THE STRUCTURE AND PERFORMANCE OF THE DELIVERY SYSTEMS FOR TSETSE AND TRYPANOSOMOSIS CONTROL INPUTS AND SERVICES IN KENYA

BY: -

M'MBOYI, F.

A Thesis submitted in partial fulfillment for the degree of

Master of Science in Agricultural Economics

Department of Agricultural Economics,

Faculty of Agriculture,

University of Nairobi.

2001

DECLARATION

I declare that this is my original work and that it has not been presented in whole or in part for the award of any other degree in this University or anywhere else.

Date: 26th April 2001 Name: **FELIX M'MBOYI**

Signature: .....

This Thesis has been submitted for examination with our approval as University supervisors.

Date: April 30, 2001 Name: **PROF. O.L.E. MBATIA**

Signature: .....

Date: 03-05-2001 Name: **Dr. H.N. OMMEH**

Signature: .....

This thesis has been submitted for examination with my approval as a supervisor from the International Livestock Research Institute – ILRI.

Date: May 15, 2001 Name: **Dr. S.W. OMAMO**

Signature: .....

Table of Contents

Acknowledgement

I wish to express my deep and sincere gratitude to Prof. O.L.E. Mbatia and Dr. H. N. Ommeh of the University of Nairobi, Department of Agricultural Economics, for accepting to spare their precious time to supervise this work. I also take this moment to truly thank Dr. S.W. Omamo of the International Livestock Research Institute-ILRI for being my supervisor at the institute and also for assisting me to come up with the thesis topic and research funds. The invaluable help of all this great scholars transformed my raw work into useful research publication.

My utmost gratitude also goes to the chairman of Agricultural Economics Department of the University of Nairobi, Prof. Oluoch Willis Kosura and the entire academic and support staff for putting in place a conducive academic atmosphere that enabled me to conduct my work with minimal constraint. To them all I say thank you so much. Let me not forget to mention my postgraduate colleagues with whom I worked tirelessly in streamlining my research work. Their support was very invaluable and I thank them all too.

Special appreciation and thanks also go to the International Livestock Research Institute-ILRI for nominating me as one of their Graduate Fellows and eventually granting me the very much needed research funds, not to forget the institute's conducive research environment and their excellent research facilities. Particular appreciation goes to Dr Guy D'Ieteren who is the project co-ordinator of the Livestock Production under Disease Risk (LPDR Project No. 18), for availing the research funds. I would also like to sincerely thank the ILRI training officer, Dr. Rob Eley for the smooth way in which he directed the flow of the research funds and also his ideas and corrections on my thesis work. Without their intellectual input, the completion of this Masters degree would be in vain and to them I owe my sincere gratitude.

My thanks go to the Government of Kenya (GoK) through the Directorate of Personnel Management (DPM) and the Ministry of Agriculture and Rural Development (MOARD) for granting me a study leave to pursue this postgraduate degree program. Without their salary support, my studies would have been in vain.

Lastly but not least, let me thank all the other individuals, institutions and organisations that directly or indirectly contributed to the success of my research work in various ways. Their entire support gave me the motivation to work extra hard in order to excel in my research work. To them all I sincerely appreciate their contribution.

ist of Tables

List of Figures

Abstract

This study aims at identifying the existing institutional framework involved in the delivery of tsetse and trypanosomosis control inputs and services in Kenya with a view to determining whether efficiency exists or not in the marketing system. The study also aims at identifying the appropriate institutional framework that enhances efficiency in the marketing system for delivery of these control inputs.

The marketing structure is analysed by looking at the market share of the first four and first eight largest traders within the various channels of the tsetse and trypanosomosis control inputs marketing system. The results of analysis show that the wholesale marketing channel is the least competitive, followed by the pharmaceutical firms and the retail traders. According to the Bain (1968) industry classification model, there is evidence of a highly concentrated marketing system amongst the wholesale traders while the pharmaceutical firms and the retail traders have a high to moderate market concentration. The marketing structure was therefore found to be inherently imperfectly competitive and was characterized by both monopolistic and oligopolistic features.

The extent of market efficiency is then analysed by looking at the market performance indicators in this market viz a viz gross margins per trading level, variable costs, opportunity cost analysis and returns to capital investments per trading level. The results of analysis show that there is evidence of inefficiency in all the studied marketing firms. The least efficient marketing channel was that controlled by the retail traders, followed by the wholesale traders. The relatively inefficient marketing channel was that controlled by the pharmaceutical firms. The results of analysis show that the retail traders had the highest returns to capital while the pharmaceutical firms had the least returns to capital.

Although the liberalisation regime was being put in place in the livestock health sector, it was evident that the role of the government in dealing with the tsetse problem was not adequate as observed by the diminishing budgetary allocations to the livestock heath sector and the reduced tsetse surveillance programs necessary to monitor the tsetse belts and spread of 'fly' in new pasture lands.

The research therefore indicated that imperfectness and non competitiveness was inherently visible in the tsetse and trypanosomosis control inputs and services marketing system and that there was urgent need for a policy intervention to remedy the situation. Some of the proposed policy recommendations included: forming of livestock farmers co-operatives to purchase tsetse control inputs at a lower per unit cost due to economies of scale; encouraging more wholesale traders to enter the wholesale channel in order to break the current cycle of their oligopolistic marketing structure; reducing information asymmetry in the market by bridging the information gap between livestock farmers and the marketing institutions.

It is therefore concluded that further research has to be undertaken to ascertain the functioning of pharmaceutical firms especially in the area of pricing. This would give a clear indication of how these firms make their trading decisions and the resultant effect such an action would have in influencing the behaviour of the retail traders, the wholesale traders and the Animal Health Service Providers. More research is still needed in this area because currently, there is very little information database from which to draw inferences on the true situation in the present tsetse and trypanosomosis control inputs and services marketing system in Kenya.

CHAPTER ONE

.0 Introduction

Bovine trypanosomosis is an infection with the salivarian trypanosomes. The disease caused ›y the tsetse-borne African species is called *nagana*. In East Africa, cattle trypanosomosis is still ›f enormous economic importance. Trypanosome infections have been a tremendous impediment o the development of Africa by making it impossible to keep domestic animals, particularly ıattle, where even small numbers of tsetse flies are present. In 1963, Wilson and associates ıstimated the area in Africa virtually devoid of cattle due to trypanosomosis at 10.4 *10^6 km2 approx. 4.6 * 10^6 sq. miles). This area which has average fertility exceeds considerably the total ırea of the U.S.A. Control measures in several African countries may have reduced the area ıffected (Mugera *et al.*, 1979).

Besides this area of nearly complete exclusion of cattle, there are extensive marginal areas vere infestation with the salivarian trypanosomes restricts cattle distribution, enforces ıomadism, or causes grave economic loss of cattle in transit to markets. The end result is that the ›rotein intake of animal origin by the human population is abnormally low over much of Africa, nostly below 11kg/head/annum, as compared with 40-70kg/head/annum ın Europe and the J.S.A (Mugera *et al.*, 1979).

The ıncidence of trypanosomosis *(nagana)* in Africa is found between the southern limits of ihe Sahara (14" N) to about 29^0 south latitude. Important in cattle that have been recorded in Eastern Africa are *Trypanosoma congolense* and *Trypanosoma brucei*, which invades the ıalivary glands of the tsetse fly and is transmitted mainly by *Glossina morsitans*. It is recognized ›y its polymorphism, consisting of slender (25-35μ), intermediate (20-24μ) and stumpy (15-20μ)

orms. Although it is possible to immunize an animal against any antigenic type, protection may lepend on the production of a polyvalent vaccine, which may be difficult to achieve.

Tsetse flies of most concern in animal trypanosomosis in East Africa are: *Glosssina allidipes,; Glossina longipennis,; Glossina swynnertani,; Glossina breupalpis,; Glossina morsitans*, although *Glossina austeni* and *Glossina palpalis* have been observed from time to ime. Fly belts in East Africa are rarely clearly demarcated. Under certain climatic conditions setse flies, in particular *Glossina pallidipes* show a tendency to migrate from their natural reeding grounds and to occupy temporarily new territory. This process is known as dispersal nd accounts for outbreaks of "fly" in areas adjacent to but not usually considered as part of ecognized fly belts (Mugera *et al.*, 1979).

.1 Importance of livestock industry in Kenya

Livestock accounts for about 10 percent of Gross Domestic Product (GDP) and over 30 ercent of the farm gate value of agricultural commodities. The sub-sector employs over 50 ercent of the agricultural labour force, and provides for substantial raw materials for the local airy, meat and meat processing industries, as well as hides and skins for tanneries; wool, and air (National Development Plan, Republic of Kenya 1997-2001). Table 1.1 depicts the trend in roduction and sale of livestock and dairy products. Despite the importance of this sub-sector to ie national economy, there has been a marked decrease and periodical fluctuation in the roduction of livestock products over the last five years since 1993 as indicated in the table. This end is attributed mainly to disease prevalence notably trypanosomosis in key livestock oducing areas of the country.

According to a 1998 report released by the Department of Livestock Production, of the Ministry of Agriculture, Livestock Development and Marketing, census results have shown that he total number of livestock declined in 1997, compared to the previous year, (1996) and this rend was attributed to, among other factors, poor disease control methods. Table 1 in Appendix I hows the livestock figures per province as per the 1997 livestock census.

Table 1.1: Production and sale of livestock and dairy products, 1993-1997.

	UNIT	1993	1994	1995	1996	1997*
Recorded milk production**	Mn. Lts.	249	258	350	257	240
Kenya Co-operative Creameries milk processed:						
Whole milk and cream	Mn. Lts.	234	204	175	165	111
Butter and Ghee	Tonnes	2394	2409	3131	2327	956
Cheese	Tonnes	220	126	141	193	136
Dried whole milk powder	Tonnes	784	2237	2480	973	255
Dried skimmed milk powder	Tonnes	1961	2120	3101	2349	1197
Other products	Tonnes	20	218	208	349	170
Livestock slaughtered						
Cattle and calves	000' head	980	991	1067	1219	1237
Sheep and Goats	000' head	1280	1310	1327	1401	1424
Pigs	000' head	88	91	91	98	99

Provisional

*Sale licensed by the Kenya Dairy Board

Source: Economic Survey 1998, Republic of Kenya

The importance of the livestock industry lies in the fact that production of livestock utilizes he low potential areas of the country. In its national livestock development policy paper ublished in 1980, the Kenyan Government recognizes this fact when it states "Livestock

production is the only form of land use – other than wildlife production –, which is most suitable in our extensive range lands." In, total the rangelands form over 70 percent of Kenya's land area. It is in these rangelands that many pastoral and nomadic people live and keep large numbers of livestock (Karugia, 1990).

There are however several constraints to achieving the objective of high productivity in the livestock sub sector which includes among others, animal diseases, low public investment in livestock development, a high rate of population growth, drought, high input costs, underdeveloped infrastructure, stagnant production technology and public policy towards the industry (Karugia, 1990). Livestock production is carried out in both high and medium potential lands (HMPL) and in arid and semi-arid lands (ASAL) areas.

The Government has recently instituted several policy strategies in the livestock sector aimed at attaining sustainability and a proper balance in investment and provision of services between the public sector, the private sector and beneficiaries. These recent policy changes include the transfer of dip management to community dip committees, provision of livestock drugs at cost and the liberalization of the veterinary and artificial insemination (AI) services (National Development Plan, Republic of Kenya, 1997-2001).

1.2 The prevailing market situation for delivery of tsetse and trypanosomosis control inputs and services

Growth in the livestock sub-sector is hampered by the institutional ineffectiveness in the delivery of control technologies for livestock diseases due to barriers in private provision of drugs and services (National Development Plan, Republic of Kenya, 1997-2001). The implication has been that farmers in some parts of the country have had no access to appropriate

technology delivery as a result of inefficiencies in marketing. Research indicates that in most cases, not only must trypanosomosis control measures be used in combination, but must be integrated to achieve desired results (D'Ieteren *et al.*, 1999).

In recent years, livestock farmers in tsetse infested areas of the country have continued to experience a decline in their production despite the presence of large pharmaceutical companies engaged in the production of trypanocidal drugs, and a visible network of traders who are involved in the sale of pharmaceutical products in the newly liberalized economy.

All the above issues envisage a challenge for delivery of key livestock technologies to livestock farmers in tsetse and trypanosomosis affected areas of Kenya. To streamline the institutional framework of the existing marketing system, several questions, which need to be addressed pertinently, include: Can the present marketing system deliver effectively tsetse and trypanosomosis control inputs and services at an affordable price to target farmers? What is the present structure of markets, and how does it impact on performance and hence efficiency of the firms involved in the marketing process?

1.3: Importance of trypanosomosis in Sub-Saharan Africa

1.3.1: Distribution of fly

Tsetse are adopted to a broad range of environmental conditions across the continent, from the semi-arid margins of the Sahel, through tropical rain forests, to the sub-tropical savannas of Kwazulu Natal in South Africa. Twenty-two species and various sub-species of tsetse are recognized, divided into three groups according to anatomical similarities:

Forest tsetse-*fusca* group: Eleven of the twelve members of this group inhabit the forests of west, central and east Africa. The exception, *Glossina longipennis*, occurs in the arid rangelands

of east Africa, feeding on elephant and rhino. *Fusca* group tsetse rarely come into contact with people or livestock, and is generally considered to be of relatively minor economic importance.

Riverine tsetse-*palpalis* group: the five species belonging to this group are found mainly in the forests and riparian vegetation of west and central Africa, extending along rivers, streams and lake shores into semi-arid woodland savannas. The group includes three widespread species of economic importance: *G. fuscipes, G. palpalis and G. tachinoides.*

Savanna tsetse-*morsitans* group: the five members of this group inhabit the woodland savannas of west, east and southern Africa surrounding the equatorial forests of central Africa. The group includes four widespread species of economic importance: *G. austeni, G. longipalpios, G. morsitans* and *G. pallidipes* (Katondo et al , 1977).

The map (fig. 1.3.1) shows the distribution of the various species of tsetse in Africa.

Figure 1.3.1: The distribution of tsetse fly in Africa.

