.5%), ten (7.8%), seven (5.4%) and nine (7%) reported to be private employed earning salaries, retired with pensions, retired without pensions and government employees, respectively. This implied that some of the dairy cattle keepers were employed in various sectors and that dairy cattle keeping subsidized their incomes and provided food for their families. Clearly, these findings support the past findings in other towns such as Dar es Salaam, Mbeya and Morogoro that, the dairy cattle keepers in the three density areas, earn incomes from other sources (formal and informal sectors) (Mlozi, 2005) and that it is the economic activity that provide employment to the low- and medium income earners as portrayed by (ILRI, 2004; Cicek and Tandogan, 2008, Foeken *et al.*, 2004) whose study findings indicated that dairy cattle keeping contribute to alleviation of income poverty.

The chi-square results ( $\chi^2 = 14.71$ ,  $df = 8$  and  $p = 0.047$ ) indicates that there was a statistically significant variation between household heads formally employed and

those who had never been formally employed based on their engagement in dairy cattle keeping in the three urban density areas. However, a large proportion of self-employed kept dairy cattle perhaps as one of the coping strategy to increase the household incomes hence improving living standards. Also, the results implied that many respondents won their daily bread through self-employed income generating activities including dairy cattle keeping. As revealed in the chi-square test results ( $\chi^2 = 35.91$ ,  $df = 20$  and  $p = 0.169$ ), that there was no statistically significant difference between the formally employed and non-formally employed respondents in the three urban density areas and their engagement in dairy cattle keeping. This suggests that the importance of dairy cattle keeping for all urban socio-demographic groups regardless of their socio-economic status.

#### **4.1.8 Main sources of household incomes**

Table 4 shows that of the 129 respondents, 123 (95.3%) engaged themselves in dairy cattle keeping as the main household income generating activity. It was however found out that the cattle keeping was supplemented with crop farming in the peri-urban areas and non-agricultural businesses in the urban centre. Of these respondents, 33 (25.5%), 39 (30.2%) and 51 (39.6%) lived in high, medium, and low density areas, respectively. This implied that regardless of the area density in which respondents lived, keeping dairy cattle was a survival alternative and coping strategy to subsidize incomes and household food security which lead to poverty alleviation. These findings concur with (Foeken *et al.*, 2004; Mlozi, 2001; Shimbe, 2008; Msuya, 2008; Manyama, 2009) findings who at different times revealed that livestock

keeping was the main source of household incomes through which income poverty was alleviated.

It also seemed most likely that other activities had a complementary relationship with dairy cattle keeping. This is because most of the respondents 100 (77.5%) who reported to keep dairy cattle, they also engaged in crop farming within BTC. From these areas, they also collected crop residues and hay as animal feeds. Of the 100 respondents, 30 (23.3%), 32 (24.8%) and 38 (29.5%) lived in high, medium, and low density areas, respectively. However, the chi-square test results ( $\chi^2 = 6.84$ ,  $df = 11$  and  $p = 0.812$ ) indicated that there was no statistically significant variation between owning extra land rural areas and living in urban areas (Table 4).

However, other important income sources that reported by the respondents were crop farming, petty trading, salaries, food vending and non-agricultural businesses. In BTC, the promotion of dairy cattle keeping has strengthened the economic and socio-political role of women. For example, dairy cattle keepers employ labourers who are lowly paid. These study findings are in line with those of Bayer and Kapunda (2006) who found out that many dairy cattle keepers manage to save enough money that can be used to improve their living standards including sending their children to secondary schools and advanced education institutions.

**Table 4: Socio-economic status of respondents (n= 129)**

Variable	Density area						p value
	High (n=35)		Medium (n=40)		Low (n=54)		
	n	%	n	%	n	%	
<b>Education status of the household heads</b>							0.023*
Non formal education	0	0	3	2.32	1	0.77	
Primary education	25	19.37	28	21.70	30	23.25	
Secondary education	4	3.10	7	5.42	16	12.40	
Certificate education and above	6	4.65	1	0.77	7	5.42	
<b>Years spent in the education system</b>							
Zero years	0	0	3	2.32	1	0.77	
4 years	0	0	8	6.20	3	2.32	
7 years	24	18.60	21	16.27	27	20.93	
11 years	5	3.87	7	5.42	16	12.40	
13 years	4	3.10	0	0	5	3.87	
Above 13 years	2	1.56	1	0.77	2	1.55	
<b>Employment status</b>							0.047*
Never been employed	25	19.37	32	24.80	35	27.13	
Private employed with salary	1	0.77	2	1.55	8	6.20	
Retired with pension	6	4.65	1	0.77	3	2.32	
Retired without pension	1	0.77	4	3.10	2	1.55	
Government employee	2	1.56	1	0.77	6	4.65	
<b>Main source of income</b>							0.812**
Livestock keeping	1	0.77	1	0.77	3	2.32	
Food and cash crop production	2	1.55	1	0.77	3	2.32	
Petty trading and livestock keeping	4	3.10	7	5.42	12	9.30	
Livestock keeping and food and cash crop production	15	11.62	14	10.85	13	10.07	
Petty trading, livestock production and crop(food and cash)	5	3.87	8	6.20	13	10.07	
Livestock keeping, crop production and salary	8	6.20	9	6.97	10	7.75	

p\* = Statistically significant,

p\*\* = Not statistically significant

## 4.2 Scope of Dairy Cattle Production in BU

### 4.2.1 Type and number of dairy cattle kept in BU

Livestock keeping (dairy cattle, goats, poultry and small ruminants) is a major urban subsistence UA activity done by individuals or households. These activities are essential for local development and are supported by the government and NGOs.

Many urban dwellers in BU generate incomes and meet nutritional needs from various employment activities which subsequently improved their livelihoods. Also, the keeping of dairy cattle is an integral activity in the urban economy and ecology, mostly done in all urban density areas both for food and income provision purposes.

Table 5 summarizes results of the 129 respondents, of whom 109 (84.5%) of the respondents who kept only dairy cows, and 30 (23.3%), 33 (25.6%) and 46 (35.7%) lived in high, medium, and low density areas, respectively. of the and 20 (15.5%) respondents who kept both dairy cows and local cattle, five (3.9%), seven (5.4%) and eight (6.2%) lived in high-, medium- and low density areas, respectively. Of all 129 respondents, 66 (52.1%) kept only pure bred dairy cows, 47 (36.4%) kept cross bred cows and 16 (12.4%) kept both pure and cross bred cows. Furthermore, of the 82 respondents who kept pure breeds of cows, 58 (70.7%) kept Friesian only, and 18 (14%), 16 (12.4%) and 24 (18.6%) lived in high-, medium- and low density areas, respectively. And of the 82 respondents, seven (5.4%) kept Ayrshire, other seven (5.4%) kept Jersey while ten (7.8%) kept more than one than one pure bred cattle including Friesians, Ayrshires and Jerseys (Table 5).

The type of dairy cattle breed kept in the study area implied that respondents were conscious on the milk quantities and eventual earnings to be accrued. Findings in Table 5 also showed that respondents who kept dairy cattle obtained cattle breeds from various sources. These included neighbours within Babati urban, and fellow cattle keepers from the neighboring regions especially Arusha. They also used AIs semen from national breeding centres i.e. NAIC - Arusha and crossbreeding by

desired bulls. For instance, 58 (45%), seven (5.4%) and other seven (5.4%) of the respondents indicated that they kept Friesians, Ayrshire and Jersey breeds respectively. Since 2005, Friesians were provided to the needy urban households in groups on the basis of cost sharing and as a way for poverty alleviation and social integration among low- income earning households (Table 5).

Also, since 2005, the government of Tanzania and an NGO namely Friends for International Development (FIDE) which is based in Babati District provided Friesians, which produce more milk than Ayrshire and Jersey breeds. Also, FIDE and the Heifers Projects for International (HPI) in collaboration with CARE and FARM AFRICA focused on dairy cattle keeping as a strategy to improve people's livelihoods by enhancing food security, improving nutritional status, generating incomes and employment provision to the poor urban dwellers. Jerseys and Ayrshires were given to beneficially urban households for extending group networks (i.e. each household was given a heifer and was later to give a yearling to three households before gaining full possession). These findings are similar to those of the HPI (2006).

**Table 5: Type and number of dairy cattle kept in BU (n = 129)**

Variable	Density area						p value
	High (n=35)		Medium (n=40)		Low (n=54)		
	n	%	n	%	n	%	
<b>Major type of livestock kept by the household</b>							0.914**
Dairy & local cattle	5	3.9	7	5.4	8	6.2	
Dairy cattle	30	23.3	33	25.6	46	35.7	
<b>Type of cattle kept by the household</b>							0.844**
Pure & cross breed	3	2.3	6	4.7	7	5.4	
Pure breed	20	15.5	18	14	28	21.7	
Cross breed	12	9.3	16	12.4	19	14.7	
<b>Breed of cattle kept by the households</b>							0.442**
Friesian	18	14	16	12.4	24	18.6	
Ayrshire	2	1.6	3	2.3	2	1.6	
Jersey	0	0	1	0.8	6	4.7	
Friesian & Ayrshire	1	0.8	2	1.6	1	0.8	
Friesian & Jersey	3	2.3	1	0.8	2	1.6	
Cross breeds	11	8.5	17	13.2	19	14.7	
<b>Number of dairy cattle kept by the households</b>							0.28**
1 to 2 dairy cows	8	6.2	12	9.3	17	13.2	
3 to 4 dairy cows	17	13.2	18	14	27	20.9	
5 to 7 dairy cows	7	5.4	8	6.2	6	4.7	
> 7 dairy cows	3	2.3	2	1.6	4	3.1	
Mean	4		3.4		4.4		
Minimum	2		1		2		
Maximum	9		17		17		
<b>Number of milking cows</b>							0.232**
One	1	0.8	0	0	0	0	
Two	16	12.4	17	13.2	3	2.3	
Three	10	7.8	10	7.8	14	10.9	
Four	4	3.1	8	6.2	16	12.4	
Five	1	0.8	1	0.8	8	6.2	
Six and above	3	2.3	4	3.1	13	10.1	

p\*\* = Not statistically significant

In BU, dairy cattle keeping are practiced in its all density areas as an integral activity for giving people's daily incomes. The findings on Table 5 show the number of dairy cows that respondents kept in the three density areas. Of the 129 respondents, 62 (48.1%) reported to keeping three to four dairy cows, of which 17 (13.2%), 18 (14%) and 27 (20.9%) lived in high-, medium- and low density areas, respectively. Others, 37 (28.7%) respondents indicated that they kept one to two dairy cattle, of which eight (6.2%), 12 (9.3%) and 17 (13.1%) lived in high-, medium- and low density areas, respectively. Yet, of all the respondents, 21 (16.3%) showed that they kept five to seven dairy cattle, of which seven (5.4%), eight (6.2%) and six (4.6%) lived in high-, medium- and low density areas, respectively. Also, nine (7%) respondents indicated that they kept between eight to 17 dairy cattle, of which three (2.3%), two (1.6%), four (3.1%) lived in high-, medium- and low density areas, respectively (Table 5).

The chi-square test results ( $\chi^2 = 25.33$ ,  $df = 22$  and  $p = 0.28$ ) indicated that there was no statistical significant difference between the means of dairy cattle kept among the respondents living in the three urban density areas (Table 5). Study results further, showed that respondents in high density areas kept a range of two to nine dairy cows with a mean of four per household. The respondents in medium- and low density areas kept between one to 17 dairy cows with a mean of five per household, respectively. These results confirm the findings (Msuya, 2008; Manyama, 2009) that urban dairy cattle keeping feature more in the medium- and low density areas. Large number of cows kept in medium- and low density areas is because of large plot sizes

(Mlozi, 2005, Msuya, 2008; Manyama, 2009) and motivated by easier accessibility of forages and farm residues.

In BU, farming by-laws restrict urban dwellers to keep dairy cow not more than two, four and 20 cattle in the high-, medium- and low density areas, respectively, under zero- grazing. Similarly, contrary to the council's by-laws, Mvena *et al.* (1991) found that 90 percent of the dairy cattle keeper in decent areas of the Dar es Salaam city kept 8 cattle instead of four allowed in the city by-laws. Yet, Msuya (2008) reported that about 43 percent of the respondents in Kinondoni Municipal Council kept five dairy cattle, mostly in the medium- and low-density areas. Manyama (2009) found that in Mbeya Municipal Council, 29.3 percent of the respondents kept five dairy cattle, which was above the number stipulated in the council's by-laws. These findings suggest that the number of dairy cattle to keep disregards the by-laws and the practice is motivated by individual curiosity and the propensity to earn money and food. These motives disregard environmental impacts which appear to increase as towns grow.

#### **4.2.2 Milk produced**

The study findings on milk production are summarized on Table 6 and show that, of the 129 respondents, 94 (72.9%) reported to produce 11 – 20 litres of milk per cow per day, of which 23 (17.9%), 30 (23.3%) and 41 (31.8%) of them lived in high-, medium- and low density areas, respectively. Other respondents, 18 (14%) reported to producing more than 20 litres of milk per cow per day, of which nine (7%), five (3.9%) and four (3.1%) lived in high-, medium- and low density areas, respectively.

Yet, of all respondents, 17 (13.1%) indicated to getting one to 10 litres per cow per day, of which three (2.3%) lived in high density areas and 14 (10.8%) distributed equally in both medium- and low density areas. These findings revealed that, the overall mean milk production per cow per day of 15.4, of which the mean milk yield in high density areas was 17.4 litres per cow per day, 15.3 in the medium density areas and 14.2 in the low density area.

These study findings showed that respondents in high density areas produce more milk than those in medium- and low density areas, of which the means milk production per cow per day was above the overall mean. The study findings were in support of study conducted in Kinondoni Municipal Council by Msuya (2008). The study findings implied that in the high density areas, there was good management of dairy cattle enterprises as revealed by (Manyama, 2009; Cicek and Tandogan, 2008; Msuya, 2008) in the towns of developing countries.

Furthermore, the study results showed that, on average, the households kept dairy cows gained 32.7, 27.2 and 25.7 litres of milk per day in high-, medium- and low density areas, respectively where as the overall mean was 28.1 litres. These study findings were higher compared to those reported by other studies conducted in other towns of Tanzania. For example, in Kinondoni Municipality, Msuya (2008) reported that, on average milk yield ranged from 3.5 to 20 litres per cow per day with overall mean of 9 litres. In Mbeya Municipal Council, Manyama (2009) found that, 82 percent of all the respondents produced milk ranging from 1 to 20 litres per day and the remaining 18 percent produced between 21 to 30 liters of milk per day. While,

Mlozi (2005) reported that, the mean of milk produced per cow per day in Mbeya, Morogoro and Dar es Salaam ranged from 1 to 6 litres.