Morsitans group *Palpalis* group *Fusca* group

Source: Katondo, 1977

From the tsetse distribution map above, it is clearly indicative that Kenya is infested with the *Morsitans* and *Fusca* species of tsetse flies. The sub Saharan region of Africa makes up the area mostly affected by the trypanosomosis and tsetse menace. The countries that are mostly hit by the tsetse problem include Kenya, Tanzania, Uganda, Democratic Republic of Congo, Congo, Central Africa Republic, Gabon, Nigeria, Cameroun, Senegal, Gambia and Ghana amongst others.

Trypanosomosis is an important constraint, if not one of the most important constraint, to livestock and mixed crop-livestock farming in tropical Africa. More than a third of the land area across Africa is infested with tsetse flies (8.7 million square km), where at least 46 million cattle are exposed to the risk of contracting tsetse- borne trypanosomosis, as are millions of sheep, goats, donkeys, camels and horses (Reid et al, 1999). African livestock producers are administering an estimated 35 million curative and preventive treatments annually (Geerts and Holmes, 1997). At a price approximately Kshs 78 per treatment, the disease is costing livestock producers and governments at least Kshs 2.73 billion per year. Assuming an average of two treatments per animal, this implies 17.5 million animals are treated each year for the disease or 38 % of those at risk.

By generally constraining farmers from the overall benefits of livestock to farming – less efficient nutrient cycling, less access to animal traction, lower income from meat and milk sales, less access to liquid capital – trypanosomosis reduces both crop yields and areas cultivated. Taking into account the lower density of cattle found in tsetse - infested as compared to tsetse-free areas of Africa, an empirical estimate of the relationship between a country's stock of livestock and total agricultural output, Swallow (1997) estimated annual losses in income (i.e. gross domestic product) for the 10 African countries completely infested by tsetse to be in the range of Kshs 149.76 billion to Kshs 74.88 billion. These countries include Kenya, Democratic Republic of Congo, Tanzania, Uganda, Congo, Central Africa Republic, Togo, Senegal, Cameroon and Nigeria.

Around 300 million out of 670 million people in Africa will be living in tsetse – infested areas of Africa by 2000 (Kruska, 1999). The costs of human trypanosomosis (sleeping sickness)

are extremely difficult to quantify. However, it has been estimated that at least 50 million people are at risk of contracting this disease (Kuzoe, 1991).

The International Livestock Research Institute (ILRI) has devoted a considerable part of its past and current research budget to the development, refinement and application of technologies to aid livestock producers in controlling trypanosomosis. These technologies include the use of livestock breeds that tolerate the disease. Recent research results on the development and application of an anti-trypanosomosis vaccine by ILRI scientists and collaborators indicate that the problems associated with antigenic variation of the parasite surface coat can be overcome. The goal now is a multi-component vaccine with components aimed at the parasite and the disease (ILRI, 1996, 1997).

What this means is that a vaccine based on these common parasite components would be effective against livestock trypanosomosis transmitted by tsetse flies in Sub Saharan Africa. Table 1.3.1 shows the number and density of cattle in tsetse areas of sub-Saharan Africa by region and agro-ecological zone (AEZ).

Table 1.3.1: Number and density of cattle in tsetse areas of sub-Saharan Africa by region and agro-ecological zone (AEZ)

REGION and AEZ	Total no. of cattle (millions)	No. of cattle in tsetse-infested areas (millions)	Percent of total	Tsetse-infested area. Cattle/km^2	Tsetse-free area. Cattle/km^2
SOUTHERN AFRICA					
Arid	4.9	0.08	2	3.4	2.8
Semi-arid	10.1	1.28	13	2.4	8.0
Sub humid	7.1	0.76	11	1.2	6.0
Humid	0.1	0.03	19	0.3	3.1
Highlands	6.1	0.05	1	6.5	8.6
Total/mean	28.4	2.20	8	2.7	5.7
EASTERN AFRICA					
Arid	15.5	1.50	10	13.7	5.4
Semi-arid	17.9	5.09	28	23.7	16.9
Sub humid	10.2	6.19	61	9.9	13.7
Humid	0.9	0.59	66	7.9	8.6
Highlands	31.7	7.96	25	21.5	34.5
Total/mean	76.2	21.32	28	15.3	15.8
MEAN-EASTERN AND SOUTHERN LESS ARID[1]					
WESTERN AFRICA					
Arid	6.2	0.01	0	9.7	1.6
Semi-arid	18.1	6.93	38	11.3	13..3
Sub humid	11.6	9.97	86	9.2	18.5
Humid	1.1	1.07	94	1.5	6.9
Highlands	0.001	0.001	100	13.2	0.0
Total/mean	37.1	17.98	48	9.0	8.1
CENTRAL AFRICA					
Arid	0.0	0.00	0	0.0	13.6
Semi-arid	1.1	0.18	15	4.3	27.3
Sub humid	2.9	2.35	82	3.0	8.3
Humid	3.6	3.46	96	1.1	4.9
Highlands	0.5	O.28	55	3.2	14.5
Total/mean	8.2	6.26	77	2.3	13.7
TOTAL/MEAN-SSA[1]	149.8	47.75	32	5.3	7.2

[1]Mean calculated as total number of cattle/total number of kms^2

Source: GIS calculations, using most recent available country-level livestock population data, usually by district, as described in Kruska et al. (1995). For some countries, information at district level data or recent census data was not available; thus the total number of cattle may be underestimated. The data will continue to be upgraded at ILRI.

1.4 Solving The Tsetse Problem

One direct impact of trypanosomosis is livestock mortality. This has an impact on agricultural production due to reduction in number of draft animals and manure for use as fertilizer. Thus people reduce the area cropped, shift to hoes for cultivation and experience reduction in crop yields. It also leads to reduction in incomes for households depending on sale of livestock, especially milk, live animals and other farm produce (Food and Agriculture Organisation , 1995).

A successful tsetse and trypanosomosis control program in a region is likely to stimulate an increase in livestock numbers (stocking rate) and a shift from rearing low productive traditional stock to high yielding improved animals. Therefore, land that was under -utilized prior to the tsetse control program is likely to be fully utilized implying that this land has been "released" from a constraint that impeded it's utilization. All these effects lead to increase in the aggregate yields of marketable livestock products from this region (Kenya Trypanosomosis Research Institute KETRI, 1998).

Methods of tsetse control used in the past such as spraying and bush clearing proved expensive, destructive to the environment or both. Other cost effective and environmentally friendly techniques like pour-on, traps and targets have been developed over the years (KETRI, 1995).

There is a wide range of drugs of several chemical series with trypanocidal or trypanophylactic action and choice of drugs is made relative to their degree of toxicity to the host animal as well as for their specific therapeutic effect.

Prophylactic drugs have application in circumscribed areas for static cattle or for protection of trade cattle being moved on the hoof through tsetse infested country en route for slaughter. Curative treatment is only carried out in situations in which cattle are infrequently infected or after the animal-vector contact has been broken. Because of slaughter resistance, it has been thought essential to control the field application of drugs by the government in any territory where the drugs are in use. Drugs commonly used in control of *nagana* in cattle include;

Table 1.4.1: Drugs commonly used in control of trypanosomosis in cattle.

Curative	**Prophylactic**
Homidium bromide (Ethidium, Booth)	Quinapyramine prophylactic (Antrycide pro salt, I.C.I. Prothidium (Booth)
Homidium chloride (Noridium, M and B)	Isometamedium (Samorin, M and B)
Quinapyramine, curative Antrycide, I.C.I. (Berenil, Hoechst)	
Cross resistance amongst Trypanocidal drugs	
Infection resistant to	Drugs that will cure
Antrycide	Metamidium 2 mg/kg
Homidium	Berenil, Metamidium 2 mg/kg
Metamidium	Berenil
Prothidium	Berenil, Metamidium 2 mg/kg
Berenil	All other drugs

Source: Mugera *et al.*, 1979

1.5 Distribution Of Tsetse In Kenya

Tsetse flies are widely distributed in Kenya. The most prevalent areas include: western Kenya region, Central Kenya region, coastal region and the eastern region of the country. All these regions extent up to the neighbouring countries of Uganda, Tanzania and Somalia. The map

(fig. 1.5.1) shows the distribution of tsetse flies in Kenya. All the shaded parts of the map depict the extent to which tsetse distribution is prevalent in Kenya today.

Figure 1.5.1: Tsetse distribution map of Kenya

Source: Lessard et al., 1990.

The map above indicates that tsetse flies are distributed in the Rift Valley, Western, Coastal and parts of Eastern provinces of Kenya. The most important tsetse species affecting livestock farmers in Kenya today are the *morsitans* and *fusca* group.

1.6 Relationship Between the Government and Leading Stakeholders in Tsetse and Trypanosomosis Control

1.6.1 Farming in Tsetse Controlled Areas (FITCA)

This is an Organisation of African Unity (OAU) project, which is funded by the European Union (EU) and co-ordinated by the government of Kenya. The government's input is in terms of personnel. FITCA is a rural development project, which was established in 1999, and it will run for four years till 2003. The main objective of this project is to improve the economic welfare of the local communities in 5 districts of Kenya i.e. Bungoma, Busia, Siaya, Bondo and Teso where tsetse fly infestation is a problem of concern to the farming community.

Objectives, purpose and philosophy of the project

The overall objective of FITCA (Kenya) Project is to improve the welfare of people in the region. The FITCA Project purpose is increased livestock productivity, which falls into three categories; tsetse and trypanosomosis control, improved livestock practices and promoting integrated crop/livestock systems.

FITCA is a community based rural development project whose emphasis is on improved livestock productivity and uses the whole- farm approach. The entry point to these communities will be through their locally based organisations such as women's groups, youth groups, self help groups, soil conservation groups, church groups etc. demonstration activities will be established by individual members of these organisations on a full cost recovery system.

Project Activities

These will include:

a) Creating awareness of the project activities and training of target groups.

b) Improved livestock husbandry practices including enhanced management and nutrition.

c) Tsetse control by the application of insecticides to cattle and the use of insecticide treated traps by the benefiting communities.

d) Improved animal health delivery systems with increased emphasis on private service providers.

e) Clearing of vegetation where many tsetse's breed and live. This will help reduce the widespread distribution of the tsetse fly and the disease it transmits.

Liaison with other projects and NGOs in the project area.

Being community based, many of the above activities will require the process of a Participatory Rural Appraisal (PRA) before they can be put in place. If the requirements of a PRA cannot be directly met by the FITCA (Kenya) project, it will pass on the findings to other relevant government departments, projects or NGOs who will hopefully be empowered to follow-up the requests. The project also hopes to liase closely with other community based projects, in order that they can complement one another, and lead to sustainable improved welfare, via improved farming practices, for people living in tsetse controlled areas.

1.6.2 International Livestock Research Institute (ILRI)

Background

The International Livestock Research Institute works to improve the well being of people in developing countries by enhancing the contribution livestock make to smallholder farming. ILRI scientists work with a wide consortium of partners in the South and North to develop technological interventions and other research-based products that increase and sustain whole-

farm productivity. ILRI transfers these products, which include high-quality information and training, to the national agricultural research systems of developing countries. ILRI works with the Kenya Agricultural Research Institute (KARI), the Kenya Trypanosomosis Research Institute and the Ministry of Agriculture and Rural Development (MOARD) in ensuring that research resulted are availed to the farmers for implementation. The institute conducts work in three programmes-biosciences, sustainable production systems, and strengthening partnerships with the national agricultural research systems of developing countries.

The Problem

The major constraints to improving livestock productivity in the tropics and subtropics, where production efficiency is only one-quarter that in developed regions, include a devastating animal disease burden, a near-ubiquitous shortage of good quality livestock feeds, rapidly diminishing forage and animal biodiversity, poor access to markets, and unresponsive policy environments.

The Mission

ILRI is the first institute to take on the full complex of these inter-related researchable problems. The centre tackles constraints in both animal production and animal health, it addresses environmental as well as productivity concerns, and it conducts work across the full spectrum of upstream-to-down stream, laboratory to field-based research. ILRI's mission is to enhance the well being of present and future generations in developing countries through research that improves sustainable livestock production.

Research

Disease and inadequate feed are the biggest constraints to improving animal agriculture in the developing world. Most of ILRI's work therefore focuses on improving livestock health and

nutrition, which allow farmers to increase their production of milk, meat, crops, forages, manure and traction.

The Strength, Products and Beneficiaries

The major scientific fields represented at the institute are cell and molecular biology; molecular and quantitative genetics; immunoparasitology; bovine immunology; epidemiology; animal science, nutrition and breeding; farming systems, ecology and socioeconomics. ILRI's research products include maps of bovine and protozoan genomes, improved vaccines and diagnostics, integrated disease-control strategies, economic and systems models, policy analyses, GIS-based decision support systems, a tropical forage gene bank, technologies for incorporating forages onto smallholder farms, systems that improve feed supplies for smallholder dairy producers, feeding strategies for multiple purpose livestock, and animal traction technologies that improve the productivity of heavy clay soils. ILRI's research products and related outputs are disseminated through an outreach programme that works to strengthen collaborations with and capacities within the national agricultural research systems of developing countries.

The government collaborates with ILRI through technology development programs and other research activities related to livestock diseases. ILRI also undertakes to fund training programs for public service employees in livestock health related research studies.

1.6.3 International Centre for Insect Physiology and Ecology (ICIPE)

Background

ICIPE was constituted as a centre of excellence in insect science research with full international legal status and mandate as an autonomous, non-profit-making, research and training institute. 11 countries, including the host country, Kenya, have subscribed ICIPE's

charter. Scientists work in multi-disciplinary teams to help solve the tropics most pervasive development problems through research and development on the 4-H's: plant, human, animal and environmental health.

The Mission

ICIPE's mission is to help alleviate poverty, ensure food security and improve the overall health status of peoples of the tropics by developing and extending management tools and strategies for harmful and useful arthropods, while preserving the natural resource base through research and capacity building.

Mandate, Major Objectives and Scope of ICIPE's Work.

The primary mandate of ICIPE is research, and institution building in integrated arthropod management. The scope of research and training activities covers the development of tools and strategies for controlling and managing human, animal and plant pests and disease vectors; the development of appropriate technologies for insect-based income generating activities and the study of socio-economic aspects of arthropod-related development issues. In addition to research activities, ICIPE plays an important role in strengthening the scientific and technological capacities of the developing countries in insect science and its application through training and collaborative work.

The government collaborates with ICIPE in the development of tsetse traps and baits and also in breeding trials of sterile male flies to stop the fertilisation of fertile female flies. Traps are distributed to rural community groups for trapping of flies in tsetse prone areas.

1.7 Relationship Between the Government and other Private Sector Stakeholders in Tsetse Control

Very few non-Governmental organisations fund tsetse control projects in Kenya. But some non-governmental organisations working on livestock improvement projects in tsetse prone areas of the country sometimes fund a few tsetse related projects. Such activities include tsetse trap development program, bush clearing especially along river valleys and the establishment of community dipping services, which may contribute directly or indirectly to tsetse control. However the Government is keen on initiating new approaches with a view to seeking a sustainable solution to the problem of tsetse in Kenya. These approaches are aimed at attracting more private sector participants and the donor community for enhanced livestock production.

1.8 The Problem Statement

The effectiveness and efficiency of market-based delivery of tsetse and trypanosomosis control inputs and services are unclear in Kenya. Despite the presence of large pharmaceutical companies engaged in the production of trypanocidal drugs, and a visible network of traders who are involved in the marketing of pharmaceutical products, the structure and performance of these markets has not been established. Without this information, the appropriate roles for the public and private sectors in delivery on tsetse and trypanosomosis control inputs and services cannot be ascertained nor can appropriate institutional structures be designed and implemented.

Historically, the livestock sub-sector has been characterized by low intensity of land use, poor marketing of livestock drugs and services, both contributing to low output per unit of land in Kenya. (National Development Plan, Republic of Kenya, 1997-2001). Since livestock production is being privatised, the Government intervention focuses on extension services, appropriate technology delivery through marketing of drugs, and improved management (NDP, Republic of Kenya, 1997-2001).

Growth in the livestock sub-sector is hampered by the institutional ineffectiveness in the delivery of control technologies for livestock diseases due to large barriers in private provision of drugs and services (NDP, Republic of Kenya, 1997-2001). The implication has been that farmers in some parts of the country have had no access to appropriate technology delivery as a result of poor marketing. Research indicates that in most cases, not only must trypanosomosis control measures be used in combination, but must be integrated to achieve desired results (D'Ieteren *et al.*, 1999).

Taking into account the lower density of cattle found in tsetse - infested as compared to tsetse-free areas of Africa, an empirical estimate of the relationship between a country's stock of

livestock and total agricultural output, Swallow (1997) estimated annual losses in income (i.e. gross domestic product) for the 10 African countries completely infested by tsetse to be in the range of Kshs 149.76 billion to Kshs 74. 88 billion.

Around 300 million out of 670 million people in Africa will be living in tsetse – infested areas of Africa by 2000 (Kruska, 1999). The costs of human trypanosomosis (sleeping sickness) are extremely difficult to quantify. However, it has been estimated that at least 50 million people are at risk of contracting this disease (Kuzoe, 1991).

1.9 Justification of the Study

Delineating the organization, structure and performance of the tsetse and trypanosomosis control inputs and services marketing system in Kenya provides for an understanding of the way livestock farmers respond to demand situations at the market place. An analysis of this response can be used in restructuring the institutional framework of the existing marketing system so as to benefit all the parties involved in the production, distribution and utilization of tsetse and trypanosomosis control inputs and services.

Given that livestock production is a key sub-sector in Kenyan agriculture, and that trypanosomosis is an important disease in key livestock producing areas, an understanding of the delivery systems of tsetse and trypanosomosis control inputs and services is essential. This information can be positively utilized by livestock farmers and also by policy makers in formulating delivery strategies with an aim of raising productivity in the livestock industry and agriculture as a whole. This translates into improved income earned by households and also in ensuring sustained national food security since livestock keeping households entirely depend on its output for sustainable food and steady income flows . Kenya is an appealing county in which

to explore these issues because tsetse covers wide expanses of land in key livestock producing areas (Oloo *et al.*, 1999).

1.10 Objectives of the Study and Hypotheses

The overall objective of the study was to identify the existing institutional framework involved in the delivery of tsetse and trypanosomosis control inputs and services in Kenya with a view to determining whether efficiency exists or not in the marketing system.

The specific objectives of the study were:

a) To determine the main channels (pathways) for delivering tsetse and trypanosomosis control inputs and services, highlighting the key players and their roles, with a view to identifying the control inputs and services best suited for private sector delivery and those for which public sector involvement may be required.

b) To identify and quantify the costs and returns (margins) to activities and functions involved in delivering and using alternative tsetse and trypanosomosis control inputs for the various players involved, with a view to determining the efficiency of the current delivery systems in the Kenyan market.

The following hypotheses were tested:

a) The Kenyan trypanosomosis control inputs and services marketing institutions are non-competitive.

c) Traders involved in the delivery of tsetse and trypanosomosis control inputs and services receive significantly excessive margins.

1.11 Scope

The Thesis is comprised of five chapters. Chapter One introduces the understanding of tsetse and Trypanosomosis as a serious disease to livestock farming in Africa. It also explains the importance of the livestock industry in Kenya and attempts to give an overview of the current marketing situation of the tsetse and Trypanosomosis control inputs.

Chapter Two is comprised of the literature review. The chapter attempts to cite previous livestock economics studies undertaken in Kenya and Africa over the years. It also explains the nature and functioning of Kenyan markets with regard to competitiveness and efficiency in other lines of agricultural production.

Chapter Three comprises of the research methodology and it explains the economic models used in analysed the data, it also gives the background information on the study areas.

Chapter Four comprises of data analysis, results and discussion. It explains the nature of the research findings and relates them to the hypotheses that were to be tested. This chapter attempts to classify the tsetse markets and also draws conclusions on whether these markets are efficient or not.

Lastly, Chapter Five gives the summary, conclusions and recommendations of the research based on the data analysis and results. The chapter gives the overview of the whole report and outlines policy recommendation based on the research findings.

CHAPTER TWO

2.0 Literature Review

2.1 Theoretical aspects

Introduction

Although there is a substantial amount of literature on livestock economics, specific studies relating to structure and performance of markets for tsetse and trypanosomosis control technologies in Kenya are lacking. The various aspects that have been studied in the livestock sector are on impact analysis for communities affected by the tsetse menace, technology adoption for tsetse and trypanosomosis control and willingness by affected communities to contribute to the control of tsetse and tyrpanosomosis among other studies.

No work has, however, been done on the structure and performance of markets, which are involved in the delivery of tsetse and tyrpanosomosis control technologies and services, and therefore it is hoped that the results of this study will provide the necessary insights on these issues. Particular emphasis is placed on the fact that this study has been done on a national level and yet previous studies on livestock economics were carried out at district levels.

Some studies on economics of tsetse and trypanosomosis control and general market efficiency were reviewed so as to give an overview of the relevant studies that have been done on tsetse and trypanosomosis occurrence and its control.

The study explores opportunities for, and constraints on, improved delivery to control trypanosomosis, which is a serious livestock disease in Kenya. Specific emphasis has been placed on the structure and functioning of the existing marketing institutions and their impacts on the performance and hence efficiency of the various players involved in the delivery process. An

additional focus has been placed on the roles played by the public and private sectors in input and service delivery in an increasingly liberalized marketing environment.

2.1.1 Technology Delivery for Tsetse and Trypanosomosis Control Inputs

African animal trypanosomosis is a parasitic disease that affects the health of people and animals in many parts of sub-Saharan Africa. The human form of the disease is commonly known as sleeping sickness and the livestock form is known as *nagana* (Echessah *et al.*, 1997). In Kenya, tsetse covers wide expanses of land in key livestock producing areas (Oloo *et al.*, 1999).

Echessah *et al.*, (1997) further recognizes that administering trypanocidal drugs, suppressing the tsetse flies (*Glossina spp.)* that transmit the disease or keeping livestock that are naturally tolerant to the disease can control the effect of the disease. He however indicates that neither bush clearing nor insecticide spraying is widely used at present because of their high costs and concerns about their negative environmental impacts.

"Community participation" has become one of the basic elements of governments' policies and programs for tsetse control. This in part reflects the desirability of local participation, it also reflects a shift in donor's policies toward more participatory approaches to rural development and the hope that some of the costs of trypanosomosis control can be "handed over to the community" (Echessah *et al.*, 1997).

Although Echessah *et al.*, (1997) goes a long way in shading light on the insights of trypanosomosis as a serious livestock disease and explains how it can be controlled by various policies and programs, he fails to advice on the important aspect of availability of the various control inputs and services through the marketing system. Most livestock farmers live in the

remote regions of the country where the marketing infrastructure is very poor and also the literacy levels are very low. The implication then is that tsetse and trypanosomosis control inputs and services may not be reaching the target groups despite their availability on the local market. Thus the significance of the present study cannot be over emphasized.

Trypanosomosis is a disease of paramount medical, social and economic significance affecting man and his domestic animals, especially in Sub-Saharan Africa. World Health Organization (W.H.O) places it among the ten major health problems facing mankind along with malaria, cancer and heart disease. In Kenya this disease is recognized as one of the most important parasitic diseases of domestic animals responsible for high mortalities, ill health and malnutrition to man by decreasing the amount of livestock protein available (Mutayoba, 1996).

Livestock perform a wide variety of economic and social functions in the households of Africa. Jahnke *et al.*, (1988) classifies the functions into four main categories; output, input, wealth and socio-cultural functions. Livestock also play an important role in Africa by contributing to the Gross Domestic Product (GDP).

Although the benefits from research expenditures, particularly from improved agricultural technologies, are generally high, ex-ante benefits to specific research projects are usually difficult to measure. For example, while the development of improved livestock disease control technologies are being emphasized in Africa, available economic analysis on the new and existing control methods are limited to costs, financial and economic estimates (Nyangito, 1992).

In economic terms, Griffin and Allonby (1979) classified the losses incurred due to trypanosomosis into direct (or immediate) and indirect ones. Some of the direct loses are due to mortalities, abortion and condemnation of meat. The indirect loses arise due to a decrease in body weight, length of reproductive life and general infertility.

Importation and local distribution of trypanocidal drugs is performed by private companies but overseen by the Government in a tightly controlled tender system. The study further points out that procurement and distribution of insecticides intended for use in tsetse control areas is handled mainly by private traders, but sales are tightly controlled and authorized only in areas where trypanosomosis risk is high. Findings from the study conclude that new initiatives that rely on high degrees of involvement and participation by affected communities and private sector lie in prospect (FITCA, 1999).

Studies show that developing countries have nearly two thirds of the world's livestock but produce only about a quarter to a third of the world's meat and a fifth of its milk (Ehui *et al.*, 1995). Low output in the developing region is due to both low technology delivery caused by poor marketing strategies, resulting into low take off rates and low yields per animal. Research can provide technologies but technologies need to be transferred to producers to ensure impact. Since this issue has not been adequately tackled, there is need to undertake research in the area of technology delivery through marketing.

The environment affecting research is determined not only directly by research policy but also by structural and macro policies. These policies can have a direct bearing on the demand for technological change and the extent of adoption through an effective delivery system. From the study, it was clear that policies that depressed domestic production and encouraged poor management of the natural resource base included; inefficient input and credit market policies that inhibited the uptake of new technology through poor delivery (Ehui and Lipner, 1993).

Sound sectoral policies in support of animal agriculture can have several effects on producers. They provide incentives to intensify livestock production with purchased inputs and to commercialise livestock production activities and integrate them in the market economy.

While studying 'the factors affecting farmer demand for pour-on treatments in Ethiopia', Wangila *et al.*, (1996) found out that household demand for the pour-on depended upon season, characteristics of the household head, structure of the cattle herd, distance to the nearest supply point and characteristics of the household's neighbours. Demand was highest in the wet season and lowest in the dry season. Wangila *et al.*, (1996), also discovered that demand for pour-ons mainly depended on farmer's perception of the private benefits and costs as well as incentives they contributed to the public benefits.

Regarding the private benefits, he hypothesized that farmer demand for pour-ons mainly depended upon household level, age, sex, herd composition and distance (travel cost) from the supply centre. Regarding the public benefits, they hypothesized that farmers will consider the characteristics of their neighbour's use of the pour-ons, and the returns their neighbours obtain from using the pour-ons.

In his results, discussion and conclusion, Wangila *et al.*, (1996) found out that the following testable hypotheses had a significant effect on demand for the chemical known as "pour-on"; -

1) Herd size, proportion of oxen in the herd, and proportion of cows in the herd had positive effects on the probability that a household treated some animals.
2) Households located far from the nearest supply point were less likely to treat their animals, due to the opportunity cost of the time required to walk the animals from the homesteads to the treatment centres. They were also the added herding costs of taking additional animals to the treatment centres and back for a treatise on fixed and variable transaction costs.
3) The greater the number of animals that were treated within a 1-km radius of a household, the more likely the household would treat its animals. Households that observed their neighbours treating cattle perceived an obligation to treat their own cattle too.

4) The more productive was cattle production in the neighbourhood around a household, the more likely it is that the household would treat some of its animals. Households, which observed good livestock production among their neighbours, would want to emulate that behaviour. Use of a pour-on was a visible way to improve production

Pour-ons are formulations of insecticide that can be applied to cattle in tsetse affected areas. Cattle treated with pour-ons act as 'live targets'; tsetse flies that land on treated animals contact the insecticide and die immediately or are immobilized by a knockdown effect. There is evidence that pour-on treatments can control tsetse, ticks (Thompson *et al.*, 1991; Bauer *et al.*, 1992) and other biting flies. (Leak, *et al.*, 1995).

Three different pour-on formulations based on synthetic pyrethroids have been proven to be effective in controlling tsetse. Deltamethrin (Spoton, Cooper Ltd., Zimbabwe) has been tested in Zimbabwe and on the island of Zanzibar ; Flumethrin (Baytical, Bayer AG, Germany) has been tested in Kenya and Burkina Faso and Cypermethrin high-cis (Ectopor, Ciba-Geigy, Switzerland) has been tested in Ethiopia (Leaks *et al.*, 1995).

The use of baited traps and targets to control tsetse flies has the potential for successful and sustainable trypanosomosis control by local communities. However, difficulties in preventing theft and damage to traps and targets in the field have led to the general conclusion that the success and sustainability of such technologies depends crucially on practical involvement of the beneficiary communities (Kamara *et al.*, 1999). He believes that ex-ante economic and social studies have been under-used in this field, and can offer insights into the behaviour, aspiration, and motivation of both individuals and communities during attempts to involve them in tsetse control, in order to provide recommendations leading to appropriate design and implementation.