Yet, the study findings indicated that over two third of all the respondents got between 11- 20 litres of milk per cow per day, and 50 percent of respondents got over 20 litres of milk per cow per day lived in high density areas. These findings suggested that, in spite of relatively less number of dairy cows kept in the high density areas, there was higher milk yield compared to the medium- and low density areas. These results contravene with the conclusive remarks made by the recent studied in some towns of Tanzania such as Mbeya, Morogoro and Dar es Salaam (Manyama, 2009; Mlozi, 2005; Msuya, 2008), which revealed that lower milk quantities were produced in the high density areas due to inadequate provision of inputs required. Perhaps, in BU, higher milk yields in the high density areas were contributed by the easier accessed and supplies agro-processing by-products within the CBD, abundant forage from the neighbouring green belt of Lake Babati, and other socio-economic factors such as cost-effective use of resources.

Empirically, basing on the overall means of milk production (of 28.1 litres of milk per day per household) and milk prices (of Tshs 721 per litre), which enabled the dairy cow keeping households in the urban density areas in BU to gain between Tshs 3600 and 57 600 with the mean of Tshs 20 518 per day. It was observed that this daily revenue obtained from milk sales was far above compared to the incomes earned by the dairy cow keepers reported by the recent studies findings conducted in various urban areas of Tanzania. For instances, in Kinondoni Municipality (Msuya, 2008), with the mean price per litre of milk of Tshs 540, the income from selling milk

was between Tshs 1500 and 5 400 with an average of Tshs 4860 per household per day. In Mbeya Municipal Council Manyama, (2009), reported that the average revenue for the three density areas earned from milk selling was Tshs 4020 per day and Mlozi (2001) reported less overall mean income of Tshs 3950 for dairy cattle keepers in Morogoro municipality. These differences, perhaps portrayed the differences in the urban context factors and cost-effective allocation and make use of resources. The results clearly indicate that, higher income generation in BU from milk sales is mainly influenced by the progressively increasing milk price due to low milk supply.

**Table 6: Households' total milk yield (n = 129)**

Variable	Density areas								p value
	High (n=35)		Medium (n=40)		Low (n=54)		Total (n=129)		
	n	%	n	%	n	%	n	%	
<b>Mean lactation days</b>	303.9		301.7		303.5		303		
<b>Lts of milk/cow/day</b>									0.36**
1 – 10	3	2.3	7	5.4	7	5.4	17	13.1	
11 – 20	23	17.8	30	23.3	41	31.8	94	72.9	
>20	9	7	5	3.9	4	3.1	18	14	
Mean	17.4		15.3		14.2		15.4		
<b>Lts of milk/HH/day</b>									0.007*
1 – 10	0	0	2	1.6	1	0.8	3	2.3	
11 – 20	8	6.2	22	17.1	23	17.8	53	41.1	
21 – 30	9	7	3	2.3	15	11.6	27	20.9	
31 – 40	11	8.5	5	3.9	6	4.7	22	17.1	
> 40	8	6.2	8	6.2	9	7	25	19.4	
Mean	32.7		27.2		25.7		28.1		
<b>Lts of milk/HH/year</b>									0.156**
< 3000	0	0	2	1.6	1	0.8	3	2.3	
3001 – 9000	16	12.4	25	19.4	36	27.9	77	59.7	
9001 – 12000	8	6.2	4	3.1	8	6.2	20	15.5	
12001 -15000	5	3.9	3	2.3	4	3.1	12	9.3	
15001- 18000	5	3.9	0	0	3	2.3	8	6.2	
>18000	1	0.8	5	3.9	2	1.6	8	6.2	
<b>Mean</b>	9943.4		8227.5		7794.3		8511.7		

$\rho^*$  = Statistically significant,

$\rho^{**}$  = Not statistically significant

Table 6 show that, the respondents in high density areas milked a cow for a period ranging 300 to 314 days with a mean of 304 days, while in the medium-density areas lactation period ranged from 272 to 306 days with mean of 302 days, and in the low-density areas the period ranged from 302 to 306 days with a mean of 303.5 days. With these mean lactation days, 9 993.40, 8 227.53 and 7 794.30 litres of milk per household per lactation period was produced in the high-, medium- and low density areas, respectively.

The overall lactation period mean was 303.03 days with a mean milk yield of 8 511.72 litres per household. These studies are in line with the standard milking days of 302 – 305 days as reported by Sachin and Avtar (2007). Further study results on milk production indicate that of the 129 respondents, 77 (60%) reported to producing milk in the range of 3 001 to 9 000 litres per year, of which 16 (12.4%), 25 (19.4%) and 36 (27.9%) of them lived in high-, medium- and low density areas, respectively. And, of all the respondents, 40 (31%) of which 18 (14%), seven (5.4%) and 15 (11.6%) lived in high-, medium- and low density areas, respectively, produced between 9 001 to 18 000 litres of milk per year (Table 6).

However, the study results showed that, of the 35 respondents in the high density areas, 27 (77.1%) produced between 21 and above 40 litres of milk per household which portrayed that there were good management practices of their cattle, which also led to long lactation periods (average of 304 days) and milk yields (overall average of 17.4 litres per cow per day and 32.7 litres per day per household), but the differences were not substantial. The chi-square results ( $\chi^2 = 40.36$ ,  $df = 38$  and  $p =$

0.36) shows there was no statistical significant differences between the means of litres of milk produced on the daily basis per cow in the three urban density areas (Table 6). However, during the discussions with key informants, the agricultural and livestock extension staff (ALES) said that there was a progressive decreased in milk yield, especially during the dry seasons in the study area. These were due to decreased farm harvests, lack of green pastures and inadequate farm residues.

Further results on Table 7, indicated that ethnic groups influenced on milk production. The significance levels in high-, medium-, and low density areas were 0.008, 0.27 and 0.645 respectively, which revealed that there was a statistically significant difference in the means milk production among the ethnic groups in the high density areas. The mean milk production in the medium and low density areas were not influenced by the difference in ethnicity.

The study findings showed that, of the 129 respondents, 67 (52%) were not the natives of the BU, of which 17 (13.2%), 21 (16.3%) and 29 (22.5%) lived in the high-, medium and low density areas (Table 7). The findings implied that, in high density areas, respondents conducted dairy cattle keeping as an important business that observed good management practices. This also implied that because of neighborhoods, the respondents had shared experiences through formal and informal technical expertise and utilized market opportunity to the high level.

**Table 7: Mean milk yields (Lts) per day basing on their ethnicity (n = 129)**

Variable	Density area					
	High (n=35)		Medium (n=40)		Low (n=54)	
	Mean	n	Mean	n	Mean	n
Iraqw'	36.7	18	31.6	19	26.5	25
Chagga	29.3	6	17.7	9	21.7	9
Rangi	44.0	1	40.0	3	22.0	4
Pare	36.6	3	29.6	5	29.6	9
Meru	21.0	4	15.3	3	24.6	6
Others	23.0	3	12.0	1	24.0	1
<b>Total mean</b>	<b>32.7</b>	<b>35</b>	<b>27.2</b>	<b>40</b>	<b>25.6</b>	<b>54</b>
<b><math>\rho</math> Value</b>	<b>0.008*</b>		<b>0.27**</b>		<b>0.645**</b>	

$\rho^*$  = Statistically significant,  $\rho^{**}$  = Not statistically significant

Table 8 indicated that of the 129 respondents who kept dairy cattle, 35 (27%), 40 (32%) and 54(41%) maintained means of 2.1, 1.7 and 1.9 milking cows respectively. This showed a higher mean of milking cow in the high density area that is sought of contributing to the high milk production in the density area than in medium- and low density area.

**Table 8: Milking dairy cows kept based on ethnicity in BU (n = 129)**

Variable	Density area					
	High (n= 35)		Medium (n= 40)		Low (n = 54)	
	Mean	n	Mean	n	Mean	n
Iraqw'	2.11	18	1.84	19	1.92	25
Chagga	2.00	6	1.22	9	1.78	9
Rangi	2.00	1	2.00	3	2.25	4
Pare	2.67	3	2.40	5	2.11	9
Meru	1.75	4	1.00	3	1.50	6
Others	1.67	3	1.00	1	2.00	1
<b>Total</b>	<b>2.06</b>	<b>35</b>	<b>1.70</b>	<b>40</b>	<b>1.91</b>	<b>54</b>
<b><math>\rho</math> Value</b>	<b>0.32**</b>		<b>0.66**</b>		<b>0.86**</b>	

$\rho^{**}$  = Not statistically significant

### 4.2.3 Selling of dairy cattle products

The study found that respondents sold dairy products mainly as fresh milk, live animals and manure. The results are in line with those revealed by other studies conducted in other areas (Thomas and Alan, 2005; Mohammad, 2009; Cicek and Tandogan, 2008). These products were mainly sold locally within BU. The study findings in Table 9 showed that, of the 129 respondents, 70 (54.3%) reported to selling fresh milk at the home, of which 13 (10.1%), 23 (17.8%) and 34 (26.4%) lived in high-, medium- and low density areas, respectively. Yet, 43 (33.3%) respondents, of which 15 (11.6%), 13 (10.1) and 15 (11.6%) lived in high-, medium- and low density areas, respectively, sold their milk to the collection centres, directly to the restaurants, canteens and local milk processing plant, respectively. Of the 129 respondents, 82 (63.6%) reported that the house wives sold the milk and kept records, and of these, 25 (19.3%), 26 (20.2%) and 31 (24%) lived in high-, medium- and low density areas, respectively. Yet, of all the respondents, 25 (19.4%) indicated that male labourers sold milk, of which six (4.7%), eight (6.2%) and 11 (8.5%) lived in high-, medium- and low density areas, respectively (Table 9). Still, 22 (17.1%) of the respondents said that other members in the households sold milk, of which, four (3.1%), six (4.7%) and 12 (9.3%) lived in high-, medium- and low density areas, respectively. These results confirm that there was high involvement of women in selling milk which included overall management.

These findings are in line with Kayumbu (2008) and FAO (2003) who revealed that in low income countries women provide over half of the agricultural work force in production, marketing of dairy and dairy related products. The implication is that, the

involvement of other household members in managing dairy cattle enterprise adds efficiency, attention and reduces payable charges to the milk production. Also, the reasons for other household members making up the most part of the labour are such a traditional practices, lack of rationality in enterprise management, and lack of efficient and qualified labour. These findings are in line with (Mwebaze, 2004; Cicek and Tandogan, 2008) who related the use of family labour as an alternative labour for effective continuity in the dairy cattle enterprise.

The study found that the main buyers of fresh milk were the immediate consumers who included neighbours, milk collectors, milk vendors, hoteliers, public offices and the local milk processing women groups. These study findings portray an existing potential for increasing milk production. Further, it was also found that, there was milk which was sent out to the neighbouring townships such as Gallapo (15km from the CBD to the east) and Magugu (20 km from the CBD to the north).

Likewise, the study findings showed that, of the 129 respondents, 54 (59.4%) reported that milk was transported on foot, of which 17 (18.7%), 15 (16.5%) and 22 (24.2%) lived in high-, medium- and low density areas, respectively. Yet, 32 (35.2%) respondents reported that milk was transported on bicycles, of which four (8.8%), ten (11%) and 14 (15.4%) lived in high-, medium- and low density areas, respectively (Table 9). Few, two (1.6%) respondents said they used public transport and three (2.3%) said used own vehicles. Transport facilities for milk were necessary for the dairy cattle keepers taking milk to their distant permanent customers such as public offices, processing plant, restaurants and canteens.

However, of the 86 respondents in the medium- and low density areas, most, 70 (81.4%) lived away from the CBD and relied on the milk collectors and milk vendors to buy their milk and thus paid low prices to the milk they bought. The study findings showed that there were high mean milk prices in the high density areas due to their nearness to the CBD. These places have many restaurants, canteens and consumers. Study results further, indicated that milk selling prices ranged between Tshs. 400 – 1 300 depended on the distance from the CBD and nature of sales (Table 9). For instance, it was noted that customers who bought  $\leq 1$  litre once or regularly on the daily basis paid higher than the customers who bought  $\geq 2$  litres on cash or bill. In the areas of Nangara and Singe wards (a maximum of six km from CBD) was sold for offered Tshs. 600 per litre, and the dairy cattle keepers were paid by installment basis, twice a month. The collection centres only managed to collect milk produced in the morning, while milk produced in the afternoon was not because consumers used to the morning milk. This was then sold to the milk vendors or neighbours at a lower price ranging from Tshs. 400 to 600 per litre.

**Table 9: Selling of dairy cattle products in BU (n = 129)**

Variable	Density area								p value	
	High (n=35)		Medium (n=40)		Low (n=54)		Total (n =129)			
	n	%	n	%	n	%	n	%		
<b>Sold dairy products</b>										
Fresh milk	35	27.1	39	30.2	52	40.3	126	97.7	0.311**	
Live animal	0	0	1	0.8	2	1.6	3	2.3		
<b>Places milk sold</b>										
At home	13	10.1	23	17.8	34	26.4	70	54.3	0.311**	
Milk collection centres	15	11.6	13	10.1	15	11.6	43	33.3		
Local processing firm.	1	0.8	0	0	1	0.8	2	1.6		
Hotels and canteens	6	4.7	4	3.1	4	3.1	14	10.9	0.663**	
<b>Milk buyers</b>										
Neighbours	4	3.1	9	7	18	14	31	24		
Milk collectors (centres)	16	12.4	18	14	20	15.5	54	41.9	0.663**	
Hoteliers	7	5.4	7	5.4	5	3.9	19	14.7		
Local milk processors	4	3.1	3	2.3	4	3.1	11	8.5		
Vendors	4	3.1	3	2.3	7	5.4	14	10.9	0.663**	
<b>Person who sold milk</b>										
Hired labourer	6	4.7	8	6.2	11	8.5	25	19.4		
House wife	25	19.3	26	20.2	31	24	82	63.6	0.989**	
Other household members	4	3.1	6	4.7	12	9.3	22	17.1		
<b>Price range in past six months (Tshs)</b>										
400 to 700	22	17.1	24	18.6	31	24	77	59.7	0.989**	
700 to 1000	11	8.5	13	10.1	19	14.7	43	33.3		
1000 to 1300	2	1.6	3	2.3	4	3.1	9	7		
<b>Distance to the point milk sold/collected</b>										
Less than 1 km	29	22.4	33	25.6	45	34.9	107	82.9	0.989**	
1 - 2 km	2	1.6	5	3.9	2	1.6	9	7		
3 - 4 km	0	0	0	0	3	2.3	3	2.3		
Above 4 km	4	3.1	2	1.6	4	3.1	10	7.8		

p\*\* = Not statistically significant

Variations in milk prices emanated from a number of factors such as lack of cooling facilities, poor transportation facilities, poor social networks of dairy cattle keepers, climatical change, and change in agro-processing costs. The study findings on Table 9 show that, of the 129 respondents, 73 (56.6%) reported that variation in milk prices increased as the running costs of agro-processing factories increased, of which 23 (17.8%), 24 (18.6%) and 26 (20.2%) lived in high-, medium- and low density areas, respectively. Agricultural extension staff revealed that, during harvest seasons there was a high supply of sunflower, leguminous and cereal crops, which lowered the running cost of the agro-processing. In turn, these lowered the price of agro-processing by-products, which affected positively on the dairy cattle keeping enterprises.