2.1.2 Development Support and Animal Health Services

According to Uarali *et al.*, (1994), no particular public-private balance is appropriate for all animal health inputs. He suggests that the most efficient method for delivering an input depends upon the way its benefits are distributed. An input whose benefits accrue to a livestock owner should be delivered by private firms, while an input whose benefits are diffused through a larger population should be delivered by public agencies. (The concepts of excludability and subtractability are used to characterize the public-private nature of animal health inputs.)
An input is subtractable if its use by one person reduces its value to others; it is excludable if it's owner or provider can withhold its benefits without incurring any cost (Cornes and Sandler, 1986; Uarali *et al.*, 1994). Uarali *et al*, (1994) notes that externalities and information asymmetries also affect the optimal balances between public and private involvement in input delivery systems.

Private delivery systems can result in over-use of inputs that generate positive consumption externalities. An input whose quality is known to the supplier but difficult to observe by potential customers can raise 'moral hazard' problems because the supplier (public or private) can be tempted to supply goods of inferior quality.

The major animal health problems in Sub Saharan Africa are parasitic and viral diseases, some of which are transmitted by arthropod vectors. These are widely distributed but their severity is strongly influenced by environmental conditions (Winrock 1992). Studies by FAO, (1995) also indicate that interactions among disease genotype, management and environment in various production systems must be understood in order that integrated disease control strategies can be developed. FAO, (1995) further reveals that considerable progress has been made in sub

Saharan Africa, especially in the Francophone part, where there are now an estimated 400 private veterinary doctors, covering most of the clinical care and drug sales.

The most important trend in the institutional organization of livestock services, now in the mainstream of current development dialogue is a better distribution between the public and private sector. The study shows that the public sector must maintain public good that it can (or must) do itself under close supervision; or can transfer fully to the private sector and maintain only an overview function. Pure public services include policy planning, quarantine, food inspection and quality control. Public service responsibilities which can be sub contracted to the private sector are, goods with externalities, such as compulsory vaccinations, extension through mass media and research which is not patantable. Pure private goods include clinical animal health care, animal breeding and credit FAO, (1995).

However the above studies failed to critically evaluate the benefits through externalities livestock producers would achieve by subscribing either to public or private services or the direct cost effective benefits that local producers of livestock would derive from subcontracting livestock health services.

2.2 Economic Theory of Markets: Relevant Empirical Studies

A marketing firm is said to be market efficient if it attains economic efficiency in production of market services, and the output prices that emerge from that marketing system are able to allocate resources efficiently. Market inefficiency is caused by market failure and government policies that support inefficient objectives. A market fails if a single or few buyers and sellers are able to influence the market prices (i.e. monopsony, oligopsony, monopoly an oligopoly respectively) (Ndirangu, 1992).

Market structure is the organizational characteristics of the market, which determine the relationship of sellers to each other and of sellers to their actual and potential suppliers. Market performance is generally analyzed by computing the profitability of the various groups of traders in the market (Abila, 1995).

Work by Serem (1996) on "Beef cattle marketing in Baringo District, Kenya" used the Bain (1968) industry classification on the basis of sales shares of the first four and eight largest firms to assess the degree of competition. In his study, Serem (1996) adopted Bains' work, only that in his case, "buyers" was used in place of sellers so as to be able to use Bains' method of analysis. In his work, every livestock trader was considered as a single firm. The markets were considered to be the surveyed livestock auctions where both traders and producers transacted in livestock.

When analyzing the concentration of the Nairobi Beef retailing system, Karugia (1990), used the Bain (1968) model as a criterion in his study to judge the degree of competition. The classification was based on the market share of the first four and eight largest firms as well as the total number of sellers in the market. His study revealed that the number of butcheries in Nairobi was found to be large and that the market shares controlled by the first four or eight largest retailers in the sample were not large enough to foster oligopolistic interdependence.

The gross margin analysis was used by Abila (1995) to study the market performance of the various types of traders involved in the Kisumu fish market. In his analysis of the traders' gross margin, he concluded that a big portion of the overall marketing margins was due to trader remuneration rather than to the cost of real marketing services such as storage, processing, transport and facilitative operations. Thus the Kisumu marketing system was found to be price inefficient.

The current study adopted the methodology by Karugia (1990) and Serem (1996) in the analysis of market concentration and also the methodology by Abila (1995) in the analysis of the trader's gross margins to assess the market performance.

Waswa-Wangia (1977) work on "Competition and Efficiency of Food Retailing to Low Income Consumers in Nairobi" investigated on indicators of efficiency and employed marketing and operational costs, marketing margins and resource productivity as the important aspects to consider

In his paper entitled, "Some Considerations of Methods of Evaluating Market Systems for Agricultural Products", Schubert (1973) states that "determination of the gross trade margins i.e. the difference between the average consumer price and the producer price, is generally the first step towards investigating technical and allocative efficiency." He continues to state that the gross trade margin is then divided into component margins per trading function. Finally, the component margins are resolved into costs and profit. The analysis should then continue to assess whether the marketing costs can be reduced.

The level of marketing costs at a given performance is independent of the internal organization of the individual business, process and factor organizations. An improvement on technical efficiency then entails examining the marketing system to assess whether marketing costs can be reduced by changes in the organization of the market or the marketing organizations themselves (Bain, 1968).

An investigation on whether trade margins contain appreciable monopoly profits, without the knowledge of the marketing costs was conducted by Ruttan (1973). He presupposed that changes in the consumer price had only a slight effect on the marketing costs of a product. Accordingly, changes in trade margins at a time when retail prices are changing are therefore the

result of changes in profit margins than changes in marketing costs. If the profit margins remain relatively stable during changing retail prices, this indicates that dealers pass on consumer price changes fully to the producer. i.e. they are not in a position to use increases in demand to expand their profit margins.

Schmidt (1979) studied the maize and beans marketing system in Kenya. He analyzed the market structure in terms of market concentration, market transparency and entry conditions. In assessing efficiency, Schmidt (1979) employed a method similar to the one, which was used by Schubert (1973). He considered the costs incurred in performing the various marketing functions and then investigated whether they were necessary or not, or whether they could be reduced. He found such costs as county council cess and bribes to police to be unnecessary. Since most of the unnecessary costs arose due to the controls in the market, he recommended that the controls be done away with.

In their work, Kidane (1978) studied the pricing efficiency of the Kenya co-operative creameries (KCC) while Ngumi (1976) studied the same aspect for the Kenya meat commission (KMC). Both studies were similar in approach and they began by delineating the theoretical efficiency characteristics obtaining in a perfect market. The characteristics of price in a perfect market that they used were:

1) Prices in different geographic areas should differ by not more than the cost of transfer from one point to another.

2) Prices at one point in time should not exceed prices in a previous point in time by more than the cost of storage.

3) The price of a product should differ from the price of another product derived from the same raw product by no more than the cost of processing.

4) A system of prices that change with changes in the market forces of supply and demand.

Kidane (1978) and Ngumi (1976) examined the pricing efficiencies of both the KCC and the KMC on the basis of their conduct in relation to the above theoretical factors. Both were found to be efficient with regard to all four grounds.

The marketing costs of a firm are the expenditures it incurs in the marketing of a commodity or commodities. On the other hand, the marketing margin is the unit spread between the selling price of the commodity and the buying price of the original equivalent. In an efficient marketing system, marketing margin should not be significantly different from marketing cost (Muturi 1994).

2.3 Summary

From the review of literature as outlined in the text, it is clearly conclusive that no past research has been undertaken in Kenya with specific emphasis on the marketing systems for tsetse and trypanosomosis control inputs. Therefore the current research is pioneering in establishing the insights on how the delivery process is being undertaken by traders in this very important livestock health sector. Most of the research literature under this chapter was meant to bring into focus the fact that tsetse and trypanosomosis was a critical problem afflicting livestock farmers in Kenya. It is hoped that as more and more research takes root in this new perspective, then eventually enough research literature will be available from which inferences and critic can be drawn.

Studies on various aspects of livestock economics have been conducted in Kenya, but no specific research has been undertaken at a national level with regard to the structure and performance of tsetse and trypanosomosis control inputs and services marketing system. Since

trypanosomosis is an important parasitic disease that affects the health of livestock and people in the tsetse infested regions of the country, it is essential to undertake a research study at the national level to determine how the animal health sector is managed in Kenya.

The various players involved in this important livestock health sector including those found in both the private and public sectors will be analysed in this study and it is hoped that the results of this research will act as a policy guideline in formulating more tangible policies in the light of the livestock health problems afflicting the livestock industry at the moment.

Because trypanosomosis is a serious livestock disease, sound sectoral policies in support of animal agriculture should be formulated to provide incentives to intensify livestock production. The players currently involved in the distribution of tsetse and trypanosomosis control inputs and services have to be surveyed in order to determine how they conduct their business because it has an implication on the level of demand for both trypanocidal drugs and pour-ons.

From the literature review, it is clear that marketing costs play a leading role in determining the extend to which price margins vary. The marketing costs are the expenditures it incurs in the marketing of a commodity. The levels of marketing costs at a given performance is however independent of the internal organization of the individual business, process and factor organizations. It is therefore concluded that the an improvement in efficiency entails examining the marketing system to assess whether marketing costs can be reduced by changes in the organization of the market.

Since farmer demand for tsetse and trypanosomosis control inputs is proportionally related to the market prices for the various products found on the market, there is need to undertake an analysis of all the different levels of distribution channels in order to find out how the participation of each market argent affects the market price of each of these inputs. It is also

important to ascertain whether channel length or number of trading participants have a bearing on the final price of the livestock health products which are consumed by livestock farmers.

From the above information, the various market structures that are prevalent in the Kenyan market will be availed. Market structures are very important in interpreting the efficiency levels prevalent in any marketing environment. The ultimate goal is thus to achieve high output in livestock industry since it contributes significantly to the economic development indicators and also acts as a major source of livelihood for millions of Kenyans in arid and semi-arid regions of the country.

CHAPTER THREE

3.0 Research Methodology

The study mainly focused on the provision of agricultural inputs and services relevant for control and treatment of tsetse and trypanosomosis respectively in Kenya. The study also took into account the roles played by both the public and private sectors in determining the delivery of these services in the increasingly liberalized markets.

3.1 Economic Models for Analysing Market Structure and Performance.

3.1.1 Industrial Organization Model

The model places emphasis on the analysis of the market structure and performance using indicators like concentration ratios and absence or presence of competition in the marketing institutions. It employs theoretical tools of perfect competition and pure monopoly, which prevail in the market. The usefulness of this model stems from the fact that we are able to employ tools and methods applicable in the normal business world.

Market structure is defined as those characteristics of the organization of the market, which seem to influence strategically the nature of competition and pricing within the market (Bain, 1968). Market structure lays emphasis on the environment in which firms operate and this is normally referred to as the economic environment surrounding an industry. These characteristics which influence the nature of competition and pricing within the market include; degree of product differentiation and conditions of entry into the market. The lower the concentration ratios the more competitive we expect the market to be. High concentration ratios imply that few firms are controlling a large percentage of the market share. These ratios are computed by classifying

markets into segments and analysing their pricing structures in relation to volume of inputs transacted to ascertain profitability.

Market performance analyses the pricing efficiency. The advantages associated with the industrial organization model include:

a) The model indicates whether the number of sellers in an industry is "small" or "large". This implies that the model indicates the market share of firms in an industry.

b) The model shows whether the shares of the market are controlled by some, or all sellers are large enough so that an "oligopolistic interdependence" of their price, output and related policies in the market may be presumed to exist.

c) The model can determine the strength of "oligopolistic interdependence" by analysing the sizes of the market shares of some or all sellers.

d) The model can be used to determine the level of efficiency in the market with respect to resource use.

The study adopted the above model because the model employs theoretical tools of perfect competition and pure monopoly which can be used to determine whether marketing firms are operating competitively or whether they are showing monopolistic tendencies. This can easily be computed using the statistical ratios as already explained in the Bain (1968) industry classification model.

3.1.2 The Gross Margin Method

Gross margin is the difference between the selling price of a commodity and the price at which the same trader bought it. Net margin or profit is the gross margin less costs incurred in

trading; this quantity is the payment to the trader for his work, his capital and his risk- taking, and it may be positive or negative at any one time (Whetham, 1972).

According to Whetham (1972), it is common for traders who deal in a variety of commodities to work on different gross margins for each according to the price- elasticity of demand in the markets in which they sell, or the price-elasticity of supply in the markets in which they buy. If demand for one commodity is elastic to a rise in price, traders may absorb a small rise in their buying prices for that commodity, but recoup themselves by raising their margin on other commodities whose demand will fall less for a rise in price. Further, any large change in prices which reflects an important change in demand, or a continuing scarcity of supply, does eventually work its way through the chain of markets, as each processor and trader adjusts his pattern of buying and selling to secure the maximum gain or the maximum loss, from the new circumstances.

3.1.2.1 Role of Price in Overall Marketing Strategy

Pricing and price alone, more than any other single decision making activity is responsible for most of the profit differences among similar firms. How the product is priced will in it self determine the product mix that will be offered. The pricing action will make the product more or less attractive to the buyer, the major factor that determines the buyer response. To the extend that costs of the mix produce both profit contributions and favourable response from buyers, the volume sold will be profitable. The sales revenue, then, is a mixture of the various prices of the different products or orders, and the resultant profit is a mixture of their profit contributions.

Gross margin is not pure profit, but it represents the contribution made by a firm enterprise to overhead costs.

3.2 Data Types And Sources

Both primary data and secondary data were used in this study. Secondary data were collected from established sources which included, public libraries, department of veterinary services of the Ministry of Agriculture and Rural Development, Kenya Trypanosomosis Research Institute (KETRI), International Livestock Research Institute (ILRI) and the International Centre for Insect Physiology and Ecology (ICIPE).

Four indicators of competition or lack of it were analysed, which included; seller concentration, market transparency, barriers to entry and product differentiation. To assess seller concentration, primary data was collected and analysed to ascertain the sales shares of the first four and eight largest sellers. This gave the existence or absence of monopoly. Viewed as a structural determinant of competition, the degree of concentration is of strategic influence (Bain 1968). Also the average monthly input sales of each seller for the last 12 months were recorded during the survey. The sales data was used to calculate the sales shares of each group of sellers within the sample. This gave the profitability of the various groups of sellers.

Investigating the type of information that was available to the sellers and buyers assessed market transparency. Sellers and buyers were interviewed to provide the relevant information. Examining institutional barriers assessed the condition of entry or restrictions and the initial capital required to enter the trade.

Studying the degree to which products of one manufacturer were distinguished from those of the others assessed product differentiation. Differentiation by brand names was examined and this was used to answer the question of consumer loyalty.

A random sample of 27 retail outlets operating in three districts i.e. Busia, Transmara and Kilifi were selected for study in the survey. Because of the difference in number of traders in each district, the selection of sampling units was as follows: Busia district-12; Kilifi district-8; Transmara district-7. Similarly, a random sample of thirty livestock farmers affected by the tsetse problem was selected from the three districts (10 livestock farmers from each district). The survey also randomly selected 7 wholesale outlets that were involved in the distribution of the control inputs in the affected regions (3 from Mombasa town and 4 from Kisumu town). Finally, 14 pharmaceutical firms involved in the production and distribution of the control inputs were also selected for sampling. This brought the total number of sampling units to 78.

At each trading level/distribution channel, respondents (traders) were asked about the location and nature of their business activities, the names of the suppliers who sold the control inputs, amounts of capital that they invested in the control inputs business and whether they were involved in selling both trypanocidal drugs and insecticides/pour-on formulations. They were also asked to specifically give the brand names of the control inputs in which they dealt, the prices of the control inputs, the number of units stocked at a particular time and the average time taken for the stock to be cleared. The retailers and wholesalers were asked to indicate the sources of their stock and the distance travelled to collect the stock from the suppliers. The traders were also asked to indicate the various types of variable costs that they encountered in undertaking their business viz a viz storage, transport, communication, labour force, handling and packaging, power, maintenance and public utility costs.

Livestock farmers affected by the tsetse problem were asked to give certain information regarding the health statistics of their herds, the breeds of livestock which they kept, the types of trypanocidal drugs and pour-on formulations which they used, the prices charged for the control

inputs purchased and related services, the sources of their control inputs, the persons who administered treatment to the animals and the number of times they treated their animals against trypanosomosis.

3.3 Sampling Design

Primary data were collected from the field survey by use of a purposive random sampling technique. Sampling units were identified and selected based on the number of traders operating in different districts and the number of pharmaceutical firms operating in Nairobi. Market outlets for sellers of trypanosomosis control inputs in four main regions of the country were the focus of this study. The study of the domestic marketing system was concentrated in Nairobi city to ascertain the types of control inputs, which were produced and marketed, from where the wholesalers and the retailers obtained their supplies. Nairobi was also assumed to be the major source of most of the imports and manufactured products.

A random sample of 27 retail traders from three districts i.e. Transmara, Kilifi and Busia and thirty livestock farmers were selected from a sample frame obtained in two divisions of each of the three districts. Also a random sample of fourteen pharmaceutical firms was selected from the sample frame obtained in the city of Nairobi. The Nth name sampling technique was applied. This brought the total number of sampling units to seventy-eight.

3.4 The Study Area

The selection of the study area was based on the following factors:

1) The tsetse fly distribution map, which indicates that Busia district, Kilifi district and Transmara district are all located in tsetse, infested areas. The districts were randomly

selected through geographical mapping to identify the density of tsetse flies infestation in the different regions of the country to give a fair representation of the actual distribution of tsetse flies in the country.

2) The towns were selected on the basis of their strategic importance in their location for distribution of tsetse control inputs in the respective regions where tsetse fly infestation is prevalent. Mombasa and Kisumu were seen to be the main regional supply centres for the coastal region and the western region of the country respectfully, while Nairobi city was chosen on the basis that it was the main nerve centre for the supply of most of the tsetse control inputs in the country.

3.4.1 Nairobi City

The town of Nairobi is the centre of Kenya's industrial activity and is home to large multinational companies (e.g. Bayer Kenya, Coopers, Hoerst, Twiga and Norvatis), which manufacture a variety of pharmaceutical products including Samorin, Veriben, Novidium, Ethidium, Dimaze, Octopor, Baytical and Spoton for use in the agricultural sector. Nairobi is also home to the leading importation firms specializing in livestock inputs such as drugs and insecticides/pour-ons. Most of these pharmaceutical companies have country wide representative offices which perform the function of marketing and delivering their products to the livestock farmers. Nairobi town is also home to the leading international research institutes for vector control and livestock disease research. The most notable ones include the International Livestock Research Institute (ILRI) and the International Centre for Insect Physiology and Ecology (ICIPE).

3.4.2: Kisumu Town

The town is the regional marketing and distribution centre of Western Kenya. It is in this town that regional wholesalers of tsetse and trypanosomosis control inputs trade are located. Wholesale traders who operate from this town supply the rest of the region with these inputs either to the numerous retail traders found in the adjacent districts affected by the tsetse problem or to the local wholesalers who operate in some of the districts experiencing the tsetse problem. These regional wholesalers obtain their stock from the pharmaceutical firms in Nairobi and also double as agents of some leading multinational pharmaceutical firms in the marketing of their products. Some of these regional wholesalers e.g. Winam chemists, Humana pharmaceutical and Hoesrch operate as subsidiaries of some leading pharmaceutical firms and the national wholesalers located in Nairobi town.

Kisumu town was selected because it hosts the leading regional wholesalers who distribute their tsetse and trypanosomosis control inputs in the surrounding districts which are affected by the tsetse problem. It is from this town that other local wholesalers and retail traders come to purchase their stock. The town is thus strategically located to serve all the adjoining areas, which face tsetse fly infestations.

3.4.3: Mombasa Town

The town mainly serves the coastal region's retail and local wholesale traders respectfully. Other retail traders who are served by the Mombasa regional wholesale traders include those found in Tana River district and also those that are found in other regions of the North Eastern Province of Kenya. The regional wholesalers in Mombasa obtain most of their supplies from Nairobi where all the major pharmaceutical firms are located in the country.

Mombasa town was selected as a sample area because it hosts the leading regional wholesale traders who supply all areas affected by the tsetse problem in coast province and part of North Eastern province. It is from Mombasa that the rest of the other levels of traders come to purchase their stock of tsetse and trypanosomosis control inputs for re-sale to the livestock farmers. The three wholesale traders operating in this town include Faiz, Agro-Touch and Badar wholesalers.

3.4.4 Busia District

The district had a total population of 275,074 persons in the 1989 population census, with a projected growth rate of about 2.95 percent per annum. Population was expected to rise to 348,292 in 1997 and 369,459 in 1999. The district is bordered to the east by Kakamega District, to the north by Teso District and to the south by Siaya District and Uganda to the west. The district lies between latitudes 0^0 and $0\ 25^0$ north and longitudes $33\ ^0 54$ east and covers an area of 1262 sq. km. It has six divisions namely, Nambale (228 sq. km.), Butula (265 sq. km.), Funyula (273 sq. km.), Budalangi (312 sq. km.), Busia municipality (19 sq. km.) and Matayos (165 sq. km.).

The district practices dairy farming, sheep and goat rearing. However, in some of the parts e.g. Funyula and Budalangi divisions, tsetse fly infestation have greatly hampered the development of dairy industry. Between 1992 and 1995 as shown in table 3.4.1 below, the number of Zebu cattle increased at a reducing rate mainly because of the trypanosomosis disease which hit especially Nambale and Budalangi divisions.

Table. 3.4.1: Livestock figures between 1991-1995

	1991	1992	1993	1994	1995
Zebu cattle	174,000	180,390	182,500	185,000	186,850
Grade. Cattle	2560	3000	3350	4500	5032
Sheep	32500	34000	35680	37700	39380
Goats	45200	47000	49800	52000	54720
Donkeys	58	75	93	100	116
TOTAL	254318	264465	271423	279100	286096

Source: District Livestock Production Office, 1997.

Soils in the district are developed from various parent materials that includes intermediate and basic igneous rocks, sedimentary rocks and colluvium. Most of the districts' soils are moderately deep, generally rocky and stony consisting of well-drained red clays of low natural fertility. The district has 924,000 hectares (924 sq. km) of agricultural land but only 40,000 hectares is under crop production. The rest are fallow, bushes, swamps or bare land. Small farms in the district range from 2 hectares to 10 hectares. There are about 31,305 farms in this category. There are about 63 large farms whose size ranges from 60-220 hectares.

About 4.3 percent of the land is under crop production while about 44 percent is grazing land. Maize (10 %) has the largest acreage amongst the crops grown followed by sugarcane, 6 percent. Land under swamp is about 7 percent of the total land area while fallow and bush land is about 7 percent.

Busia district is divided into four agro-ecological zones: LM1, LM2, LM3, and LM4. LM1 covers Nambale, Butula, Matayos and Municipality Divisions. LM2 covers parts of Nambale, Butula and Township Divisions, while LM3 is found in Nambale, Budalangi and Funyula Divisions. LM4 covers parts of Funyula and Budalangi Divisions. The table (2) in Appendix II shows the agro-ecological zones by divisions.

Busia district has the potential for a number of livestock activities. These include dairy farming, poultry keeping, zebu cattle, goats and sheep rearing, bee keeping and pig rearing as indicated in table 6.3 of Appendix III.

Map No. 1 in figure 6.1 of Appendix IV a; shows the location of Busia District on the Kenyan map. The position of the district indicates that it is in a major tsetse infested region of the country. Map No. 2 in figure 6.2 of Appendix IV b; shows how Busia District is sub-divided into four major agro-ecological zones i.e. Coconut/Cassava, Coconut/Cassava/Cashewnut, Cashewnuts/Cassava and Millet zones respectively.

3.4.0 Transmara District

The district is situated in the southwestern part of the Rift Valley province and lies between latitude 0^{u} 50 and 1^{0} 50 south and longitude 34^{0} 35^{0} and 14^{0} east. It borders the Republic of Tanzania to the south, Kuria and Migori Districts to the west, Kisii, Nyamira and Bomet to the north and Narok District to the east. It has an area of 2901 sq. km. With five administrative divisions namely Pirrar (404 sq. km.), Kilgoris (445 sq. km.), Lolgorian (953 sq. km.), Keiyan (467 sq. km.), and Kirindoni (632 sq. km.).

Livestock rearing is the main economic activity and a lot of value is attached to livestock. There are large herds of cattle, sheep and goats in the district. The majority of cattle kept are of

Zebu type with few exotic types. Ranching and individual rearing are the two main types of livestock farming in the district. 65 percent of the land in the district is communally owned and used for ranching. However since the early 19th century, tsetse infestation has been rampant in this district. The table (3.4.1) shows livestock numbers over a period of five years.

Table 3.4.1: Livestock figures between 1991-1995

	1991	1992	1993	1994	1995
Dairy cattle	30,210	31,720	33,300	35,000	40,250
Beef cattle	272,100	285,700	300,000	315,000	362,250
Sheep	29,940	31,430	33,000	35,000	40,250
Goats	25,940	27,240	28,600	30,000	34,500
Donkeys	1,642	1,810	1,900	2,000	2,300
TOTAL	359,832	377,900	396,800	417,000	497,550

Source: District Livestock Production Office, 1997.

Transmara soils are diverse in both texture and structure. This diversity is attributed to its physical disposition. That is, its nature of formation. The hilly half of the district is generally characterized by eroded steep hills and deposition of alluvial soils on the valley bottom. The other half of the district and more so the leeward side slopes with low rainfall are sandy with a significant percentage of clay. These soils are found in the eastern part of the district.

The Kenya soils survey map identifies forty-three different soil types within the district. The land in the district either falls under trust land or individual land. Trust land covers about 82% the entire district. The group ranches, which are mainly found in Lolgorian, Kirindoni, Pirrar, and Keiyan Divisions, fall under the trust land category. Main economic activity in these ranches

is livestock rearing. The trust land is under-utilized because of trypanosomosis, crop destruction caused by wildlife and gross misuse caused by communal land ownership.

Individual land covers about 18% of the total land in the district. This category of land use is found along the Transmara-Kisii border, Transmara-Bomet border and also in the Osopuko, Shankoe, Poroko, Ololnchani, Oloiborsoiko, in Pirrar Division, Emarti, Murugan in Kirindoni Division. Farmers practice mixed farming, with the main cash and food crops grown. Tea is being introduced as an additional cash crop. Dairy cattle are also kept. Average land holding here is between 8 to 12 hectares.

The agro-ecological zones in the district are: the lower midland two (LM2), the upper midland four (UM4), upper midland two (UM2), upper midland one (UM1), and the lower high land one and two (LH1 and 2). The table (3) in Appendix III shows livestock production by division.

Map No. 3 in figure 6.3 of Appendix IV c; shows where Transmara district is situated on the Kenyan map. From its location, the district is in a major tsetse infested region where the incidence of trypanosomosis was reported as early as the 19th century. Records indicate that this area acted as a dispersal point for tsetse flies. Map No. 4 in figure 6.4 of Appendix IV d; indicates the major agro-ecological zones in Transmara district i.e. Coffee/tea, Tea/dairy, Maize/Pyrethrum, Coffee/Maize, Marginal sugarcane, Wheat/Maize/Pyrethrum, Wheat/Maize/Berley, Sunflower/Maize, Livestock/Sorghum and Livestock/Sorghum/Ranching zones respectively.

3.5.0 Kilifi District

The district is in coast province and lies between latitude 2^{0} $20^{//}$ and 4^{0} south, and between longitude 39^{0} and $40^{0}14^{/}$ east. It borders Taita Taveta District to the West, Tana River District to

the North and Northwest, Mombasa District and Kwale District to the south. The district has five divisions and covers a total area of 12,483 sq. km. The administrative divisions include Kaloleni (914 sq. km.), Bahari (827 sq. km.), Malindi (5259 sq. km.), Magarini (729 sq. km.), Marafa (1617 sq. km.) and Ganze (3137 sq. km.).

The main types of livestock found in this district are Zebu cattle, which are tolerant to the conditions of these marginal zones. Exotic cattle and cross breed are also found in the high and medium potential areas of the district. Livestock is mainly kept in ranches. The prevalence of trypanosomosis is high in this area. Table 3.5.1 below shows the trend in livestock numbers over a period of five years.