Also, of the 129 respondents, 31 (24.0%) reported that the climatical changes led to the variation in milk production and hence fluctuation in milk prices, of which eight (6.2%), six (4.7%) and 17 (13.2%) lived in high-, medium and low density areas, respectively. Furthermore, respondents indicated that selling of milk in BU was mainly affected by transport costs, repair and service charges, and labour charges. Selling of milk in all density areas was mainly done by mothers, fathers and labourers, who are mainly responsible for selling milk in respective household (Table 9). Of the 129 respondents, 107 (82.9%) reported that selling of milk (including travel and transaction time) took an average of less than an hours per day to travel from home to the place of sale, while, 22 (17.1%) said, it involved travel distance ranging from one to 4 kilometres. The study findings implied that there are inadequate milk collection centres over the council. Some disadvantages for this, are

such as wastage of long time and transport costs which could be saved for enterprise management.

#### **4.2.4 Constraints encountered in dairy cattle keeping**

The study findings on Table 10 summarize the respondents' opinions of the main constraints of keeping dairy cattle in BU. These were reported to include inadequate capital, shortage of feeds, and high cost of supplementary feeds, low milk yields and low cow reproductive performance. These findings concur with the findings of recent studies by Ally, 2007; Mlozi, 2005; Msuya, 2008; Manyama, 2009 who did more or less similar studies in various areas of Tanzania. Yet, others were poor management skills, shortage and irregular electricity services and water supply, poor road infrastructure, presence of animal diseases and high costs of agro-vet inputs. Of the 129 respondents, 71 (55%) reported that they faced low cow reproductive performance, of which 20 (15.5%), 23 (17.8%) and 28 (21.7%) lived in high-, medium- and low density areas, respectively. The study findings are in support with Foeken *et al.* (2004) conducted in Morogoro and Mbeya municipalities which reported that in Morogoro municipality, cattle under zero-grazing management showed lower reproductive levels than natural grazing cows.

Of all the 129 respondents, 34 (26.4%) indicated that they faced shortages of feeds, of which six (4.7%), nine (7%) and 19 (14.7%) lived in high-, medium- and low density areas, respectively. this constrain has a reversing implication on the milk production although at varying degrees. Other respondents were, 14 (10.9%) reported that they experienced poor dairy cows' management skills, of which five (3.9%), four

(3.1%) and five (3.9%) lived in high-, medium- and low density areas, respectively. This revealed that, in the urban dairy cattle keeping and gaining skills of cows' management occur simultaneously. Yet, of the 129 respondents, ten (7.8%) reported to facing high costs of concentrates, of which four (3.1%), four (3.1%) and two (1.6%) lived in high-, medium- and low density areas, respectively (Table 10).

**Table 10: Constraints encountered in undertaking dairy cattle keeping (n= 129)**

Variable	Density area						Total (n=129)	p value	
	High (n=35)		Medium (n=40)		Low(n=54)				
	n	%	n	%	n	%			
<b>Constraints faced in keeping dairy cattle</b>									
Shortage of feeds	6	4.7	9	7.0	19	14.7	34	26.4	0.461**
High cost of concentrates	4	3.1	4	3.1	2	1.6	10	7.8	
Poor animal reproductive performance	20	15.5	23	17.8	28	21.7	71	55.0	0.072**
Poor dairy cow management skills	5	3.9	4	3.1	5	3.9	14	10.9	
<b>Challenges encountered in undertaking dairy cattle keeping</b>									
High price for supplements	4	3.1	6	4.7	9	7.0	19	14.7	0.072**
Inadequate dairy cattle management knowledge	7	5.4	5	3.9	14	10.9	26	20.2	
Animal diseases and death	7	5.4	11	8.5	4	3.1	22	17.1	
Inadequate and substandard extension services	4	3.1	2	1.6	12	9.3	18	14.0	
Poor milk production	13	10.1	16	12.4	15	11.6	44	34.1	

ρ\*\* = Not statistically significant

Further, study findings on Table 10 indicate that, the dairy cattle breed types kept were of varying percentages in purity which was difficult to identify the causes of low reproductive performance. Also, the chi-square results ( $\chi^2 = 5.67$ ,  $df = 6$  and  $p = 0.461$ ) indicated that there was no statistical significant differences in means of respondents perceptions of constraints that they faced in the urban areas. This implied that respondents in all the three density areas faced similar constraints and challenges, in spite of their socio-economic status.

In addition, the study findings on Table 10 show that, of the 129 respondents, 44 (34.1%) reported that they experienced low milk yields, of which 13 (10.1%), 16 (12.4) and 15 (11.6%) lived in high-, medium- and low density areas, respectively. Also, of all the respondents, 26 (20.2%) reported that they experienced poor dairy cattle management skills, of which seven (5.4%), five (3.9%) and 14 (10.9%) lived in the high-, medium- and low density areas, respectively. Others reported constraints for keeping dairy cattle in BU were, 19 (14.7%) respondents who reported high prices of supplements and agro-vets, 22 (17.1%) respondents said animal death caused by diseases, and 18 (14%) indicated inadequacy of extension services provisions (Table 10).

The respondents were also asked to mention problems that they perceived as constraints in dairy cattle keeping. Results on Table 10 reveal that respondents mentioned unreliable milk markets as the most important problem, followed by high prices of drugs and concentrates. These constraints also were reported by Urassa and Raphael (2003) and Mlozi (2005) in their study findings conducted in Morogoro and Mbeya Municipalities. Also, similar constraints, in dairy cattle keeping have been reported by other studies (Nkya *et al.*, 2007; Ally, 2007; Shimbe, 2008; Msuya, 2008). This portrays that these problems are common in dairy cattle keeping in the urbanized environments which need to be tackled all together.

### **4.3 Institutional Factors Influencing Dairy Cattle Keeping in BU**

#### **4.3.1 Resource base in dairy cattle keeping**

The urban ecological setup of BU provides for plenty of resources required for dairy cattle keeping. These resources include land, water, fodder, agro-processing plants,

animal supplements, local materials for housing, local mineral supplements, labour, conducive weather and agro-input supplies. The study findings show the important resources used in UA activities in BU (Table 11) which concur with the findings by others (Mlozi, 1996, 2005; Foeken *et al.*, 2004; Mwebaze, 2004; Lee-Smith and Nasir, 1992; Thys *et al.*, 2005; Chrislensen, 2007).

The study results on Table 11 show that of the 129 respondents, 100 (77.5%) reported that they owned extra land than residential plots of which 30 (23.3%), 32 (24.8%) and 38 (29.5%) lived in high-, medium- and low density areas, respectively. Of the 100 respondents owning extra land, 43 (33.3%) indicated to owning between 1 to 2 acres, 32 (24.8%) said between 3 to 4 acres, 13 (10.1%) said between 4 to 6 acres and 12 (9.3%) owned more than 7 acres (Table 11).

Also, of the 100 respondents, 97 (86%) indicated that they used their land for agro-forestry and production of cash and food crops, while three (2.3%) reported to hiring out their land to people growing annual crops. Crop farming and agro-forestry activities are integral to the dairy cattle keeping in the study areas because farm residues, pasture and agro-processing by-products are collected as animal feedstuff at cheap cost (Plate 1). Further, the study results on Table 11 reveal that respondents acquired land through different ways.



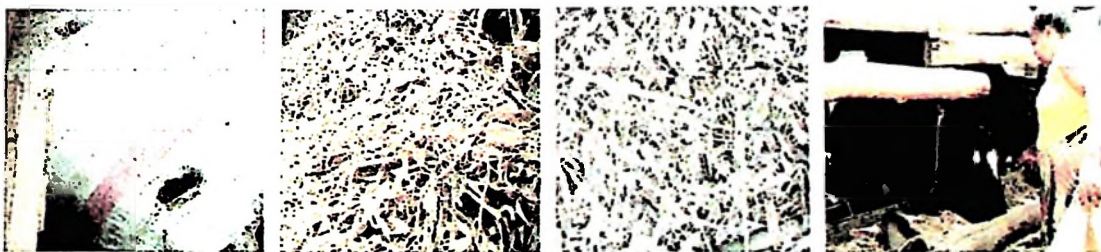
**Plate 1: Agro-forestry farming as a source of forage for dairy cattle in BU**

Of the 129 respondents, 46 (35.7%) reported that they acquired land through purchasing, 43 (33.3%) said through inheritance from their kin, nine (7%) got it by

being allocated land by the village government authorities, and two (1.6%) said by hiring others' land. In BU, essential cash crops include pigeon peas, lablab, sunflower and plantains while food crops are maize and horticultural crops (BTC, 2008).

This study found out that crop farming in the study area provides a multiple benefit to the dairy cattle keepers. These results were in support with (IFAD, 2005; Hertog, 2006; Luoga, 2002) that there is a symbiotic relationship between dairy cattle keeping and crop farming. It provides for recycling phenomenon which is very crucial for urban ecology. All the 129 respondents reported that they used farm residues as a primary animal feed, especially during the dry season. The farm residues mainly included raw banana trunk (green leaves, trunk, fruit), leguminous crops (non powdery remains after removal of beans), and cereal crop residues (whole except maize cobs).

Of the 129 respondents, 120 (93%) reported that they used by-products of agro-processing factories, of which 30 (23.4%), 40 (31%) and 50 (38.8%) lived in high-, medium- and low density areas, respectively. The common agro by-products include maize bran and sunflower cakes, which were used to cattle feed, either as natural concentrates or as nutritional supplement especially to milking cows (Plate 2).



**Plate 2: Some common crop residues used as dairy cattle feed in BU**

However, access to good quality feedstuff and supplements was increasingly becoming difficult for most dairy cattle keepers. Most keepers employ the cut and carry of green forage to their cattle. All the weather dependable sources of browse and green forage is the reserved green belt of Lake Babati. However, the dairy cattle keepers owning extra land elsewhere in BU go out and bring farm residues from there for the dairy cattle (Plate 3).



**Plate 3: Surroundings of Lake Babati a potential source of browse and forage in BU**

Observations showed that it was common for the respondents to have a store (dry space, container, room, house) within the surroundings for stacking dry feedstuff, which were used to feed cattle parallel to green or raw feedstuff throughout the entire dry season from June to November. The green forages are collected from farms, public open spaces, recreational areas, reserved flood plains, forest reserved areas and Lake Babati reserved area (Table 11).

Study results on Table 11 show that, of the 129 respondents, 86 (66.7%) mentioned that they collected manure from the animal sheds and send it out to fertilize their farms located in the peri-urban, of which 24 (18.6%), 28 (21.7%) and 34 (26.4%) lived in high-, medium- and low density areas, respectively. Others, four (3.2%) reported to use manure for generating bio-gas for household use (energy for

domestic use), and 30 (23.3%) reported to have been selling cow dung as manure, of which seven (5.4%), eight (6.2%) and 15 (11.6%) lived in high-, medium- and low density areas, respectively. This implied that urban dairy cattle keepers also generate income from either selling manure or using it in the farms and gardening and saved money that could be used to purchase industrial fertilizers.

**Table 11: Resource base in dairy cattle keeping in BU (n = 129)**

Variable	Density area						Total (n=129)	p value	
	High (n=35)		Medium (n=40)		Low (n=54)				
	n	%	n	%	n	%			
<b>Owning land somewhere in BU</b>									
Yes	30	23.2	32	24.8	38	29.5	100	77.5	0.215**
No	5	3.9	8	6.2	16	12.4	29	22.5	
<b>Size of land acquired</b>									
1- 2 Acre	12	9.3	15	11.6	16	12.4	43	33.3	
3 - 4 Acre	6	4.6	11	8.5	15	11.6	32	24.8	
5 - 6 Acre	5	3.9	3	2.3	5	3.9	13	10.1	
7 - 8 Acre	2	1.6	0	0	2	1.6	4	3.1	
Above 8 Acre	5	3.9	3	2.3	0	0	8	6.2	
<b>Methods of acquiring land</b>									
Purchased	14	10.9	14	10.9	18	13.9	46	35.7	
Rented	1	0.8	0	0	1	0.8	2	1.6	
Inherited	12	9.3	16	12.4	15	11.6	43	33.3	
Provided with village government and kins	3	2.3	2	1.6	4	3.1	9	7.0	0.234**
<b>Major types of feeds for cows</b>									
Hey, Banana trees, Farm crop residues, agro-processed, minerals	28	21.7	25	19.4	36	27.9	89	70.0	
Hey, farm residues, agro- processed by products, mineral sup.	7	5.4	15	11.6	18	13.9	40	31.0	0.249**
<b>Main sources of feeds for dairy cows</b>									
Own farm, agro-processing factories, reserved areas, input stockists	29	22.5	27	20.9	37	28.7	93	72.1	
Farm, agro-processing factories, agro-vets. open areas	6	4.7	13	10.1	17	13.2	36	27.9	
<b>Ways of disposing cow-dung</b>									
Hipping temporarily in the backyard	0	0	1	0.8	1	0.8	2	1.6	
Hipping and sell	7	5.5	8	6.2	15	11.6	30	23.3	
Taken to the own farm	24	18.6	28	21.7	34	26.4	86	66.7	
Hipped for gardening and bio-gas	4	3.1	3	2.3	4	3.1	11	8.5	

ρ\*\* = Not statistically significant

Generally, respondents in the medium and low density areas who were close to the peri-urban areas combined livestock activities with crop farming and mostly used more manure than those in the high density areas who were closer to the CBD in BU. Observations showed that some dairy cattle keepers in BU had managed to dig wells (bore holes and shallow wells) or install water reservoir tanks mainly for watering the dairy cattle as added benefits (Plate 4).



Plate 4: Biogas and water reservoir structures in the dairy cattle keepers' compounds

#### 4.3.2 Respondents' opinions about the reasons and opportunities

Respondents were asked about their opinions on the socio-economic factors that influenced the dairy cattle keeping activities. Table 12 presents the respondents' opinions. The aspects asked included incomes for the households, provision for food, employment of the household members and manure for organic urban farming. The findings showed that, of the 129 respondents, most, 108 (83.7%) indicated that they did urban dairy cattle keeping to raise their household incomes, of which 29 (22.5%), 35 (27.1%) and 44 (34.1%) lived in high-, medium- and low density areas, respectively. And, of all respondents, 17 (13.2%) reported that they kept dairy cattle

to improve household food security. of which four (3.1%), four (3.2%) and nine (7%) lived in high-, medium- and low-density areas, respectively. Moreover, four (3.2%) respondents said that they kept dairy cattle to employ the household members (Table 12). These findings are in support with (Mohammad, 2009; Mlozi, 2005; Foeken *et al.*, 2004) that have reported that urban dairy cattle keeping was survival alternative and coping strategy for low income urban dwellers.

The study findings on Table 12 revealed that keeping dairy cattle in BU was an important UA activity because it contributed household income generation, urban food security and employment. In addition, results on Table 12 depict that of the 129 interviewees, more than two thirds, 88 (68.2%) mentioned that they were encouraged to keep dairy cattle because of the presence of resources (i.e. land, heifers, pastures, feed), of which 24 (18.65%), 28 (21.7%) and 36 (27.9%) lived in high-, medium- and low density areas, respectively. Also, 33 (25.6%) of the respondents reported that they kept dairy cattle because of presence of urban milk demand, of which ten (7.8%) and 13 (10.1%) lived in both high- and medium- and low density areas, respectively. Yet, other eight (6.2%) respondents indicated that they kept dairy cattle in BU because of the presence of extension services from various stakeholders such as government extension agents, NGOs and the presence of microfinance banks and input-service providers.