Table 3.5.1: Livestock numbers between 1991-1995

	1991	1992	1993	1994	1995
Beef cattle	219,579	203,815	171,850	177,780	188,380
Dairy cattle	15,869	16,258	16,890	13,326	35,000
Goats	191,711	173,078	201,130	169,995	158,052
Sheep	32,892	32,826	22,900	56,089	62,718
Donkeys	620	634	660	682	713
TOTAL	460,051	426,611	413,430	417,872	444,863

Source: District Livestock Office, Kilifi Annual Reports 1991-1995

The district can be categorized into four major agro-ecological zones, which are closely correlated to the land-use pattern and have great influence on the land potential. These are the: livestock/millet zone, low land ranching zone, coconut/cassava zone and cahewnut/cassava zone. In the district, 1,040 sq. km. Of land can be categorized as high potential, medium and low

potential land covers 2,470 sq. km. and 8,510 sq. km respectively. Over 90% of the population of the district depend on agriculture for their living. There are about 100,000 smallholdings in the district covering a total area of 7,115 sq. km or 59% of the district.

Only about 2,335 sq. km or 18.6% of the district is suitable for arable farming. Out of the total arable land, only a small proportion is actually put under cultivation with the small-scale farmer cultivating no more than two hectares on annual crops. The remainder of the land is put under tree crops, pasture for small stock or left fallow.

In the rangelands, the farmers practice farming activities with greater reliance on small stock. There exists extensive grazing under traditional pastoralism. Mixed head of goats, sheep and cattle are pre-dominant and exceed the carrying capacity in these areas. The several soil types in the district differ widely in depth, texture, physical and chemical properties enabling different economic activities to be practiced in the district.

Map No 5 in figure 6.5 of Appendix IV f; shows the position of Kilifi District on the Kenyan map. The location of the district in this region puts it in the infestation zone of tsetse fly menace. Map No. 6 in figure 6.6 of Appendix IV g; indicates the type of agro-ecological zones found in Busia district i.e. Cotton, marginal Sugarcane, Sugarcane, and marginal Cotton zones respectively.

3.6 The Models To Use

3.6.1 Market Structure

The Bain industry classification on the basis of sales shares of the first 4 and 4 largest firms was used to analyse seller concentration. This was formulated as shown in table 3.6.1 below:

Table 3.6.1: The Bain (1968) industry classification model on the basis of the first four and eight largest firms

Type	% share of the 4 largest firms	% share of the 8 largest firms	No of sellers	Description
I	> 90	> 90	Very few	Oligopoly
II	65 - 75	85 - 90	Few	Highly concentrated
III	50 - 65	70 - 85	< 100	High - Moderate concentration
IV	35 - 50	45 - 70	large	Low - Moderate concentration
V	< 35	< 45	Very large	Moderate concentration with large competitive fringe
VI	Very small	Very small each controlling <1%		Atomistic industry

Source: Bain (1968).

3.6.2 Market Performance

Market performance was analysed by comparing marketing costs and marketing margins and by evaluating the traders' gross margins in relation to the consumer price of tsetse and trypanosomosis control inputs and the opportunity costs of entrepreneurial input.

The total variable costs, TVC, of marketing these inputs and services for each pharmaceutical firm, wholesaler and retailer was derived as;

$$TVC_{ij} = \sum_{i=1}^{n} a_i \quad \ldots\ldots (3.1)$$

$$TVC_W = \sum_{i=1}^{n} a_i \quad \text{.....(3.2)}$$

$$TVC_R = \sum_{i=1}^{n} a_i \quad \text{.....(3.3)}$$

*Where by:

a_1= storage costs

a_2= Handling and packaging costs

a_3 = electricity costs

a_4 = Local transport costs

a_5= Cost(value) of drug loss

a_6= water costs

a_7= Telephone costs

a_8= E-mail costs

a_9= Faxing costs

a_{10}= Vehicle maintenance costs

a_{11}= Cost of maintaining casuals

a_{12}= Contributions made in public functions

a_{13} = Other variable costs

* All costs in Kshs per period of twelve months (Year-1999)

The Marketing margins, MM_T, for the trypanosomosis inputs sold by each of the traders were derived as;

MM_T = selling price (dosage per cow) - buying price (dosage per cow)..... (3.4)

The resultant marketing margin for each individual trader was derived as;

$MMT_p = SP_p - BP_p$..... (3.5)

$MMT_W = SP_W - BP_W$..... (3.6)

$MMT_R = SP_R - BP_R$.....(3.7)

Where by:

MMT_p = Marketing margin for the pharmaceutical firm

MMT_W = Marketing margin for the wholesale trader

MMT_R = Marketing margin for the retail trader

S_P = Selling price in per dosage per animal

B_P = Buying price in Kshs per dosage per animal

This was used in calculating a traders' gross margin, GMT*, as follows:

$GMT_p = MMT\_TVC_p$ ..... (3.8)

$GMT_W = MMT - TVC_W$ ..... (3.9)

$GMT_R = MMT - TVC_R$ ..... (3.10)

Where:

GMT_M = Gross margin for the pharmaceutical firm

GMT_W = Gross margin for wholesale trader

GMT_R = Gross margin for retail trader

To determine the gross margin for pharmaceutical firms, wholesale traders and the retail traders of these control inputs and services, the traders were put into separate groups depending on the quantity of control inputs they sold in the livestock market. For each group, the gross margin was the average of the group members' gross margins. The gross margins for the different group of traders were then separately expressed as a ratio of the opportunity cost of capital. They were also compared to the opportunity cost of the traders' entrepreneurship, defined as the minimum income that a trader is required to shift from the tsetse and trypanosomosis control inputs trade. This was calculated from the answers given by the traders in the questionnaire.

NOTE

*In general economics and farm management, Gross margin(GM)=Total Revenue(TR)-Total Variable Costs(TVC).If this definition is applied in the tsetse and trypanosomosis control inputs and services market, then,

GM=(value of sales) - (cost of marketing + value of purchases)

=(Unit selling price * quantity) - (unit buying price * quantity)

-(Unit variable marketing costs * quantity)

For a dosage of tsetse and trypanosomosis control inputs, therefore,

GM= (marketing margin - variable marketing costs)

3.7 Conclusion

In conducting the survey, several potential problems were encountered. However, an effort was made to remedy most of these problems in an effort to limit the significance of error manifestation in all the variables, which were under study.

Due to a minimal budget allocation, the money resource constraint led to the reduction of sampling units and the study area. The study period was also lowered to suit the available budget. However the researcher managed to work within the limited resources and time allocated for the study by exercising stringent budgetary controls.

Some wholesale 3.7 %) and retail traders (1.6 %) gave scanty and unclear data, which could not be verified due to their unwillingness to fully cooperate with some of the enumerators. These traders did not want to part with information regarding their pricing decisions. However since the majority of the respondents gave clear and reliable information willingly, the error term in the collected data was assumed to be insignificant.

Although tsetse covers a wide region in Kenya, the study was concentrated in major areas of the country where infestation by the fly is highly manifested. The selected towns are also known to be the main regional centres where traders involved in the marketing of the tsetse and trypanosomosis control inputs are located. It was therefore assumed that the selected regions and towns would give a fair representation of the overall situation in the country.

Farmers in some areas that were surveyed demanded to be paid a token in order to give information about their livestock farming activities. This behaviour was considered negative because it could curtail future research effort which is geared towards alleviating poverty and promoting development activities in the agricultural sector through dissemination of adoptable research findings which livestock farmers can apply. It took quite a great deal of time and reason

to convince these farmers that the research that was being conducted would benefit them by positively being reflected in the government policy towards livestock production under disease risk. The farmers were informed that in the long run, the government and its development partners would utilize the information acquired from them to formulate viable policies towards a risk free livestock production environment.

Most farmers (53.7 percent) and a few traders (16.5percent) did not keep clear records about their farming and trading activities respectively. Thus was problematic when the enumerators demanded specific written data variables. However, this problem was solved by asking farmers to accurately remember situations, events and periods, which affected their livestock production activities within the past calendar year (1999).

CHAPTER FOUR

4.0 Data Analysis, Results and Discussion

This chapter presents the results of data analysis as well as the discussion. The chapter begins with a presentation and discussion of the marketing structure of the tsetse and trypanosomosis control inputs in Kenya. Secondly the role of the private sector and public service in delivery of tsetse and trypanosomosis control services in Kenya is discussed with emphasis on particular roles of each sector. Lastly, attention will be focused on the performance of the various groups of traders involved in the marketing of these control inputs to ascertain efficiency.

Performance will be determined by the trader gross margins obtained in various trading circumstances. The Bain (1968) industry classification model will be instrumental in interpreting the results of the gross margin analysis over the period running from January 1999 to December 1999.

4.1 Description of the Movement Patterns of Tsetse and Trypanosomosis Control Inputs in Kenya

In this section, we present the major tsetse and trypanosomosis control inputs marketing channels that exist in Kenya and the major contribution by the various groups of traders to the respective channel levels. The outcome is summarized in figure 4.1. Which is a simplification of the actual situation. However, the figure serves to outline areas of importance in the linkage between producers of tsetse and trypanosomosis control inputs and the ultimate consumers of these control inputs.

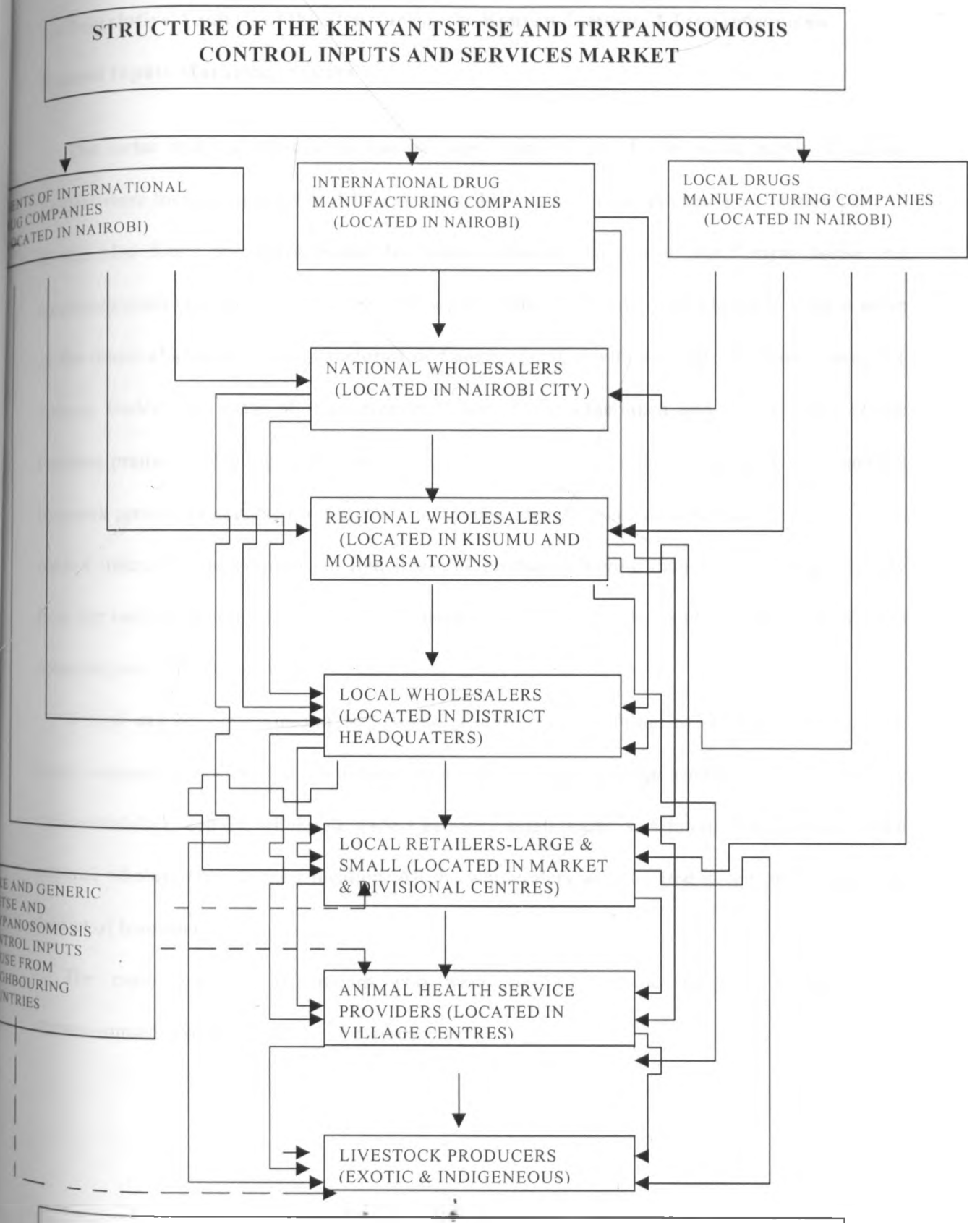


Figure 4.1: Movement patterns of tsetse and trypanosomosis control inputs in Kenya

4.2 Descriptive Analysis of the Structure of the Kenyan Tsetse and Trypanosomosis Control Inputs Marketing System

The tsetse and trypanosomosis control inputs market was found to be highly dynamic. Traders were found to interact at different channel levels with trade-ins being a common pattern. It was also found that three major distribution channels existed in the Kenyan tsetse and trypanosomosis control inputs market (with a provision of a fourth minor channel). Within some of the major channels, several categories of traders operated with a major distinction being the volume traded, the scale of marketing operation being undertaken and the location of the business premises. One very noticeable feature of this market was the dynamism with which the livestock producers managed to purchase and obtain their supplies of tsetse and trypanosomosis control inputs. It was common to find livestock producers buying their input supplies directly from the national wholesalers, regional wholesalers, local wholesalers and the local retailers thus obtaining very diverse prices.

A high market concentration of national wholesalers was found to exist in Nairobi. This factor subsequently resulted to a very competitive marketing environment in which price differentials between the wholesale traders had very small margins. A major characteristic of the national wholesalers was their location. All the wholesalers were located in the central business district of Nairobi city.

The major category of traders who were involved in the business of tsetse and trypanosomosis control inputs were classified as:

4.2.1 Pharmaceutical Firms

The names of pharmaceutical firms which were surveyed can be seen in Table 4.2.1 below while the initial capital investment for pharmaceutical firms can be seen in Table 6.3 of Appendix III while Table 6.4 in Appendix IV contains the list of the most common control inputs supplied by this firms to other business enterprises.

Table 4.2.1: List of pharmaceutical firms and wholesale traders interviewed during the sample survey

PHARMACEUTICAL FIRMS	WHOLESALE TRADERS
Norvatis Pharmaceutical Ltd	Winam Chemists (Kisumu)
Sanofi Pharmaceutical Company Ltd	Hoersch Pharmaceuticals (Kisumu)
Highchen/Hoersch Pharmaceutical Ltd	Humana Pharmaceuticals (Kisumu)
Lesukut Pharmaceutical Ltd	Health Care (Coopers Bus.Partner)
Twiga Chemical Industries Ltd	(Kisumu)
Bayer Kenya Ltd	Faiz Pharmaceuticals (Mombasa)
Cooper Pharmaceuticals Ltd	Agro-Touch Pharmaceuticals
Mimea Mifugo Kenya Ltd	(Mombasa)
Nairobi Veterinary Centre	Badar Chemists (Mombasa)
Medipharm East African Pharmaceutical Ltd	
Jumbo Agrovet Pharmaceuticals Ltd	
Sigma Pharmaceuticals Ltd	
Licorne Pharmaceuticals Ltd	
Monks Medicare East Africa Ltd	

Table 4.2.2 : An analysis of the capital investments in tsetse and trypanosomosis control inputs trade per location of interview.

District of Interview	All Units in Kshs	N	Minimum	Maximum	Mean	Std. Deviation
Kilifi	Initial investment	8	70,000.00	300,000.00	18,6250.00	69,475.07
Busia	Initial investment	12	5,000.00	150,000.00	48,666.66	43,113.66
Trans Mara	Initial investment	7	15,000.00	500,000.00	12,3571.42	171,189.81
Mombasa	Initial investment	3	1,000,000.00	2,500,000.00	1,666,666.66	763,762.61
Kisumu	Initial investment	4	1,000,000.00	5,000,000.00	3,125,000.00	1,652,018.96
Nairobi	Initial investment	14	.00	15,000,000.00	5,428,571.42	4,376,586.05

4.2.1.1 Agents of International Drug/Pour-On Companies

These were the local agents selling on behalf of and or being the sole distribution agents of particular tsetse and trypanosomosis control inputs. A major characteristic of these companies was that they held the sole responsibility of distributing a particular product brand. Any other trader who was interested in selling that brand was required to contact the local agent and not the overseas company, which was involved in manufacturing the particular brand. Local agents of international drugs/pour-ons were found to have mostly medium sized offices, clearing agents at the airport and a large warehouse to store the control inputs brought into the country. Also, these agents mainly hired local distribution agents who were paid a commission, calculated as a

percentage of total sales volume. The local distribution agents had a wide network of distribution centres countrywide.

4.2.1.2 International Drug/Pour-On Companies

These were found to be established under a foreign direct investment venture. These firms held a license to utilize the mother company's trademark in manufacturing and distributing the tsetse and trypanosomosis control inputs. The international drug/pour-ons companies mainly traded in the brand names, which the mother companies specialized in producing e.g Bayer East Africa Ltd, Coopers Ltd and Novartis East African Ltd. These companies were found to have established a very elaborate marketing and distribution system which involved both farmer and trader education on the use of their products. The marketing campaign included weekly product exhibitions in different parts of the country, trader seminars, farmers' days, very competitive pricing systems and a very flexible trader credit scheme. Most of these companies usually had manufacturing units in Nairobi and also they had several sales and marketing offices located in the city centre and branch offices in regional centres in the country.

4.2.1.3 Local Drug Companies

A very major characteristic of these companies is that they were mostly established from the 1980's e.g Mimea Mifugo Ltd and Twiga Chemicals Ltd. These companies operate at a lower capacity than any other companies under the same category. The companies were found to produce a variety of the tsetse and trypanosomosis control inputs prevalent in the market today. The distribution system used by these companies was very much similar to that used by the other two categories in the system.

4.2.2 Wholesale Traders

The list of the seven wholesale traders who were surveyed is found in Table 4.2.2.1 while the amount of initial capital investment put into this business is found in Table 4.2.2.2 while Table 6.4 of Appendix IV contains the list of control inputs which wholesale traders transact in their business.

Table 4.2.2.1 : List of pharmaceutical firms and wholesale traders interviewed during the sample survey

PHARMACEUTICAL FIRMS	WHOLESALE TRADERS
Norvatis Pharmaceutical Ltd	Winam Chemists (Kisumu)
Sanofi Pharmaceutical Company Ltd	Hoersch Pharmaceuticals (Kisumu)
Highchen/Hoersch Pharmaceutical Ltd	Humana Pharmaceuticals (Kisumu)
Lesukut Pharmaceutical Ltd	Health Care (Coopers Bus.Partner)
Twiga Chemical Industries Ltd	(Kisumu)
Bayer Kenya Ltd	Faiz Pharmaceuticals (Mombasa)
Cooper Pharmaceuticals Ltd	Agro-Touch Pharmaceuticals
Mimea Mifugo Kenya Ltd	(Mombasa)
Nairobi Veterinary Centre	Badar Chemists (Mombasa)
Medipharm East African Pharmaceutical Ltd	
Jumbo Agrovet Pharmaceuticals Ltd	
Sigma Pharmaceuticals Ltd	
Licorne Pharmaceuticals Ltd	
Monks Medicare East Africa Ltd	

Table 4.2.2.2 : An analysis of the capital Investments in tsetse and trypanosomosis control inputs trade per district.

District of Interview	All Units in Kshs	N	Minimum	Maximum	Mean	Std. Deviation
Kilifi	Initial investment	8	70,000.00	300,000.00	186,250.00	694,75.07
Busia	Initial investment	12	5,000.00	150,000.00	48,666.66	43,113.66
Trans Mara	Initial investment	7	15,000.00	500,000.00	123,571.42	171,189.81
Mombasa	Initial investment	3	1,000,000.00	2,500,000.00	1,666,666.66	763,762.61
Kisumu	Initial investment	4	1,000,000.00	5,000,000.00	3,125,000.00	1,652,018.96
Nairobi	Initial investment	14	.00	15,000,000.00	5,428,571.42	4,376,586.05

4.2.2.1 National Wholesalers

These traders are called national wholesalers because they transact their business on a very large scale and were mainly located in Nairobi from where other traders from the same channel level or a lower level came to purchase their stock from all over the country. The wholesale price charged by these traders was found to be almost similar to that charged by pharmaceutical companies who occupy the top level in the distribution channel. The reason given was that competition between the wholesalers and the pharmaceutical firms was high due to their similar location in Nairobi and their nature and volume of transactions with the other traders lower in the channels. A very typical characteristic of these traders is the fact that they offer both

wholesale and retail services and even some of them sell directly to the livestock farmers. The price charged by wholesale traders, retail traders and livestock farmers was determined the traders themselves but also affected by the volume of control inputs purchased at the time of transaction.

4.2.2.2 Regional Wholesalers

These traders were found to operate from strategic market locations from where they served a whole region that was affected by the tsetse problem. A good example are the four wholesalers found in Kisumu town (Winam chemists, Hoersch, Health care and Humana pharmaceuticals) who serve the whole of western Kenya region including Nyanza, Western and Rift Valley provinces. Regional wholesalers purchase their trading stock from the upper level of the distribution channel i.e. the pharmaceutical firms. Some regional wholesalers were also found to have formed trading alliances with some leading multinational firms e.g. the partnership between Healthcare Ltd. and Coopers who operate a joint business in Kisumu town. The alliance involves the wholesalers undertaking to be the exclusive distributors of a pharmaceutical firm's product/s in a particular region. Regional wholesalers mainly served the numerous retail traders and animal health service providers who were distributed all over the districts affected by the tsetse problem. They also sold their inputs directly to the livestock farmers. The prices charged by these traders had a significant different from that charged by national wholesalers and pharmaceutical firms. The reason being that these traders enjoyed oligopolistic competition due to their small number and they therefore made independent pricing decisions with a high proportion of net margin. Another feature of these traders was that they were found to be highly concentrated in the areas from which they operated. These traders were also found to have

diversified their business activities by engaging in both veterinary and human medicine plus other agricultural inputs. Examples include fertilizer, animal feeds and agricultural implements.

4.2.2.3 Local Wholesalers

These traders were found to be highly concentrated in the markets from which they operated in the sense that they were sparsely located. An example was in Kilifi where only one local wholesale trader operated in the whole district. The price margins between these traders and those of retailers were found to have a marginal variance. These traders were also found to be exercising some form of discriminative pricing where by, they offered different prices to different retail traders, animal health service providers and livestock farmers who purchased the same volume of control inputs. The traders in this category obtained their stock from the national wholesalers and the pharmaceutical firms. The main customers of these traders were local retailers, animal health service providers and the livestock farmers.

4.2.3 Local Retailers

These were found to have a high to moderate market concentration in the districts from which they operated. The traders were considerably many i.e. monopolistic competition. The price charged by these traders was found to be significantly different from that charged by the wholesalers and pharmaceutical firms. The reason given was that each individual retailer tried to maximize net margins by charging a high price and also the costs involved in marketing at this level were comparatively higher per unit of control input as when compared to the other trading levels. These traders stocked the largest variety of tsetse and trypanosomosis control inputs in small units from the entire major suppliers and manufacturers. Retailers were mainly concentrated in divisional administrative centres, district headquarters and the local market

centres where they had numerous stockist stalls offering a variety of human and veterinary medicine and other general agricultural inputs. The main customers of these traders were found to be livestock farmers and the animal health service providers. The local retailers purchased small volumes of stock on a weekly basis and replenished it depending on the seasonal demand variations. Livestock producers have mentioned "retail traders" as being behind the cross border sale of fake and sub-standard livestock drugs in the market by taking advantage of their remote location in district market centres and also using the livestock farmer ignorance in introducing these harmful products. For example in Kilifi and Busia districts, livestock farmers forwarded such fake products to the Kenya Trypanosomosis Research Institute's survey team for analysis in the period between 1999-2000. the test results proved positive indicative of the fact that fake products had less than adequate chemical ingredients to cause complete prophylaxis in infected livestock.

4.2.4 Animal Health Service Providers

These were found to be quasi traders in the sense that they doubled as private veterinary traders and consultants on one hand and public veterinary officers offering extension services on the other hand. Although minor in the marketing channels, these traders were found to be the immediate link between livestock farmers and the other middlemen in the distribution process. They were oftenly mobile with no fixed trading premises and usually traded in the control inputs by responding directly to particular disease cases and farmer needs. The most unique characteristic of these traders was that they combined both the price of the service and the price of drugs to give a single price blanket. As one veterinary officer put it, " perhaps the greatest cost to livestock farmers is the cost of acquiring market information on drug brands,

prices and quality". This sediment was expressed to describe the nature of animal health service providers who were adversely mentioned with regard to being non committal in availing marketing information so as to exploit livestock farmers either by selling to them fake drugs or charging high prices for services rendered. Although the majority of animal health service providers were qualified veterinary doctors, a small number also consisted of animal health technicians who operated mobile businesses deep in the village centres.

These traders were uniquely placed in the sense that they acted as a bridge between the private sector and the public sector. While undertaking the normal public sector role of extension service routines to livestock farmers, they also offered private service of delivery of drugs and treatment of livestock at the highest possible price in the marketing channel. The traders in this category purchased their supplies from regional and local wholesalers and also from the retailers depending on the proximity of the traders in question. The traders in this category were adversely mentioned by farmers as being the culprits behind the cross border trading in fake and sub-standard drugs. An example was at the border point between Kenya and Uganda in Busia town where there was a visible existence of a smuggling ring of livestock health products into Kenya. Some of the people who were arrested with these fake products later confessed that they had been contacted by animal health service providers for continuous supply. In Kilifi district in Baharini division, livestock farmers also gave accounts of fake livestock health products which were being smuggled in through fishing canoes that ply between Kenya-Tanzania and Zanzibar. These fishermen brought with them smuggled drugs from the neighbouring country and sold them at very low prices to local animal health service providers. Most of the farmers who mainly depended on these traders complained of high service and drug prices.

4.2.5 Livestock Farmers

These were the end users of most of the control inputs sold on the market. Two category of this group were found to exist i.e. zero grazers and the indigenous livestock farmers.

a) **Zero grazers**

Were found to have the most knowledge about the prevalence of tsetse and trypanosomosis problem. The farmers in this category kept pure exotic breeds and also cross breeds mainly for milk production. These farmers were unique in the sense that they understood the science of disease occurrence and drug administration and as a result they undertook to treat their animals by themselves and did not seek the services of the animal health service providers. These farmers also had perfect information on current market trends in prices, new product brands, drug quality and prevention methods. They also undertook to purchase their supply of control inputs from national wholesalers, regional wholesalers and local wholesalers. They also did some minimal purchases from local retailers and animal health service providers. These farmers took time to study information about drug flows and thus they were least affected by the problem of fake and substandard products entering the market. It is worth noting that farmers in this category did not depend on the unreliable and unavailable extension services but took upon themselves to seek all information regarding the control inputs. The farmers in this category mainly concentrated on purchasing preventive inputs since their animals spend most of the time in sheds and clean confinements where tsetse flies rarely visited. In terms of cost saving, farmers in this category benefited because there was minimal tsetse attack incidences.

b) **Indigenous livestock farmers**

These are considered as the most vulnerable and most uninformed group of farmers who bore the full brunt of the incidence of tsetse and trypanosomosis prevalence and the costs that go with them. The livestock kept by this traders faced very high infection risks since they roamed the country side for pasture and went down the river where tsetse fly hide, for watering. This group of farmers heavily relied on the local retailers and the animal health service providers for purchase of control inputs and treatment respectively. This group of farmers was found to be paying the highest prices for tsetse and trypanosomosis control inputs and the services that go with them. This category of farmers was considered as being high risk in the use of fake and generic products, which have flooded the local market from neighbouring countries. The farmers were mainly concerned with the prices charged and not the quality of the drugs offered. Farmers in this group did not have clear knowledge about the existence of the other marketing and distribution channels and thus they paid the highest price charged for the tsetse and trypanosomosis control inputs. Due to their ignorance this group of farmers was found not to make judgement between veterinary doctors, animal health service providers and the retailers, and seldom they did not have adequate information on diagnosis, disease prevalence and the drug brands available in the market.