**Table 12: Reasons and opportunities towards urban dairy cattle keeping in BU (n=129)**

Variable	Density area						Total (n=129)		p value
	High (n=35)		Medium (n=40)		Low (n=54)				
	n	%	n	%	n	%	n	%	
<b>Major reasons for keeping Dairy cows</b>									<b>0.721**</b>
For raising household income	29	22.5	35	27.1	44	34.1	108	83.7	
For employment opportunities	2	1.6	1	0.8	1	0.8	4	3.1	
For provision of food security	4	3.1	4	3.1	9	7	17	13.2	
<b>Institutional opportunities encouraging keeping</b>									<b>0.867**</b>
Available milk market	10	7.8	10	7.8	13	10.1	33	25.6	
Available extension services	0	0	1	0.8	3	2.3	4	3.1	
Availability of facilitating institutions (i.e. Banks, SACCOS)	1	0.8	1	0.8	2	1.6	4	3.1	
Availability of (land, heifers, pastures, materials, feed)	24	18.6	28	21.7	36	27.9	88	68.2	
<b>Potential motivating agents</b>									<b>0.892**</b>
Extension agent	4	3.1	3	2.3	5	3.9	12	9.3	
Neighbour	3	2.3	3	2.3	5	3.9	11	8.5	
Friends	3	2.3	6	4.7	12	9.3	21	16.3	
Own anxiety	19	14.7	21	16.3	25	19.4	65	50.4	
Parents	6	4.7	7	5.4	7	5.4	20	15.5	

ρ\*\* = Not statistically significant

Study results further show that, the rate at which the influencing factors compelled individual urban households to utilize the institutional opportunities in undertaking dairy cattle keeping did not differ. For instance, the chi square test results ( $\chi^2 = 2.079$ ,  $df = 4$  and  $\rho = 0.721$ ) indicate that there was no statistical significant differences between the means of reasons of the factors that influenced the keeping of dairy cattle among the respondents living in the three urban density areas. These findings suggested that in spite of the different urban density areas in which respondents lived they still had similar essential requirements which compelled them to engage in UA activities such as dairy cattle keeping and crop farming.

Moreover, the study results revealed that respondents were encouraged to engage in urban dairy cattle keeping because of the advice and encouragement they got from various sources including extension agents, neighbours, friends and parents to improve their livelihoods. Findings on Table 12 show that, of the 129 respondents, 65 (50.4%) reported that they were motivated to keep dairy cattle because of own anxiety, of which 24 (18.6%), 16 (12.4%) and 25 (19.4%) lived in high-, medium- and low density areas, respectively. Also, of all the 129 respondents, 21 (16.3%), 20 (15.5%), 12 (9.3%) and 11 (8.5%) mentioned that they kept dairy cattle because they were advised by friends, parents, extension agents and neighbours, respectively (Table 12). The chi-square results ( $\chi^2 = 3.59$ ,  $df = 8$  and  $p = 0.892$ ) indicate that there was no statistical significant difference between means on motivating factors for keeping dairy cattle in the different urban density areas.

#### 4.3.3 Respondents' opinions about the provision of extension services

In BU, UA is inseparable from urbanization and thus the provision of agricultural and livestock extension services (ALES) was an essential component to the urban economy. During the survey, the household heads were asked to give their opinions about the provision of ALES in dairy cattle keeping. Table 13 presents the study findings which show that, of the 129 respondents, most, 122 (94.6%) reported that ALES agents visited once for the last 3 months, of which 33 (25.6%), 39 (30.2%) and 50 (38.8%) lived in high-, medium- and low density areas, respectively. Yet, of all respondents, few, seven (5.4%) said that the ALES agents did not visit them during this period. Nevertheless, the ALES were attributed in improving livestock husbandry as revealed by Foeken *et al.* (2004), Cicek and Tandogan (2008) and Mlozi (2005).



Study results on Table 13 further show that, of the 129 respondents, most, 122 (94.6%) of the respondents agreed that the ALES agents visited them. Of all the 129 respondents, 65 (50.4%) reported that the ALES agents had visited them once per month, of which 19 (14.7%), 20 (15.5%) and 26 (20.2%) lived in high, medium- and low density areas, respectively. Yet, 24 (18.6%) respondents reported that ALES agents visited them any time whenever they called them for consultation, of which five (3.9%), eight (6.2%) and 11 (8.5%) lived in high-, medium- and low density areas, respectively.

Still, four (3.1%), and nine (7%) of the respondents who lived in high-, medium- and low-density areas mentioned that ALES agents visited them during the official visits such as monitoring and evaluation sessions and opportunities and obstacles for development meetings (Table 13). These findings suggested that of all the 129 respondents, regardless of the area density, 89 (69%) had been visited by the ALES agents at least once per month for technical advises. The frequency of which the ALES agents only served the farmers was not significant to improve management skills if not their own efforts instead.

**Table 13: Respondents' opinions on extension services (n= 129)**

Variable	Density area					p value
	High (n=35)		Low (n=54)			
	n	n	%	n	%	
<b>Extension staff visited households</b>						0.581**
Yes	33	39	30.2	50	38.8	
No	2	1	0.8	4	3.1	
<b>Frequency of contact with extension staff</b>						0.744**
Whenever i call them	5	8	6.2	11	8.5	
Once per week	2	2	1.6	1	0.8	
2 times per month	2	-	-	3	2.3	
At most once per month	19	20	15.5	26	20.2	
Regularly on the M&E basis	4	9	7.0	9	7	
<b>Where technical information was sought</b>						0.025*
Friends	2	3	2.3	10	7.8	
Extension agents	16	13	10.1	22	17.1	
Fellow group members	10	5	3.9	5	3.9	
Personal experience	7	19	14.7	17	13.2	
<b>Accessibility of technical information</b>		0.326**				
Yes	35	27.1	39	30.2	54	41.9
No	0	0	1	0.8	0	0

ρ\* = Statistically significant,

ρ\*\* = Not statistically significant

Furthermore, the study findings on Table 13 depict that, of the 129 respondents, only five (3.9%) mentioned that they receive advisory services from ALES agents once per week, while other five (3.9%) said twice per month. This suggested that there was poor and unequal provision of UA extension services in the study area, which implied that most of the respondents did not rely on the provision of formal extension services, but on informal sources of information. These included their personal experiences, individual creativity, mass media, social networks, neighbours, friends, and farmers' groups (Table 13).

#### **4.3.4 Respondents' opinions about institutional services**

Institutional services are necessary to contribute to the individuals' efforts for improving households' livelihoods. The institutions have the role to facilitate and support its people through capacity building and to an environment that can improve capital, markets, and extension services and instill entrepreneurship among its people as recommended by Shah (2003). The study findings on Table 14 indicated that, of the 129 respondents, 57 (44.2%) reported that they attended a short course to equip them with knowledge and skills on dairy cattle keeping. The dairy cattle keepers were trained in the areas included agro-forestry, disease control, heat determining, artificial insemination (AI) and selling of milk. Of the 54 respondents, 20 (15.5%), 15 (11.6%) and 22 (17.1%) lived in high-, medium- and low density areas, respectively.

The short courses were organized by NGOs, farmer groups, and BU authority. The remaining 72 (55.8%) respondents, of which 15 (11.6%), 25 (19.4%) and 32 (24.8%) lived in high-, medium- and low density areas, respectively who had never attended formal short courses they reported to had got knowledge and skills through social networks and informal consultations. The study findings on Table 14 show that, of the 57 respondents who attended short courses, 32 (56%) reported that they were also provided with heifers through the farmer groups which were done by the NGOs. For the remaining 25 (44%) respondents, training was done by the government ALES agents, and then each was given a heifer by the BU authority.

**Table 14: Respondents' opinions on facilitation and support services (n=129)**

Variable	Density area								p value
	High (n=35)		Medium (n=40)		Low (n=54)		Total (n=129)		
	n	%	n	%	n	%	n	%	
<b>Any training on dairy cattle keeping</b>									0.48**
Yes	20	15.5	15	11.6	22	17.1	57	44.2	
No	15	11.6	25	19.4	32	24.8	72	55.8	
<b>Who provided training</b>									0.233**
Government extension agents	6	4.7	4	3.1	11	8.5	21	16.3	
NGOs extension agents	12	9.3	11	8.5	11	8.5	34	26.4	
Farmers' network	3	2.3	0	0	1	0.8	4	3.1	
<b>Supporting institutions available in the Ward/Council</b>									0.859**
NGOs	8	6.2	3	2.3	14	10.9	25	19.4	
Keepers' networking group	6	4.7	11	8.5	13	10.1	30	23.3	
Microfinance banks	1	0.8	1	0.8	2	1.6	4	3.1	
Local government institutions	16	12.4	20	15.5	16	12.4	52	40.3	
<b>Types of support provided</b>									0.457**
Advisory	10	7.8	14	10.9	11	8.5	35	27.1	
Financial loans	0	0	1	0.8	1	0.8	2	1.6	
Material support	0	0	1	0.8	1	0.8	2	1.6	
Cow grants	2	1.6	4	3.1	5	3.9	11	8.5	
Training facilitations	5	3.9	2	1.6	8	6.2	15	11.6	

p\*\* = Not statistically significant

The study findings showed that, NGOs such as FIDE, Care International and FARM AFRICA facilitated 32 (24.8%) of trained respondents, of which 12 (9.3)%, ten (7.8%) and ten (7.8%) kept dairy cattle in high-, medium- and low density areas, respectively, while four (7%) were trained through the farmer groups' network. The NGOs were reported to have started providing heifers from 2005 to 2008, while the BU authority gave one heifer to 25 households in 2009 (Table 14). The study findings revealed that less half of the urban dwellers in BU who kept dairy cattle, were each given a heifer by the NGOs and BU authority and the other half bought heifers using own savings (Table 14). The chi-square results ( $\chi^2 = 97$ , df=97 and  $p = 0.48$ ) indicate that there was no statistical significant difference in means on training and heifer support services among the respondent in the three urban density areas.

But, the chi-square results ( $\chi^2 = 225$ ,  $df = 224$  and  $p = 0.457$ ) showed that there was a statistical significant differences in means between the types of support among the respondents in the three urban density areas. The findings conformed to the study findings by Shah (2003) on the high involvement of non- governmental organizations in people's development.

#### **4.3.5 Respondents' opinions on the awareness about the legal issues**

Results on Table 15 revealed that of the 129 respondents, most, 114 (88.4%) indicated that they were aware about the Council UA by-laws that regulated and controlled UA. However, chi-square results ( $\chi^2 = 2.547$ ,  $df = 2$  and  $p = 0.280$ ) indicated that there was no statistical significant difference on means about the awareness of respondents of the UA by-laws in the three urban density areas. Also, of the 114 respondents, 63 (55.3%) reported that they were satisfied on how the BU enforced the bylaws. The chi-square results ( $\chi^2 = 1.572$ ,  $df = 2$  and  $p = 0.459$ ) showed that there was no statistical significant difference in means on the UA by-laws among the respondents in the three density areas.

These study findings suggested that, dairy cattle keeping in all the urban density areas were motivated by other factors other than awareness about legal issues such as UA by-laws. The urban dwellers who kept dairy cattle in the three density areas of BU, were highly cognizant to use the opportunities and resources within their reach to generate household incomes, promote own food security and gain social stability, as it was reported by Foeken *et al.* (2004) and Elias and Mdoe (2003). However, the most important point for the urban dairy cow keepers was the

propensity to earn money and food and the individual capacity to manage certain size of dairy cattle enterprise which is intensified in line with urbanization.

Study results further showed that of the 51 respondents who were not satisfied with by-laws' enforcement, 33 (64.7%) reported that the indication of poorly enforced UA by-laws in BU was the noticeable environmental degradation and 18 (35.3%) reported the practice of free grazing of urban dairy cattle. For instance, some dairy cattle keepers kept their cattle indoor during the day but took them out at night to avoid being caught by the BU authorities. However, 63 (55.3%) of the respondents said they were impressed that urban dwellers who kept dairy cattle practiced zero-grazing (Table 15). The chi-square results ( $\chi^2 = 6.145$ ,  $df = 4$  and  $p = 0.189$ ) portrayed that there was no statistical significant differences of means on the effectiveness of UA by-laws in the three urban density areas (Table 15).

**Table 15: Respondents' opinions about legal issues (n =129)**

Variable	Density area								p value
	High (n=35)		Medium (n=40)		Low(n=54)		Total (n=129)		
	n	%	n	%	n	%	n	%	
<b>Awareness of UA bylaws</b>									
Yes	33	25.6	33	25.6	48	37.2	114	88.4	
No	2	1.6	7	5.4	6.0	4.7	15	11.6	
<b>Are UA bylaws observed by the keepers</b>									
Yes	21	16.3	16	12.4	26	20.2	63	48.8	0.280**
No	12	9.3	17	13.2	22	17.1	51	39.5	
<b>Reasons for the urban keepers not observing bylaws</b>									
Still relatively high urban environmental degradation	4	3.1	11	8.5	15	11.6	30	23.3	
Most of urban dwellers still practicing free grazing	7	5.4	6	4.7	5	3.9	18	14.0	
A significant number of urban dwellers practicing zero grazing	22	17.1	16	12.4	28	21.7	66	51.2	
<b>Challenges of dairy cattle keeping</b>									
High price for supplements	4	3.1	6	4.7	9	7.0	19	14.7	0.072**
Inadequate dairy cattle management knowledge	7	5.4	5	3.9	14	10.9	26	20.2	
Animal diseases and death	7	5.4	11	8.5	4	3.1	22	17.1	
Inadequate and substandard extension services	4	3.1	2	1.6	12	9.3	18	14.0	
Poor milk production	13	10.1	16	12.4	15	11.6	44	34.1	
<b>Cultural outlook of dairy cattle keeping</b>									
Increased urban keeping with urbanization challenges	8	6.2	16	12.4	24	18.6	48	37.2	0.316**
Increased milk production with increased milk demand	22	17.1	20	15.5	26	20.2	68	52.7	
Decreased dairy cow keepers with decreased urban resources	5	3.9	4	3.1	4	3.1	13	10.1	

p\* = Not statistically significant

The observations supported the findings by other studies conducted in various Tanzanian towns. Study conducted in Dar es Salaam (Foeken *et al.*, 2004; Mlozi, 2004, 2005; Msuya, 2008), Mbeya (Mlozi, 2004; Manyama, 2009) and Morogoro (Mlozi, 2004, 2005) showed that, nearly all the by-laws are ignored by most urban farmers because they violate by keeping more number of dairy cattle heads and allow them to graze openly on restricted public land. It seems that the effective

enforcement of these by-laws is fully inflicted by dynamic struggle by the urban dairy cattle keepers to subsidize incomes, offer food and employment to their dependants in order to cope with the urban challenges. Further, all the 129 respondents gave their viewpoint on the future prospects of the urban dairy cattle keeping. Of all the 129 respondents, 65 (50.4%) prospect the increased number of dairy cattle keepers with increased milk productivity. And 41 (31.8%) hope of increased milk production with economically affordable number of dairy cows while three (2.3%) prospected reduced number of urban dwellers engaged in dairy cattle keeping and also 20 (15.5%) expect the increased number of urban dwellers keeping dairy cattle (Table 15).

However, throughout the prospective opinion at least 121 (97.7%) respondents were positive to progressive increasing number of the dairy cattle keepers and number of dairy cows with and that milk productivity will increase while the number of animal will set to optimum with decreasing resource base (Table 15). As indicated in the chi square results ( $\chi^2 = 4.731$ ,  $df = 4$  and  $p = 0.316$ ) that there is no statistical significant difference in cultural outlook of future dairy cattle among the respondents lived in the three urban density areas. However, this implied that dairy cattle keeping will be undertaken by the well to keepers due to the increased production costs as resource base is progressively exhausted.

#### **4.4 Economic Efficiency of Keeping Dairy Cattle in BU**

##### **4.4.1 Multiple linear regression analysis**

The results on Table 16 indicates that, the number of milking cows in the herd, quantity of milk produced per cow per day (litres), current average price, and number person involved in taking care of dairy cattle in the household (provision of labour) are the positive predictor variables that strongly influence on the annual incomes generated from milk sales (criterion) in the three density areas. The standardized regression coefficients presented in Table 16 implied that, a change of one SD unit in number of milking cows, milk yields, milk price, number of labourers and the plot size variables, will impact on the annual revenues due to milk sales by SD units of 0.792, 0.516, 0.23, 0.06 and 0.002 respectively. This implied that the predictor variables impacted on the annual revenues attained from the dairy cattle enterprises with different strength, from number of milking cows with larger  $\beta$  value of 0.744 down to the plot size with least  $\beta$  value of 0.22 in the three density areas.

The predictor variables were found to be statistically significant at  $F(5, 123)$  and  $p \leq 0.000$ . The predictor and criterion variables in the regression model in Table 16 indicated that they were strongly linearly related (successful) because had accounted for 81% the variance in the criterion variable. The number of milking cows was the highest predictor of the annual revenues earned from milk sales in the three density areas. This had a  $\beta$  value of 0.744 and an unstandardized regression coefficient ( $b^*$ ) of 0.926 and t-value of 27.20 and  $p \leq 0.000$  indicating that the number of milking cows (predictor) was statistically significant. This implied that the proportion of milking cows had positive relationship with incomes generated from milk sales of

the respondents and that, the respondents with more milking cows earned more money in a year.

**Table 16: Multiple linear regressions of selected variables**

$X_i$	$\beta$	Standardized regression Coefficients ( $SD_{\beta}$ )	Unstandardized Coefficients ( $b^*$ )	t value	$\rho$ Value
Current milk price	0.220	0.226	0.587	8.06	0.00057
Number of milking cows	0.744	0.792	0.926	27.20	0.00007
Plot size	-0.002	-0.002	-0.007	-0.08	0.93588
Number of person taking care of dairy cows	-0.059	-0.061	-0.192	-2.17	0.03209
Milk yield per cow per day	0.496	0.516	0.853	18.16	0.00001
SE = 0.601		$R^2 = 0.855$	Adjusted $R^2 = 0.810$		

Y = Dependent Variable (Criterion): Total annual income from selling milk (Tsh)

$X_i$  = Independent variables (Predictors): Number of milking cows, Milk yield, Current price of milk (Tsh), Number of person involved in taking care of dairy cows per day, and Plot size.

$R^2$  = Coefficient of determination

$SD_{\beta}$  = Units of standard deviation

Milk yields that is litres of milk produced per cow per day, was the second highest predictor of annual milk production and annual earnings from milk sales with unstandardized regression coefficient ( $b^*$ ) of 0.853,  $\beta$  value of 0.496, t- value of 18.16 and  $\rho \leq 0.00001$ , indicating that the predictor was strongly linearly correlated and thus, statistically significant. Basing on the strong linear relationship of means of milk production with the means of annual income revenues, it is expected that any decline in milk production would compel the farmers to intensify management dairy cattle enterprise in order to maintain milk yields including well feeding and dropping ones not producing satisfactorily. The price of milk was the third highest predictor of annual revenue of the dairy cattle enterprise from sales of milk. This had

unstandardized regression ( $b^*$ ) coefficient of 0.587,  $\beta$  value of 0.048, t-value of 8.06 and  $p \leq 0.00001$ , which also revealed that it was statistically significant. The average higher prices in BU implied that, there is high milk demand with low milk production and low dairy sector investment.

These findings comply with the findings by studies conducted in Mbeya (Mlozi, 2003, 2005; Manyama, 2009), Morogoro (Mlozi, 2003, 2005; Shimbe, 2008), Dar es salaam (Mlozi, 2003, 2005; Msuya, 2008), Hai (Nyange and Mdoe, 2004) which reported the declining mean milk prices due to more milk brought in the urban areas from the surrounding peri-urban areas and lack of dairy processing factories. The above highest three predictor variables had a positive linear relationship with annual incomes that were gained by the dairy keepers in the three density areas. This implied that, the dairy cattle keeper was likely to gain higher annual revenue if maintained large number of milking dairy cows which produced higher milk yields and certainly sold milk at good prices.

Another predictor variable, is the plot size with unstandardized regression coefficient ( $b^*$ ) of - 0.007,  $\beta$  value of - 0.002, t-value of - 0.08, and  $p \leq 0.936$ , which was not statistically significant, and had a reciprocal relationship with the milk yields, prices and number of milking cows, and consequently, the annual revenues. This was because the study findings showed that, on average, there was higher overall means of annual revenues from milk sales in the high density areas (with small plot sizes) compared to the medium- and low density areas (with large plot sizes) (Table 16).

This implied that, overall means of annual revenues from milk sales in the high density areas was the function of other socio-economic factors such as good management practices of dairy cattle.

And, the number of persons who took care of dairy cows in the household (labourers) with unstandardized regression coefficient ( $b^*$ ) of - 0.192,  $\beta$  value of - - 0.059, t-value of -2.17, and  $p \leq 0.03$ , which was not statistically significant, and had a negative relationship with the milk yields, prices and number of milking cows, and consequently, the annual revenues. This implied that, there was large number of labourers in the larger plot areas (i.e. medium and low density areas) in which were observed lower annual income earnings. It also means that the multiple linear regression models were strongly acceptable and statistically significant at  $p \leq 0.05$ . The multiple linear regression model defined its criterion variable by 81% of its predictor variables with a coefficient of determination ( $R^2$ ) of 0.86 and the standard error (SE) of 0.601 (Table 16).

#### **4.4.2 Income Analysis**

##### **4.4.2.1 Income generated from milk sales**

The study findings on Table 17 depict that, the overall mean milk price per litre in all three density areas was Tshs 721.32, and the dairy cow keepers gained Tshs 3600 to 57 600 with a mean income of Tshs 2519 on the daily basis. Also the annual revenue ranged from Tshs 1 087 200 to 17 452 800 with mean annual revenue of Tshs 6 224 430 from milk sales. These findings implied that, on average the respondents in the three density areas in BU earned higher annual incomes from milk sales compared to

incomes gained by the senior government officers accrued from monthly salaries. For example, Senior ALES agents who are currently being paid take-home salaries between Tshs 250 000 and 450 000 per month, they gain an annual income ranging between Tshs 3.0 and 5.4 million with an average of Tshs 4.2 million. These study findings support those of Mlozi (1996) and Msuya (2008) in Dar es Salaam city, and Manyama (2009) in Mbeya municipality who revealed that income from milk sales privileged the monthly earnings by most of government employees during the period of study.

The study findings also showed that the overall mean total annual revenue of Tshs 6 480 670 was realized from sales of milk, live animals and manure. The study findings on Table 17 show that the mean daily earnings from milk sales were high in the high-density areas, which ranged from Tshs 7 200 to 48 000 with a daily mean of Tshs 24 903 and annual mean of Tshs 7,568 194. The study findings showed that, means daily and annual (in brackets) incomes from milk sales in the medium- and low density areas were Tshs 18 993 (5 746 793) and Tshs 18 807 (5 707 278) respectively. These findings validated the Manyama (2009) findings in Mbeya, which revealed that the contribution of dairy cattle keeping to the household income was highest in high density areas and least in low density areas. This implied that there was relatively low income earning in the medium- and low density areas possibly due to poor cattle management including poor feeding, irregular technical extension services availed and inadequate animal medication.

Other reasons were inaccessible customers and poor supplementary feeding because cattle were managed by hired cow boys, while in high density areas, formally

unemployed owners made close follow-up and supervision in feeding, cleanness, animal disease control and that the keepers regularly sought extension advises. Also, the earned incomes on the daily basis were higher in BU compared with what was reported in other studies. For instance, in Mbeya (Manyama, 2009) revealed that only 4% of the 150 respondents earned a mean of  $\geq$  Tshs 10 000, Msuya (2008) reported 51.3% of all respondents earned a mean of  $\geq$  Tshs 10 000. This indicated that in BU there were more inputs and good milk prices.

The study findings implied that, keeping dairy cattle is a serious business from which incomes earned contributed to changing respondents' livelihoods and alleviates poverty. And, for those dealing with other income generating activities, it accrued their incomes. However, comparing earnings from dairy cattle enterprises with the public salaries for the government ALES agents in BU signifies the reasons that compel urban dwellers of different socio-economic status (including public servants) to continue practicing dairy cow keeping. Intuitively, it is only ethical from an environmental point of view, but unethical from economic point of view to tell dairy cattle keepers to leave it.

**Table 17: Respondents' income from the dairy cattle enterprises (n=129)**

Variable	Density area								p value
	High (n= 35)		Medium (n=40)		Low (n=54)		Total (n=129)		
	n	%	n	%	n	%	n	%	
Mean milk price /Lts	765.71		676.25		725.93		721.32		
Daily income from milk sales (thousands Tshs. 10 <sup>3</sup> )									0.024*
< 5	0	0	2	1.56	1	0.77	3	2.32	
5 – 10	2	1.56	16	12.40	14	10.85	32	24.80	
10.1 – 15	2	1.56	6	4.65	12	9.30	20	15.50	
15.1 – 20	7	5.42	3	2.32	6	4.65	16	12.40	
20.1 – 25	7	5.42	2	1.56	5	3.87	14	10.85	
25.1 – 30	11	8.52	3	2.32	8	6.20	22	17.05	
≥30	6	4.65	8	6.20	8	6.20	22	17.05	
Mean	24.9		18.9		18.8		20.5		
Minimum	7.2		4.8		3.6		3.6		
Maximum	48		57.6		48.0		57.6		
Annual income from milk sales (million Tshs. 10 <sup>6</sup> )									0.308**
< 2	0	0	4	3.10	4	3.10	8	6.20	
2.0- 4.0	2	1.56	20	15.50	21	16.27	43	33.33	
4.01 - 6.0	9	6.97	3	2.32	6	4.65	18	13.95	
6.01 - 8.0	11	8.53	3	2.32	11	8.52	25	19.37	
8.01 - 10.0	7	5.43	3	2.32	3	2.32	13	10.07	
10.01 - 12.0	2	1.56	1	0.77	4	3.10	7	5.42	
>12	4	3.10	6	4.65	4	3.10	14	10.85	
Mean	7.6		5.7		5.7		6.2		
Minimum	21.8		1.5		1.1		1.1		
Maximum	14.5		17.4		14.6		17.5		
Annual income from selling live dairy cattle (million Tshs. 10 <sup>6</sup> )									0.311**
< 2	0	0	3	2.32	3	2.32	6	4.65	
2.0 - 4.0	2	1.56	21	16.27	20	15.50	43	33.33	
4.01 - 6.0	7	5.42	3	2.32	9	6.97	19	14.72	
6.01 - 8.0	10	7.75	2	1.56	11	8.52	23	17.82	
8.01 - 10.0	9	6.97	3	2.32	3	2.32	15	11.62	
10.01 - 12.0	1	0.77	2	1.56	2	1.56	5	3.87	
>12	5	3.87	6	4.65	6	4.65	17	13.17	
Mean	7.8		5.8		6.0		6.5		
Minimum	2.4		1.5		1.1		1.1		
Maximum	15.7		17.5		15.6		17.5		

p\* = Statistically significant.

p\*\* = Not statistically significant

**4.4.2.2 Income generated from the dairy cattle enterprise**

Dairy cattle keeping in BU were an important self-employed income generating activity, where cows acted as the production factories as well as saving banks for the urban keepers. Study findings found out that, household income generated from the

dairy cow enterprises was due to sales of fresh milk, live animals, man-day wages and manure. On average, an individual household keeper earned the annual gross income ranging from Tshs 1.09 to 17.46 million with overall average of Tshs 6.481 million. These findings conform to many other studies' (Mlozi, 2001; Shimbe, 2008; Msuya, 2008; Upton, 2004; Urassa and Raphael, 2003; Tuvana, 2004; Manyama, 2009) findings that, dairy cattle keeping contributed positively towards alleviating households' poverty.

Also these income earnings count more than average income of Tshs 1 544 100 per household reported by Manyama (2009) in Mbeya municipality. These earnings depicted that, dairy cow keepers earned up to 96 percent from sales of fresh milk, and 4 percent from sales of live animals and manure (Table 17). This signifies that, primarily, urban dwellers kept dairy cows to get milk most of which was sold to earn extra money for betterment of their livelihoods which also is in support of Cicek and Tandogan (2008).

Further study results show that, of the 129 respondents, 43 (33.3%), of which 20 (15.5%), 21 (16.2%) and two (1.6%) lived in low-, medium- and high density areas, respectively, indicated that they earned Tshs 2 to 4 million per year from selling live dairy cattle. Also, 42 (32.6%) respondents indicated that they earned within a range of Tshs 4 to 8 million annually, of which 20 (15.5%), five (4.8%) and 17 (13.2%) lived in high-, medium- and low density areas, respectively. Yet, 37 (32.6%) of all the respondents, mentioned that they gained incomes ranging from Tshs 8 to 10 million of which 15 (11.6%), 11 (8.6%) and 11 (8.6%) lived in high-, medium- and

low density areas, respectively (Table 17). These results revealed that fresh milk sales were a major output that contributed 96% to the annual revenue that dairy cattle keepers earned in BU. As indicated in the chi-square test results ( $\chi^2 = 229.81$ ,  $df = 220$  and  $p \leq 0.311$ ) there was no statistically significant differences of means between annual revenue generated by dairy cattle keepers in the three urban density areas. The implication of the findings in Table 17 was that, other external sources of milk were insignificant.

Table 18 shows the study findings on respondents' mean incomes from milk sales. It indicated that, on average all ethnic groups earned more income in the high density areas while in the medium- and low density areas were consistently lower. Individually, the study findings showed that the Rangi were the highest earners followed by the Iraqw's and Pare in all the three density areas. However, in comparison with the means income earning from milk sales in high-, medium and low density areas, the significance level resulted were ( $p = 0.26, 0.32$  and  $0.28$ ) respectively, revealed that there was a no statistically significant difference in the means of income gained by the household keepers in the three density areas in BU. These findings suggest that the urban dairy cattle keepers in the three density areas obtain most of inputs from the same sources especially the forages and supplements and do not differ significantly in experienced and enterprises' management skills.

**Table 18: Respondents' income from milk sales based on ethnicity ( n =129)**

Variable	Density area					
	High (n=35)		Medium (n=40)		Low (n=54)	
	Mean	n	Mean	n	Mean	n
Iraqw's	8390088	18	6648805	19	6648805	25
Chagga	7053066	6	3479733	9	3479733	9
Rangi	10771200	1	9098000	3	9098000	4
Pare	7876933	3	6655440	5	6655440	9
Meru	5080200	4	2794400	3	3272400	6
Others	5608000	3	3272400	1	4348800	1
Total mean	7568194	35	5746792	40	5707277	54
$\rho$ Value	0.26**		0.32**		0.28**	

$\rho^{**}$  = Not statistically significant

#### 4.4.3 Production costs in the dairy cattle enterprise

Keeping dairy cattle in urban areas of BU requires capital, which is used in management of the zero-grazed animals such as feeding, paying laborers, transport, treatment, insemination services, and maintaining sheds. Fodder is collected and brought to zero-grazed cattle from the open and reserved areas, and areas surrounding Lake Babati, which costs between Tshs 2000 and 10 000 per load depending on its density, bulkiness and ability to negotiate with the sellers. Observations showed that fodder and supplementary feeds are obtained within a range of 2 to 10 kilometres radius and are transported on bicycle, on-head carrying, trucks, pick-ups, pull carts, ox-carts, push carts, wheelbarrows, power tillers and tractors (Plate 5).



**Plate 5: Loads and some common facilities used for transportation of forages**

Supplementary feeds include mainly maize bran, sunflower cakes, concentrates such as *ng'ombe* mix, Maclik super, Meru dairy lick, mineral bricks and crude minerals obtained from agro-processing factories, vendors and inputs stockiest (Table 18).

The major feed stuffs next to fodder are the farm residues which are also collected using vehicles (trucks, pick-ups, motorbikes, bicycles, carts, wheelbarrows, tractors). These are being collected in a lumpsum from either own farms or bought from others during the harvest seasons which is normally between May and August and stocked for a feed source during the dry months of June, July, August, September, October, November and December. This activity involves cost of vehicle repairs, fuel, labour and running.

The study findings on Table 19 show that the mean costs involved in the dairy cattle keeping in BU were grouped as the initial investment costs (i.e. costs incurred for purchasing dairy cattle, building cow sheds), and variable costs included the day to day management activities (i.e. fodder, feeding, buying concentrates, labour wages, medication, and insemination costs). Study results indicated that, the total annual cost per respondent ranged from between Tshs 817 000 to 6 606 000 with an annual

mean production costs of Tshs 1 975 648 for a respondent who kept four dairy cows and it varied in the three density areas (Table 19).

**Table 19: Production costs (Tshs) of keeping dairy cattle in BU (n =129)**

Variable		Density area			Total (n=129)	p valu e
		High (n=35)	Medium (n=40)	Low (n=54)		
Number of dairy cattle kept by the household	Mean	4	3	5	4	0.28 **
	Minimum	2	1	2	1	
	Maximum	9	17	17	17	
Initial investment cost (Tshs)	Mean	466.686	280.700	321.074	348.062	0.15 9**
	Minimum	120.000	30.000	25.000	25.000	
	Maximum	1,090,000	820,000	900.000	1,090.000	
Total variable cost for the dairy cattle enterprise per year (Tshs)	Mean	1,652,426	1,615,485	1,601.190	1,619.524	0.32 8**
	Minimum	460,000	765,000	756,500	460,000	
	Maximum	3,784,500	6,526,000	3,481,000	6,526,000	
Total production cost for dairy cattle enterprise (Tshs)	Mean	2,148,826	1,896,185	1,922.264	1,975,648	0.36 9**
	Minimum	929,000	817,000	907,000	817,000	
	Maximum	4,499,500	6,606,000	3,992,000	6,606,000	

p\*\* = Not statistically significant

The study found that a respondent in the high density areas who kept one to nine dairy cows incurred a mean production cost ranging from Tshs 929 000 to 4 499 500 with mean of Tshs 2 148 826 and the break-even point was four dairy cows. In the medium density areas, a respondent who kept between 1 to 17 dairy cows incurred a production cost ranging from Tshs 817 000 to 6 606 000 with mean of Tshs 1 896 185 and the break-even point was three dairy cows. In low density areas, a respondent who kept 2 to 17 cows incurred a production cost ranging between Tshs 907 000 and 3 992 000 with a mean of Tshs 1 922 264 and the break-even point was five cows. The chi-square test results ( $\chi^2 = 252.08$ ,  $df = 246$  and  $p \leq 0.369$ ) showed

that there was no statistically significant differences between the means in the total production costs (initial investment and total variable costs), among the respondents in the high-, medium- and low density areas. Also, the chi-Square test results ( $\chi^2 = 25.34$ ,  $df = 22$  and  $p \leq 0.28$ ) depicted that there was no statistically significant differences in means between the distribution dairy cows in the three urban density areas. Further, findings on Table 19 show that there were relatively higher mean production costs (Tshs 2 148 826) in the high density areas above the overall mean production costs of Tshs 1 975 648, they were low in the medium- and low density areas (Tshs 1 896 185 and 1 922 264).

These findings implied that, there are additional costs in the high density areas in building and maintaining sanitary cow sheds and constrained home environment, supervision and bringing in the required inputs to the zero-grazed cows. Also, the high production costs in the high density areas may have been due to incurring extra costs in paying labourers who cut and head-curved fodder from distances far away ranging from 1 to 10 kilometers and paying costs for the domestic utilities such as water and electricity.

Furthermore, the study analyses of overall average of production costs basing on the milk yields summarized on Table 20. From these findings it was clearly revealed that there was a high average production cost per litre of milk (Tshs 246) in the low density areas and least average production costs per litre of milk (Tshs 216). This implied that higher means of production costs in the medium- and low density areas is due to the costs and charges due to distance engaged in transportation of nutritional

concentrates and supplements from CBD, transportation of milk to the customers, hiring the veterinary –extension services, collection of forages, treatments, AIs and other overheads. These costs which are attributed in poor husbandry practices and therefore low income earned in the medium and low density areas emanated from these hindrances and low milk prices. However, good dairy cattle husbandry practices are necessary for the improved dairy cattle to give optimal milk yields for optimal economic efficiency.

**Table 20: Average production cost per litre of milk (Tshs/Lt) in BU (n = 129)**

Variable	Density area			Total (n = 129)
	High (n =35)	Medium (n=40)	Low (n =54)	
Mean total production cost (Tshs)	2 148 826	1 896 185	1 922 264	5 967 275
Mean annual milk yield (lts)	9943.4	8227.52	7794.3	25 965.22
Average milk production cost per litre of milk (Tshs/Lt)	216.1	230.5	246.6	229.82

#### 4.4.4 Benefit-Cost Ratio analysis

A benefit cost ratio (BCR) is an economic analysis used to compare costs and benefits for choosing a particular project as the most viable one. The BCR compares the total costs involved in production with the net revenue realized of an enterprise at the market price. The BCR analyses the cost-effectiveness in the use of resources in production of goods or services that has the highest net revenue value. Thus, a BCR is used in the analysis of the economic efficiency for deciding whether a particular enterprise is feasible or not (Johnson, 2010). In this study, BCR is used to enable the researcher to recommend for a dairy cattle enterprise with a high BCR usually above one. In this light, to ascertain the economic efficiency of an enterprise, the mean total costs and total revenue of each respondent's dairy cattle enterprises incomes in high-,

medium- and low density areas were compared and found to be ranging from one to seven. The computation results of the BCR in the respective dairy cattle enterprises in the three urban density areas are shown on Table 21.

Table 21 shows that, respondents who kept two, four and six dairy cows in the high-, medium- and low density areas had higher BCR of 3.86, 3.82 and 3.78, respectively. These dairy cattle enterprises recorded an average total production costs of Tshs 609 555, 1 897 471 and 2 207 084, and realized mean revenues of Tshs 2 334 595, 2 419 362 and 3 574 849, respectively.

The study findings show that it was more costly to keep dairy cattle in the high density areas compared to the medium and low density areas. For instance, a respondent in the high density area spent an average of Tshs 609 550 for keeping two dairy cows and earned a net revenue of Tshs 2 334 595, while, one keeping in the medium-, and low density areas, spent an average of Tshs 1 280 017 to keep two dairy cows and earned an average net income of Tshs 1 600 000, respectively. These study findings, implied that economic efficiency of an enterprise is the function of cost-effectiveness in the resource utilization, that for one keeping in the medium- and low density areas need to maximize the dairy cattle number to the break even of four and six cows respectively to realize the maximum profitability.

**Table 21: Benefit-Cost Ratio analysis of dairy cattle enterprises in BU (n = 129)**

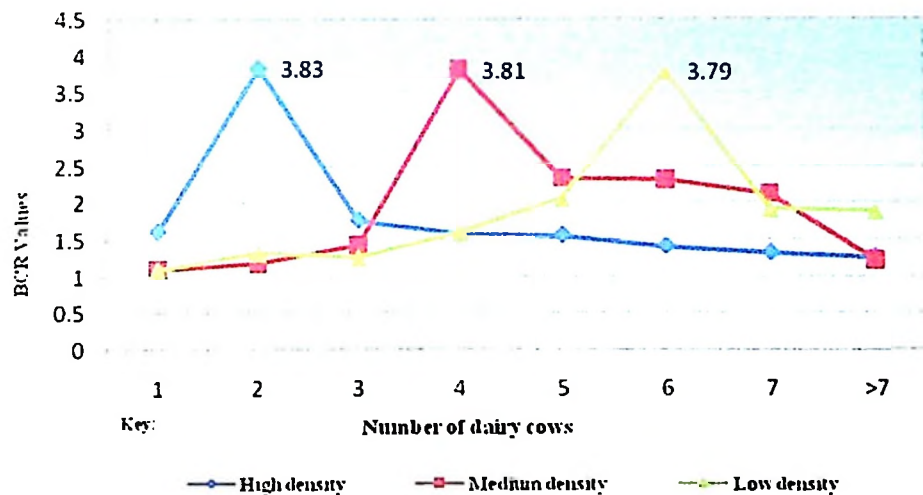
Density area	Number of dairy cows	TR – Milk	TC	NR	BCR
High	1	971800	370916.03	600883.97	1.62
	2	2944150	609554.87	2334595.1	3.83
	3	3007880	1085877.3	1922002.7	1.77
	4	3357485.7	1301351.1	2056134.7	1.58
	5	3332400	1301718.8	2030681.3	1.56
	6	2461600	1021410.8	1440189.2	1.41
	7	3009400	1297155.2	1712244.8	1.32
Medium	>7	3731200	1650973.5	2080226.5	1.26
	1	1136000	540952.38	595047.62	1.10
	2	2635270.6	1208839.7	1426430.9	1.18
	3	3295100	1356008.2	1939091.8	1.43
	4	4316833.3	1897470.5	2419362.8	3.81
	5	4352000	1306906.9	3045093.1	2.33
	6	4452000	1345015.1	3106984.9	2.31
Low	7	4571800	1465320.5	3106479.5	2.12
	>7	51531600	23212432	28319168	1.22
	1	1573000	749047.62	823952.38	1.10
	2	3215440	1380017.2	1835422.8	1.33
	3	4067720	1799876.1	2267843.9	1.26
	4	4458955.6	1708412.1	2750543.5	1.61
	5	4943657	1615574.2	3328082.8	2.06
6	5781933	2207084.1	3574848.9	3.79	
7	5780000	1986254.3	3793745.7	1.91	
>7	5720900	1986423.6	3734476.4	1.88	

Key: 1= respondents each kept 1 cow. 2= respondents each raising 2 cows. 3= respondents each raising 3 cows. 4= respondents each with 4 cows. 5= respondents each raising 5 cows. 6= respondents each raising 6 cows. 7= respondents each with 7 cows. >7= respondents kept >7 cows. TR = Total Revenue. TC = Total Revenue. NR = Net Revenue. BCR = Benefit Cost Ratio.

Keeping dairy cattle in the urban areas require efficient use of available resources such as capital, open space, labour, pasture, plots, and livestock extensions services (LES), and comply with policy and legal requirements. Table 21, show that, respondents who kept 1 to 7 dairy cows in the three density areas incurred various production costs and earned differently. Further, study findings indicate that as the number of dairy cows increased above the optimal BCR level in a particulars density area, milk production declined and its subsequent net income *ceteris paribas*. It is due to this scenario that for economical and sustainable dairy cow keeping in BU, it is worth to strictly keep two, four and six dairy cows in the high-, medium- and low

density areas, respectively at which maximum economic efficiencies were attained (Table 21, Fig. 3). However, as the chi-square results ( $\chi^2 = 258$ ,  $df = 256$  and  $p = 0.453$ ) indicated, there is no statistical significant differences of means between the BCRs in the three density areas of keeping two, four and six dairy cows in the high-, medium- and low density areas, respectively.

The statistical findings on the Table 21 are presented on the Fig. 3, which show the BCR curves of the most economic efficient points of dairy cattle enterprises in the high- (2), medium- (4) and low- (6) density areas. These, study findings are in line with the study recommendations made in Kinondoni Municipal Council (Msuya, 2008) and Mbeya Municipal Council (Manyama, 2009).



**Figure 3: BCR curve for dairy cow enterprises in BU**

## CHAPTER FIVE

### 5.0 CONCLUSIONS AND RECOMMENDATIONS

The main objective of the current study was to investigate the economic efficiency of dairy cattle keeping under zero-grazing in three urban density areas of BU. The significance of the study was to establish the empirical data to backup the missing information in the current urban dairy cattle keeping extension package and, finally to recommend to all urban development stakeholders especially the policy makers, planners, ALES and dairy cattle keepers. The study was intended to improve the practice of dairy cattle keeping since the activity is one of the major household income generating activities. However, this chapter presents conclusions and recommendations basing on the study findings and suggests areas for future research.

#### 5.1 Conclusions

This study focused on dairy cattle keeping. The study found out that, keeping dairy cattle is the major income generating activity for the respondents in BU, and that, dairy cattle keeping is an imperative economic activity and survival alternative strategy for the majority low- and medium income earning urban dwellers in their struggle to cope with urbanization challenges. This activity was found out to be influenced by the socio-economic, psycho-cultural and urban contextual factors that make it highly replicable in other urban settings of Tanzania. The fact that urban dairy cattle keeping continue to be instituted in BU implies many advantages for local stakeholders. These advantages include nutritional and food supply, subsidizing household income, emotion, cultural, savings, ecological functions and social

coherence. Singling out any of these advantages would most likely miss out the essence of urban determination into dairy cattle keeping and UA at large.

From the findings of the study, it was learned that majority household heads were married and their households were male headed. The majority of dairy cattle keeping household heads had attended schooling system as high as primary education level and in all three density areas more women engaged into dairy cow management activities such as feeding, milking, milk sales and supervising dairy cattle keeping activities. Keeping dairy cattle is practiced by urban dwellers from all socio-economic groups as a coping strategy to boost household income, subsidizing nutrition and food security for household members and confronting increasing unemployment problem with rapid urbanization.

In BU dairy cattle keepers used both zero grazing and mixed grazing. Only those who practiced zero grazing were eligible for the present study and were sampled accordingly. Generally, many of the respondents were rearing 3 - 4 cows and preferred pure Friesians, followed by cross bred cows although some dairy cattle keepers mixed with the Ayrshire and/ or Jersey breeds. Also, it was established that majority of the respondents in the high and medium urban density areas kept between 2 to 3 milking cows while in the low density areas kept larger number of milking cows ranging from 3 to more than 6 cows. These numbers were determined by the anxiety to fulfill the essential requirements, socio-economic status and capacity to manage the dairy cattle enterprises by the individual household keepers in the particular urban density areas.

The study findings showed that milk yield is high in the high density areas, followed by low and medium density areas. Milk yield means in high, medium and low density areas were 17.4, 15.3 and 14.2 litres per cow per day, respectively, with overall mean of 15.4 litres. This showed that, mean milk yield in high density areas, was above the overall means of milk yield. Similarly, the means of annual milk yield were 9943, 8227 and 7794 litres in high-, medium- and low density areas compared to the overall mean annual milk yield of 8512 litres per household.

In addition, on average, 96.5% of the annual income collected by individual household was from milk sales. It was found that price was ranging from Tshs 400 to 1300. Of all respondents, 93% sold milk at range of Tshs 400 – 1000 with an average of Tshs 700 per litre and only 7% sold milk at average of Tshs 1150. There was relatively higher average milk price in the high-, lesser in low- and least in the medium density areas at Tshs 766, 676 and 726 per litre, respectively. The overall mean milk price per litre in the three density areas was Tshs 721. The prices in high- and low density areas found to be above the overall average milk price. This was because most of the dairy cattle keepers in the medium- and low density depended on the milk collectors, hawkers and the collection centres to buy daily milk yields which in turn provided lower prices. Mainly, milk was sold at the home, milk collection centres, restaurants, public offices, canteens and local milk processing plant. This portrays that prominent milk buyers are the immediate consumers including neighbours, milk collectors, vendors, restaurants, milk processing plant and public offices. Milk vendors and collectors mainly use bicycles to transport milk to the consumers' places.

It was further revealed that the overall mean income from milk sales by the dairy cattle keepers in BU was Tshs 20 510 and Tshs 6.48 million on daily and annual basis, respectively. Dairy cattle keepers in the high density areas earned an average daily and annual income of Tshs 24 900 and 7.84 million, respectively. Most of the dairy cattle keepers in high density areas earned above Tshs 15 000 per day and between Tshs 4.01- 12 million per year. In the medium- and low density areas, most of the respondents earned below Tshs 15 000 per day with mean incomes of Tshs 18 990 and Tshs 18 800 per day, respectively, and incomes ranged from Tshs 2.0 to 6.0 million per year with mean incomes of Tshs 5.75 and 5.71 million on the annual basis, respectively. This indicated that, milk yields and milk prices mainly determined the amount of money earned by the dairy cattle keepers in all the three density areas. Further, study findings indicated that, there were highest earned incomes in high density areas, which implied that, the use of resources including small homestead spaces, maintenance of higher ratio of milking cows to total cattle herds, effective control of diseases, effective feeding, cleanliness of cow sheds and close follow up and supervision of labourer was cost-effective.

Further, study findings revealed that, production costs vary depending on the number of dairy cattle kept, number of milking cows, the initial investment cost, management intensity, source and number of labourers, pathological situation and, location and types feeds administered by individual household keeping dairy cattle. The study findings showed that, in BU the current average milk production costs per litre of milk (Tshs/Lt) costs in high-, medium- and low density areas were 216.1, 230.5 and 246.6 respectively, with the overall mean of 230. It was established that,

the dairy cattle enterprises incurred an average of Tshs 537 207, Tshs 632 062 and Tshs 384 453 to take care of one cow in high-, medium- and low density areas with four, three and five cows respectively.

Basing on the production costs and annual revenues, the BCRs were analyzed established to reveal the economic efficiency in each of the three density areas. It was resolved that the highest BCR values of 3.86, 3.82 and 3.78, were reached with two, four and six dairy cows, in high-, medium- and low density areas, respectively. The dairy cattle enterprises The BCR values of 3.86, 3.82 and 3.78 were more worthwhile at the with 2 cows in high density areas were found to have highest net revenue of Tshs 2 334 595, those in medium density areas with 4 dairy cows were found to be more beneficial with net revenue of Tshs 3 419 363 while in the low density areas dairy cow enterprises with 6 cows were found to have higher net revenue of Tshs 4 574 849.

From the study findings, it was also established that a number of socio-economic factors influenced the economic efficiency of dairy cattle keeping in respective density areas. These factors included the number of milking cows in the cattle herd, milk yields, milk prices, plot size, economic status of individual households, number of people living in the household that provide manpower to a number of activities contributing to better cows management, education level and formal employment boosted household capital from salary and other sources that contributed positively to undergo better management practices to dairy cattle keeping. Dairy cow breed types of the kept cows were seem to have negative relationship to the annual earnings from

sales of milk in BU. These were positive predictors of annual milk produce and annual revenue from selling milk in the three density areas.

Also it was induced from the findings that, the institutional arrangements such as extension services, provision of credits and grants, facilitation with heifers and trainings to the dairy cattle keepers, provision with the subsidized agro-vet inputs influenced dairy cattle keeping and impacted positively on the economic efficiency of dairy cattle keeping to the great deal. Further, there was no statistical significant difference in the cultural perception on the UA by-laws among the dairy cow keepers in the three density areas. The extent of dairy cattle keeping by individual households in BU was controlled and guided more by the individuals' anxiety and socio-economic status rather than the UA by-laws.

However, dairy cattle keepers in all density areas in the BU context are constrained by inadequate capital, shortage of feeds, high cost of supplementary feeds, poor milk productivity, poor animal reproductive performance, and lack of dairy cattle management skills, inadequate electricity services and poor water services. Others were poor road infrastructure, animal diseases and high cost of agro-vet inputs. Unreliable milk market, high prices of drugs and concentrates are the major challenges to dairy cattle keeping in the study area.

## **5.2 Recommendations**

### **5.2.1 Recommendations based on the findings**

Small scale dairy cattle enterprises contribute significantly to the welfare economics of the households in the study area and hence need to be promoted. The economic efficiency aspect in dairy cattle keeping is whole about the cost-effective resources allocation and effective management of such resources in a favourable environment. This earmarks the venture between all responsible stakeholders to establish a well coordinated and enhanced context. The small dairy cattle enterprises in BU were important self-employed, individual and/ or household initiative based income generating activities. In order to ensure viability and sustainable profitability for sustainable change of living standards, BU authority should see that dairy cattle keepers raise 2, 4 and 6 dairy cows in high, medium and low density areas, respectively. The current study, therefore, recommends the following;

- i. The BU should zone specific areas/plots for dairy cattle keeping in each density area as an important step in the process of sustainable planning and implementing its Strategic Plans (SPs).
- ii. The ALES should train the urban farmers about the aspects of “economic efficiency” of dairy cattle keeping in order equipping them with the knowledge of agribusiness and sustainable use of resources.
- iii. BU authority should revise its UA by-laws to reflect the study findings based on economic efficiency of keeping dairy cattle in the three density areas.

- iv. BU authority in collaboration with other agencies should support smallholder dairy cattle keepers with good quality heifers to equip them with high productive stock.
- v. BU authority should facilitate and support the dairy cattle keepers to establish co-operatives and networks through which they can establish milk sales centers and members be provided with inputs at a more cost-effective manner.
- vi. BU authority should mobilize various stakeholders to support the smallholder dairy cattle keepers with loans to boost their capital strength that should be devoted to modernization of production and marketing of milk and its products.

#### **5.2.2 Areas for further research**

Further avenues for research on similar issues may include;

- i. Research to be done to establish the role of urban dairy cattle keeping in the urban environmental management in BU.
- ii. Research to be done to provide a better understanding on how children contribute to dairy cattle keeping in BU.
- iii. Research to be conducted to establish the role of urban agricultural and livestock extension systems towards the change of dairy cattle keepers' livelihood in BU.

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## APPENDICES

### Appendix 1: Household questionnaire

On

Analysis of economic efficiency of keeping dairy cattle in Babati Urban (BU)

By

Daniel Luther Anthony. MSc. Student, P. O. Box 383, BABATI.

Telephone: +255 784 963 873/712 391 213, Email: [danielluther58@yahoo.com](mailto:danielluther58@yahoo.com).

Dear Respondent,

Your household has been selected randomly to participate in a research on the economic efficiency of keeping dairy cattle enterprise in this council. I am earnestly you to participate in this survey by answering this questionnaire. You are important in this study because representing hundreds of urban dwellers keeping dairy cattle in the council. I would like to assure you that your answers will be confidential. The findings of this study will be important baseline information for urban dwellers, extension agents, urban planners, decision makers, and all other development agencies for urban development and environmental management of our council.

I wish you all the best.

#### General Information

Questionnaire's Number (Household code).....

Interviewer's name .....

Day/Month/Year of interview .....

Name of respondent (household head).....

Residence of respondent: Mtaa ..... Ward..... Division..... Council..... Region

#### Part I: Background Information

- i. Sex of household head .... 1 = Female, 2 = Male
- ii. Ethnicity ... 1 = Iraqw, 2 = Chagga, 3 = Rangi, 4 = Pare, 5 = Others (Specify)
- iii. Nationality..... 1 = Tanzanian, 2 = Non Tanzanian
- iv. Religion of household head ... 1 = , 2 = Muslim, 3 = others (specify)

- v. Age of household head ..... 1 = Youth age (18 to 35 years), 2 = Old age (36 to 55 years), 3 = Elderly age (above 55 years).
- vi. Marital status of household head ... 1 = Married, 2 = Widowed, 3 = Divorced, 4 = Others.
- vii. Education level of household head..... (.... years spent in schooling)
- 1 = Non formal adult education (..... Years spent),
- 2 = Primary education (..... Years spent),
- 3 = Secondary education (..... Years spent),
- 4 = Certificate education and above (..... Years spent).
- viii. Primary formal employment of household head .....
- 1 = Never been employed, 2 = Retired officer with a pension, 3 = Retired officer without a pension, 5 = Government employee, 6 = others (specify).....
- ix. Cadre of work of household head....
- 1 = Not applicable, 2 = Teacher, 3 = Agricultural officer, 4 = Other (specify)
- x. How long have you worked in your formal employment?
- 1 = Not applicable, 2 = Between 5 – 9 years, 3 = Between 10 – 14 years, 4 = Above 14 years, 5 = Others (specify)....
- xi. How far is your working place from home?
- 1 = Not applicable, 2 = Less than one km, 3 = Between one – 2 km, 4 = Between two – 3km, 5 = Others (specify)
- xii. What is your employment status.. 1 = Not applicable, 2 = Full time, 3 = Part time, 4 = Others (specify)
- xiii. How long have you stayed in this council? 1 = Below 5 years, 2 = 5 years and above

- xiv. Where were you living before coming to live in this town? 1 = Within Babati District. 2 = Other districts (Specify).....
- xv. How many people live in your household? .....
- xvi. Please fill in the number of household members in the respective age group in the following table

Sex /Age group	0-6 years	7 – 13 years	14-20 years	21 – 45 years	46 – 59 years	Over 60 years	Total
Male							
Female							
Total							

- xvii. How many children do you have for the time being? 1 = one. 2 = two. 3 = three, 4 = others(specify)
- xviii. Area of density in which respondent live.. 1 = High, 2 = Medium, 3 = Low,
- xix. What is the size of your plot ..... (Sq. meters)?
- xx. What is the area used for dairy cattle keeping out of that in (xx) above ... (Sq. meters)?
- xxi. What are the main sources of income for your household?  
 1 = Petty Trading 2 = Livestock keeping 3 = Food and cash crop production,  
 4 = Salary, 5 = 1 and 2 above, 6 = 2 and 3 above, 7 = 1, 2 and 3 above, 8 = 2, 3 and 4 above, 9 = Others (Specify)
- xxii. Which areas on the household income is spent on: 1 = Food for the household, 2 = School fees, 3 = Livestock management, 4 = Domestic utilities, 5 = Clothing for the household, 6 = 1, 2, 3, 4 and 5 above, 7 = Others (Specify).
- xxiii. Why do you keep livestock? 1 = For food, 2 = For raising household income, 3 = For manure, 4 = For household level employment opportunity, 5 = At least 1, 2 and 4 above, 6 = Others (specify)

- xxiv. Who in your household is primarily responsible for taking care of livestock?  
1 = Father, 2 = Mother, 3 = Children, 4 = hired male labourer, 5 = Household manpower, 6 = 4 and 5 above, 7 = Others (specify)
- xxv. If children in (xxvi) above, are they 1 = Males, 2 = Females, 3 = Both males and females, 4 = Not applicable
- xxvi. What are the main types of livestock enterprises that you commonly keep and their numbers.

Code	Type of livestock enterprise	Number
1	cows and local cattle	
2	cattle	
3	cows	
4	s	

- xxvii. Please mention assets that you own

Code	Household assets
1	Permanent house
2	Farms
3	Bicycle
4	Bio-gas system
5	At least 1, 2 and 3 above
6	Others (Specify)

### Part II: Dairy cattle keeping

- i. In which year did you start keeping dairy cattle? ..... years
- ii. Which type of cattle do you keep? ..... 1 = Local breed, 2 = pure breed, 3 = cross breed, 4 = 1 and 2 above, 5 = 1 and 3 above, 6 = Others (specify)
- iii. What is the breed of the cattle that you keep? ..... 1 = Friesian, 2 = Ayrshire, 3 = Jersey, 4 = 1 and 2 above, 5 = 1 and 3 above, 6 = Other (Specify)
- iv. How many cows are of each type you keep? 1 = local breed, 2 = pure breed, 3 = cross breed
- v. Why do you decide to keep this number of cattle? 1 = I just got it by the way, 2 = Competitiveness with others, 3 = To increase milk production and hence more

- income, 4 = More resistance to diseases and harsh environments, 5 = At least 3 and 4 above, 6 = Others (specify)
- vi. Who first gave you the idea to keep cattle? 1 = Livestock extension agents, 2 = Neighbour, 3 = Friends, 4 = Own anxiety 5 = NGOs, 6 = Parents, 7 = Others (specify)
- vii. Where did you get these breeds of dairy cattle from? ... 1 = Natural insemination (Bulls), 2 = Artificial insemination (Semens), 3 = Pure heifers from outside the Council, 4 = Others (Specify).
- viii. How did you acquire cattle to start cattle keeping? 1 = Buying, 2 = Given as animal grant by the government, 3 = Borrowed, 4 = 1 and 2 above, 5 = 1 and 3 above, 6 = Given as grant by the NGO for the group, 7 = Others (specify)
- ix. How much money did you spent for buying the starting cattle?
- x. How many cows did you start with?
- xi. How much was your initial investment cost? .....
- xii. How did you get capital to start with your dairy cattle enterprise? 1 = Salary, 2 = Own saving, 3 = Loan from bank, 4 = Royalty from friends, 6 = Others (specify)
- xiii. Do you own any other land elsewhere in Babati Town Council?..1= Yes 2= No
- xiv. If answered 'Yes' in (xii), how big is it? 1 = 1-2 Acres, 2 = 3 - 4 Acres, 3 = 5 - 6 Acres, 4 = 7 - 8 Acres, 5 = Above 8 Acres, 6 = Not applicable,
- xv. If answered 'Yes' in (xii), what is the state of ownership of your land? 1 = Purchased, 2 = Rented, 3 = Inherited, 4 = Not applicable, 5 = Others (specify)
- xvi. If answered 'Yes' in (xii), what is the current use of your land? .....1 = Hiring to others,  
2 = Livestock farming, 3 = Crop farming, 4 = Crop and pasture production, 5 = Not applicable, 6 = Others

xvii. What is your main source of labour for taking care of dairy cattle? .....

Source /relationship	Number of persons	Hours spent /day	Type of work done/day	Wage (Tsh) per month
1 = Father, 2 = Mother, 3 = Hired male, 4 = Children, 5 = 1, 2, and 4 above, 6 = Others (specify)	1 = 1 2 = 2 3 = 3 4 = Others	1 = 6 2 = 8 3 = 12 4 = Others	1 = Gathering forages, 2 = Feeding cows, 3 = Cleaning cattle house 4 = Milking, 5 = Bringing in Conc. and other supplements, 6 = selling fresh milk 7 = 1 to 6 above, 8 = Not applicable	1 = 16000/= to 25000/= 2 = 26000/= to 35000/= 3 = 36000/= to 45000/= 4 = 46000/= to 55000/=

xviii. How many cattle do you currently keep in your herd? 1 = Two, 2 = Three, 3 = Four, 4 = Five, 5 = Six, 6 = Others (Specify)

xix. What is the composition of your cattle herd? 1 = Milking cows, 2 = Weaned calves, 3 = Bulls, 4 = Calves, 5 = Heifers, 6 = Others (specify).....

xx. Do you use any veterinary medication to treat cattle diseases? 1 = Yes 2 = No

xxi. If answered 'yes' in question (xix), please fill in the required information in the following table below:-

Common diseases	Medication used	Average Cost (Tshs)	Person doing treatment	Source of medication
1 = ECF	1 = OTC		1 = Govt. veterinarian,	1 = Input stockist
2 = Trips	2 =		2 = Private veterinarian,	2 = Government vet
3 = Babesiasis	3 = Berenel		3 = CAHWs,	3 = Others (specify)..
4 =	4 = Penstrept		4 = My self,	
Analosmosiasis	5 = Surgical		5 = Others (specify)..	
5 = Neumoniam	6 =			
6 = Liver flookes	7 = Manipulations			
7 =				
Physiological				

xxii. Please fill in the required information in the following table below: (The information is about the types and quantity of feeds, fodder, mineral bricks given to your dairy cows and their respective cost and sources).

Type of feed	Average Costs (Tshs)	Source of feeds
1 = Hey,		1 = Own farm,
2 = Banana trees,		2 = Input stockist,
3 = Farm crop residues,		3 = Agro-processing by-products,
4 = Agro-process by-		

products. 5 = Leguminous crop residues. 6 = Mineral supplement. 7 = 1, 2, 3, 4 and 5 above. 8 = 1, 3, 4 and 5 above		4 = Lake Babati reserved area. 5 = Open and reserved areas. 6 = 1, 2, 3, 4, and 5 above. 7 = 1, 2, 3, and 5 above.
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- xxiii. What is the average distance do you get feeds from? ..... km.
- xxiv. Which are costs associated with collecting feeds?..... 1 = Hiring transportation facilities, 2 = Labour, 3 = None. 4 = Others (specify)
- xxv. Production costs in a dairy cattle enterprise

Item	Quantity	Cost/unit (Tsh)	Total cost (Tsh)
<b>Fixed and investment costs</b>			
Purchase of cow			
Housing			
Other (Specify)			
<b>Variable and overhead costs</b>			
Feeds			
Concentrates			
Labour			
Veterinary services			
Transportation			
Water and electricity			
Manure disposal			
Others (Specify)			

**Part III: Milk Production**

i. Total number of dairy cattle owned	ii. Total number of dairy lactating cows	iii. Average milk yield/cow/day	iv. Lactation length (months)	v. Dry Period (months)

- vi. How many litres of milk do you get per day per cow? ..... litres
- vii. Is there seasonal variation in milk production? 1 = Yes 2 = No
- viii. If answered 'Yes' in (vi) above, please provide the following information

Milk production	Reason
Low (months):	1 = Hormonal factors 2 = Feeding inefficiencies 3 = Climatological changes
High (months):	4 = Diseases 5 = 1, 2, 3, and 4 above

	6 = Others (Specify).....
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#### Part IV: Marketing of Dairy Cow Products

- i. Which products do you sell? 1 = Fresh milk 2 = Youghurt 3 = Others (Specify)..
- ii. Where do you sell milk? ..... 1 = At home, 2 = Milk collection centre, 3 = Farmers' FORA /cooperatives, 4 = Hotels, 5 = Hawks, 6 = Others (Specify)...
- iii. To whom do you sell milk? 1 = Neighbours, 2 = Milk collectors, 3 = Hoteliers, 4 = Hawkers, 5 = Milk processors, 6 = 1, 3, and 4 above, 7 = Others (Specify)
- iv. What factors do you consider when planning selling price for milk?
  - 1 = Recovery of incurred production costs. 2 = Honesty to traditional buyers
  - 3 = Prior personal contract based on constant supply, 4 = Urgent cash needs
  - 5 = Others (Specify) .....
- v. What is the current milk price/litre (Tshs)? ..... 1 = 900 to 950, 2 = 1000 to 1050, 3 = 600 to 650, 4 = 700 to 750, 5 = 800 to 850, 6 = 500 to 550.
- vi. What is the average distance from the cattle house to the milk selling point? 1 = 0 (km), 2 = 1(km), 3 = 2(km), 4 = Others
- vii. What was the range of price of milk per litre for the past six months (Tshs)? ..... 1 = 200 to 400, 2 = 400 to 600, 3 = 600 to 800, 4 = 800 to 1000, 5 = Others (Specify)
- viii. What factors determine this difference in the selling prices?
  - 1 = Variation in milk production, 2 = Availability of Milk customers, 3 = Climatrical change, 4 = Change in agro-processing running costs, 5 = 1, 2, 3, and 4 above, 6 = Others (Specify)
- ix. Which means do you use to transport milk product to the markets? 1 = Bicycle, 2 = Work, 3 = Public transport, 4 = Own vehicle, 5 = None, 6 = Others (specify)

x. Which types of costs are associated with milk transportation to the buyers? 1  
 = Labour charges, 2 = Hiring costs, 3 = Buying fuel, 4 = 1, 2, and 3 above, 5 =  
 None, 6 = Others (Specify)

xi. What is the average milk transportation cost per year? .....

xii. Do you find difficulties in selling milk? 1 = Yes 2 = No

xiii. If answered 'yes' in question (v) above, what difficulties do you face?

1 = Inconsistent faithfulness by some customers

2 = Milk market is very far from home, 3 = lack of milk cooling cans,

4 = insufficient number of available milk customers,

5 = Not applicable, 6 = Others (specify).....

xiv. Who mainly sells the milk?

1 = Father, 2 = Mother, 3 = Labourers, 4 = Others (specify) .....

xv. Which type of marketing costs do you incur when selling milk?

1 = Charges for hiring selling kiosk, 2 = Transportation cost, 3 = None, 4 = Others

xvi. Please fill in the following table to analyze the amount you earning from selling milk per cow per day?

Number of Milking cows	Litres/ Cow/day	Lactation period (months)	Total Lts	Lts Sold	Price (Tshs)/ Litre	Income (Tshs)	Litres consumed in the HH

xvii. How much money do you get per month from selling milk? .....Tshs

xviii. From last year (June 2009/June 2010) how much money did you get from selling

1. Bulls ... Tshs 2. Milk cows ... Tshs 3. Yearling bullocks...Tshs

5. Yearling heifers ..... Tshs

xix. How do you normally dispose cow dung? 1 = Hipping onto the back yard,

2 = Hipping onto open space and given to needy people for free,

- 3 = Taken to my own farm, 4 = Selling, 5 = Biogas, 6 = At least 2 and 5 above.
- xx. What are the costs associated with cow-dung disposal? 1 = None, 2 = Transportation, 3 = Others (Specify)
- xxi. How much money do you get from selling manure from the cow shed per month (Tshs)?
- xxii. Which means of insemination do you opt and practice? ...1 = Artificial, 2 = Natural, 3 = Both
- xxiii. What is the average cost for the insemination per year (Tshs.)? ... 1 = 3000 – 6000/=, 2 = 6000 – 9000/=, 3 = 9000 - 12000/=, 4 = above 12000/=
- xxiv. Do you keep records for the dairy cattle keeping enterprise?....1 = Yes, 2 = No
- xxv. Do you use these records in your dairy cows management routines? ...1 = Yes, 2 = No

#### **Part V: Institutional Information and Supporting Services**

- i. What are the available institutional opportunities that encourage you to undertake the keeping of dairy cattle? = Availability of high milk market, 2 = Availability of extension services, 3 = Availability of heifers, 4 = Availability of facilitating institutions (NGOs, Banks), 5 = 1, 2, 3, 4, and 5 above, 6 = Others (Specify).  
Do you access technical information about improving cattle keeping? . 1 = Yes 2 = No
- ii. Which medium do you get the source of information?  
1 = Radio, 2 = Personal experience, 3 = Extension staff, 4 = Friends, 5 = Fellow group members, 6 = 2, 3, and 4 above, 7 = Others (Specify),
- .iii. Does extension staff visit you to give advice on improving cattle keeping? 1 = Yes 2 = No
- iv. If answered 'Yes' in question (iv) above, what is the frequency of contact with extension staff 1 = whenever I call them, 2 = Once per week, 3 = 2-3 times per month, 4 = Not applicable, 5 = Others (Specify).....

- i. What constraints do you face in keeping dairy cattle: 1= Cost of supplement feeds, 2 = Lack of cooling facilities, 3 = Cost of treatment, 4 = 1 and 3 above, 5 = Others (Specify).....
- v. Is there any dairy farmers' organization in your ward/council? 1 = Yes, 2 = No.
- vi. If answered yes in (vii) above, are you a member of the organization? 1 = Yes, 2 = No, 3 = Not applicable
- vii. If yes in (viii) above, how do the organization assist you?  
1 = Coordination for empowerment agents, 2 = Buy/sell my milk,  
3 = Provision of extension services, 4 = Not applicable, 5 = At least 1, and 2 above, 6 = Others (specify)
- viii. Did you get any credit for undertaking your dairy cow enterprise? 1 = Yes 2 = No
- ix. If answered 'Yes' in question (x) what was the source of the credit that you received?  
1 = Commercial Banks, 2 = SACCOS, 3 = NGOs, 4 = Impersonal,  
5 = Not applicable, 6 = Others (Specify)
- x. Did you get any training on dairy cattle keeping? 1 = Yes 2 = No
- xi. If answered 'Yes' in (xii) above, who did it? .... 1 = Government extension agent, 2 = NGOs' extension agent, 3 = Farmers FORA, 4 = Not applicable, 5 = Others (specify)
- xii. How was it done? ..... 1 = Informal learning by doing, 2 = Practically through excursion,  
3 = Formal theoretical then paid visits to the successful dairy cattle keepers,  
4 = Not applicable, 5 = Others (Specify)
- xiii. What was the duration of training? 1 = Less than one week, 2 = 1 to 2 weeks, 3 = 3 to 4 weeks, 4 = Not applicable, 5 = Others (Specify)
- xiv. Where was training done? 1 = At the Ward, 2 = At Tengeru LITI, 3 = Both 1 and 2 above, 4 = Not applicable, 5 = Others

- xv. What did you get from the training? 1 =Animal management skills, 2 = Disease control, 3 = Heat determination, 4 = Not applicable, 5 = Others,
- xvi. Have you been visited by extension agents for the last three months? 1 = Yes, 2 = No
- xvii. If answered 'Yes' in (xviii) above, how many times in the last three months? ...1 =One, 2 = Two, 3 = Three, 4 = Not applicable, 5 = Others
- xviii. Do you receive any support from the government?..... 1 = Yes, 2 = No
- xix. What kinds of support you get? ..... 1 = Extension services, 2 = Subsidized agro vets, 3 = Trainings, 4 = Not applicable, 5 = 1, 2, and 3 above, 6 = Others (Specify)
- xx. Are there NGOs that facilitates for undertaking dairy cattle keeping? 1 = Yes 2 = No
- xxi. If answered 'Yes' in (xxii) above, what types of facilitation do they provides? 1 = Advisory, 2 = Financial loan, 3 = Materials support, 4 = Cow grants, 5 = Training facilitations, 6 = At least 1, 3, and 5 above. 7 = Not applicable, 8 = Others (Specify)
- xxii. What are the institutions doing facilitation?

1	2	3	4	5	6
Microfinance Bank	NG Os	Farmers' FOR A	At least 1 and 2 above,	None	Others (specify)

- xxiii. Are there any motivations you receive from the government institutions regarding the keeping dairy cattle enterprise? ..... 1 = Yes 2 = No
- xxiv. If answered 'Yes' in (xxv) above, please mention these motivations. ... 1 = Provision of subsidized agro-vets services, 2 = Capacitating local milk processors, 3 = Provision with heifers on grant basis, 4 = Not applicable, 5 = Others (specify)
- xxv. Are you informed about any council by laws that regulate and control urban farming and cattle keeping... 1 = Yes 2 = No

- xxvi. If answered 'Yes' in (xxvii) above, do you think these by laws are effective in regulating and controlling urban farming and cattle keeping in this council?... 1 = Yes, 2 = No, 3 = Not applicable.
- xxvii. Give reason (s) to the answer in (xxviii) above... .. 1 = There is still noticeable environmental degradation, 2 = Free grazing is still practiced by some urban dwellers, 3 = At least 1 and 2 above are currently valuable, 3 = Not applicable, 5 = Others(Specify)...
- xxviii. What are the challenges that you encounter in undertaking dairy cattle keeping?  
 1 = Milk prices uncertainties. 2 = High price for supplements.  
 3 = Inadequate knowledge in undertaking dairy cattle keeping.  
 4 = Animal death, 5 = Inadequate extension services provision.  
 6 = Unprofessional veterinary services provided. 7 = At least 1 – 6 above, 8 = Others (specify)
- xxix. What is your future thinking regarding dairy cattle keeping in this council?  
 1 = Increase in urban dwellers engaged in dairy cattle keeping.  
 2 = Increase in milk productivity with optimum numbers of dairy cows,  
 3 = Reduced number of urban dwellers keeping dairy cattle,  
 4 = The concept of economic efficiency will be well understood,  
 5 = At least 1, 2, and 3 above. 6 = Others (specify) .....

xxxxxxx Thank you very much for the information xxxxxxxx

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