4.3 Analysis of Market Structure

There were 27 retail traders, 7 wholesale traders and 14 pharmaceutical firms who were sampled during the survey. An analysis was done for each level of traders to determine market shares controlled by the first 4 and 8 largest traders in each trading category. Table 4.3.1 shows the mean gross margin analysis per district of interview for each group of traders, while Table 4.3.2 in shows the mean variable marketing costs for each group of traders interviewed.

Table 4.3.1: Analysis of gross margins per location of interview for tsetse and trypanosomosis control inputs traders

Descriptive Statistics (All Units In Kshs)

District of Interview		N	Minimum	Maximum	Mean	Std. Deviation
Kilifi	TOTALREV	8	23,400.00	124,250.00	71,238.75	33,670.14
	VARCOST	8	14,250.00	66,970.00	42,560.63	19,940.94
	GROSSMAR	8	9,150.00	57,280.00	28,678.13	16,193.04
Busia	TOTALREV	12	51,780.00	6,549,700.00	719,734.16	1,839,624.09
	VARCOST	12	6,300.00	35,400.00	21,630.83	7,211.80
	GROSSMAR	12	34,368.00	6,526,215.00	698,103.33	1,839,034.55
Trans Mara	TOTALREV	7	65,250.00	741,000.00	308,328.57	279,250.25
	VARCOST	7	6,900.00	73,240.00	32,721.57	21,880.28
	GROSSMAR	7	31,760.00	734,100.00	275,607.00	292,296.92
Mombasa	TOTALREV	3	725,000.00	9,790,000.00	5,535,500.00	4,558,004.85
	VARCOST	3	132,150.00	209,400.00	159,916.66	42,960.45
	GROSSMAR	3	586,800.00	9,657,850.00	5,375,583.33	4,556,688.09
Kisumu	TOTALREV	4	950,000.00	6,640,000.00	3,818,625.00	2,451,180.17
	VARCOST	4	133,380.00	563,750.00	299,820.00	204,369.99
	GROSSMAR	4	816,620.00	6,281,250.00	3,518,805.00	2,426,439.05
Nairobi	TOTALREV	14	6,000,000.00	405,000,000.00	111,664,642.85	105,473,792.94
	VARCOST	14	189,000.00	1,156,875.00	707,540.00	353,410.14
	GROSSMAR	14	5,467,100.00	404,126,075.00	110,957,102.85	105,369,607.69

The results of analysis for gross margin values for the different traders as indicated in table 4.3.1 show a significant variation in individual margins. For the retail traders, Busia district registered the highest mean gross margin value of Kshs 698,103.3 followed by Transmara district with a value of Kshs 275,607 while Kilifi district had a value of Kshs 28,678. These values are correspondingly inverse to the mean variable costs for each trader.

The wholesale traders in Mombasa registered a mean gross margin of Kshs 5,375,583.3 while in Kisumu the value was Kshs 3,518,805. it therefore implies that the wholesale traders in Kisumu who were more than those at Mombasa competed amongst themselves greater than their counterparts at Mombasa who enjoyed oligopolistic competition.

The gross margins for the pharmaceutical firms were significantly high in the tune of Kshs 110,957,102.8. The reason given for this figure was that these firms were operating at a greater capacity than either of the other traders in the marketing channel and they therefore produced at scale economies. However, this gross margin would be reduced significantly when the fixed operating costs had been deducted to obtain net operating margin.

Table 4.3.2: Analysis of variable marketing costs for the traders in individual locations of interview

ation of interview	All Costs In Kshs per annum	N	Minimum	Maximum	Mean	Std. Deviation
	Other variable costs	8	1,500.00	9,000.00	4,818.75	2,331.14
	Contributions made in public functions	8	1,000.00	11,375.00	4,009.37	3,259.16
	The cost of maintaining casuals	8	.00	.00	.00	.00
	Vehicle maintenance costs	8	.00	14,000.00	4,843.75	6,031.07
	Fax costs	8	.00	.00	.00	.00
	E-mail costs	8	.00	.00	.00	.00
	Telephone costs	8	.00	35,520.00	8,515.00	11,392.53
	Water costs	8	.00	4,620.00	2,517.50	1,559.91
	Electricity costs	8	.00	8,400.00	4,002.50	2,884.15
	Handling and packaging costs	8	.00	.00	.00	.00
	The drug losses	8	500.00	7,000.00	3,433.75	2,319.67
	The local transport costs	8	1,160.00	27,000.00	10,420.00	8,145.84
Busia	Other variable costs	12	900.00	5,400.00	2,362.92	1,271.17
	Contributions made in public functions	12	750.00	5,250.00	1,851.67	1,327.96
	The cost of maintaining casuals	12	.00	.00	.00	.00
	Vehicle maintenance costs	12	.00	9,000.00	1,791.67	3,353.82
	Fax costs	12	.00	.00	.0000	.00
	E-mail costs	12	.00	.00	.0000	.00
	Telephone costs	12	.00	10,800.00	5,108.33	2,879.88
	Water costs	12	.00	1,800.00	678.00	708.81
	Electricity costs	12	.00	12,600.00	3,640.67	3,168.96
	Handling and packaging costs	12	.00	3,150.00	787.50	1,215.45
	The drug losses	12	330.00	6,300.00	2,592.08	1,614.50
	The local transport costs	12	980.00	10,000.00	2,818.00	2,571.87
Trans Mara	Other variable costs	7	900.00	3,960.00	2,701.43	1,049.61
	Contributions made in public functions	7	.00	4,455.00	1,622.14	2,052.54
	The cost of maintaining casuals	7	.00	.00	.00	.00
	Vehicle maintenance costs	7	.00	9,900.00	3,077.14	4,072.31
	Fax costs	7	.00	.00	.00	.00
	E-mail costs	7	.00	.00	.00	.00
	Telephone costs	7	.00	7,128.00	2,932.57	3,143.47
	Water costs	7	.00	840.00	204.86	356.99
	Electricity costs	7	.00	3,564.00	1,294.86	1,668.12
	Handling and packaging costs	7	.00	.00	.00	.00
	The drug losses	7	1,500.00	30,000.00	9,288.57	9,684.27
	The local transport costs	7	4,500.00	23,000.00	11,600.00	6,737.21
Mombasa	Other variable costs	3	3,750.00	9,000.00	6,250.00	2,633.91
	Contributions made in public functions	3	3,000.00	6,000.00	4,666.67	1,527.53
	The cost of maintaining casuals	3	.00	.00	.00	.00
	Vehicle maintenance costs	3	10,000.00	30,000.00	23,333.33	11,547.01
	Fax costs	3	9,900.00	14,400.00	12,100.00	2,251.67
	E-mail costs	3	.00	.00	.00	.00

	Telephone costs	3	12,600.00	19,200.00	16,600.00	3,515.68
	Water costs	3	3,600.00	4,800.00	4,300.00	624.50
	Electricity costs	3	5,400.00	9,600.00	7,000.00	2,271.56
	Handling and packaging costs	3	4,000.00	10,500.00	8,166.67	3,617.09
	The drug losses	3	22,500.00	50,000.00	34,166.67	14,215.60
	The local transport costs	3	30,000.00	60,000.00	43,333.33	15,275.25
	Other variable costs	4	5,000.00	7,500.00	6,375.00	1,108.68
	Contributions made in public functions	4	4,500.00	10,000.00	7,187.50	2,357.39
	The cost of maintaining casuals	4	.00	18,750.00	9,312.50	8,101.89
	Vehicle maintenance costs	4	10,000.00	70,000.00	38,562.50	25,379.10
	Fax costs	4	2,700.00	30,000.00	15,675.00	13,372.45
	E-mail costs	4	.00	.00	.00	.00
	Telephone costs	4	9,000.00	48,000.00	28,500.00	17,058.72
	Water costs	4	1,440.00	7,500.00	4185.00	2,601.71
	Electricity costs	4	3,240.00	45,000.00	17,460.00	18,728.33
	Handling and packaging costs	4	3,000.00	25,000.00	10,,875.00	10,427.33
	The drug losses	4	5,000.00	175,000.00	87,500.00	76,757.19
	The local transport costs	4	23,250.00	162,500.00	74,187.50	62,856.11
	Other variable costs	14	10,000.00	105,000.00	37,428.57	30,505.89
	Contributions made in public functions	14	.00	9,000.00	2,757.14	3,558.67
	The cost of maintaining casuals	14	.00	45,000.00	21,044.64	15,173.64
	Vehicle maintenance costs	14	20,000.00	135,000.00	60,644.64	33,824.66
	Fax costs per annum	14	18,000.00	162,000.00	74,828.57	50,423.85
	E-mail costs per annum	14	.00	42,000.00	7,705.71	10,401.48
	Telephone costs per annum	14	30,000.00	37,5000.00	167,100.00	117,968.12
	Water costs per annum	14	3,600.00	75,000.00	25,714.28	21,869.60
	Electricity costs per annum	14	7,200.00	420,000.00	11,477.14	123,090.53
	Handling and packaging costs	14	.00	350,000.00	68,928.57	84,584.47
	The drug losses per annum	14	10,000.00	13,5000.00	46,892.85	37,402.27

4.3.1 Retail Trader Analysis

Degree of seller concentration

Table 4.3.4 shows the gross margin results for the 27 retail traders analysed in descending order. The market share controlled by the first 4 and 8 largest traders was found to be very high. Table 4.3.3 shows the sales share of the first 4 and 8 largest traders.

Table 4.3.3: Market share of the first 4 and 8 largest retail traders

Type	% share of the 4 Largest firms	% share of the 8 largest firms	No. of sellers	Description
III	52.0	75.0	27	High –Moderate concentration

Results of the analysis show that the first 4 largest retail traders handled 52.0 percent of the transactions while the 8 largest traders handled 75.0 percent of the transactions. These results therefore fall under the "High-Moderate concentration" description of the market, implying that the tsetse and trypanosomosis inputs market is monopsonistic in nature. From the gross margins figures in Table 4.3.4, it was evident that the largest retailer controlled 15.6 percent, which is a substantial share of the total market of these control inputs.

Table 4.3.4: Gross margins for retail traders in descending order

[a]RANK	[b]LOC.OF BUSINESS	[c]GROSS MARGIN/KSHS	[d]*CUM. GM	[e]*CUM. % OF GM	[f]%* SHARE OF TRADER= c/g*100
1	TRANSMARA	734,100	734,100	15.6	15.58
2	BUSIA	698,103	1,432,203	30.4	14.81
3	TRANSMARA	554,000	1,986,203	42.1	11.76
4	BUSIA	464,825	2,451,028	52.0	9.86
5	TRANSMARA	431,200	2,882,228	61.2	9.15
6	BUSIA	270,740	3,152,968	66.9	5.74
7	BUSIA	196,700	3,349,668	71.1	4.17
8	BUSIA	185,780	3,535,448	75.0	3.94
9	BUSIA	181,470	3,716,918	78.9	3.85
10	BUSIA	176,612	3,893,530	82.6	3.75
11	BUSIA	111,600	4,005,130	85.0	2.37
12	BUSIA	91,000	4,096,130	87.0	1.93
13	BUSIA	89,550	4,185,680	88.8	1.90
14	TRANSMARA	83,789	4,269,469	90.6	1.78
15	KILIFI	57,280	4,326,749	91.8	1.22
16	TRANSMARA	54,350	4,381,099	93.0	1.15
17	BUSIA	47,380	4,428,479	94.0	1.01
18	KILIFI	46,125	4,474,604	94.9	0.98
19	TRANSMARA	40,050	4,514,654	95.8	0.85
20	BUSIA	34,368	4,549,022	96.5	0.73
21	KILIFI	32,810	4,581,832	97.2	0.69
22	TRANSMARA	31,760	4,613,592	97.9	0.67
23	KILIFI	25,350	463,8942	98.9	0.54
24	KILIFI	25,310	4,664,252	98.97	0.54
25	KILIFI	18,320	4,682,572	99.0	0.39
26	KILIFI	15,080	4,697,652	99.6	0.32
27	KILIFI	9,150	[g]47,12732	100	0.29

***Note:**

*CUM. GM = cumulative addition of the Gross Margin in descending order

*CUM.% OF GM = cumulative addition of the GM in descending order expressed as a percentage of the total GM

*% SHARE OF TRADER = individual GM of each trader expressed as a percentage of total GM

4.3.2 Wholesale Trader Analysis

Degree of seller concentration

Table 4.3.5 shows the gross margin results for the 7 wholesale traders analysed in descending order. The market share controlled by the first 4 largest wholesale traders was 87.7 percent and this was considered to be very high. Table 4.3.6 shows the sales share (87.7 %) of the first 4 wholesale traders in the sample as well as the total number of wholesale traders interviewed. Table 6.1 of Appendix I shows how the gross margin analysis of wholesalers in Mombasa town and Kisumu town was calculated respectively, while Table 6.2 in Appendix II shows the mean value of the variable marketing costs for the wholesalers in their different locations of business.

Table 4.3.5: Gross margins for wholesale traders in descending order

RANK	LOC. OF BUSINESS	GROSS MARGIN	CUM. GM	CUM. % GM	% SHARE OF TRADER
1	MOMBASA	9,657,850	9,657,850	32.0	32.0
2	KISUMU	6,281,250	15,939,100	52.8	20.8
3	MOMBASA	5,883,100	21,822,200	72.3	19.5
4	KISUMU	4,656,600	26,478,800	87.7	15.4
5	KISUMU	2,320,750	28,799,550	95.4	7.7
6	KISUMU	816,620	29,616,170	98.1	2.7
7	MOMBASA	586,800	302,02,970	100	1.9

Table 4.3.6: Market share of the first 4 largest wholesale traders

Type	% share of the 4 Largest firms	% share of the 8 largest firms	No. of sellers	Description
II	87.7	-	7	Highly concentrated

Results of analysis show that the first 4 largest wholesale traders handled 87.7 percent of the transactions. These results therefore conclude that the market channel in this category is highly concentrated. From the gross margin values for individual wholesale traders shown in Table 4.3.5 it was evident that the largest wholesale trader controlled 31.98 percent of the total market share in the marketing channel and this is a very high figure. This high value is attributed to the fact that the trader in question was the main supplier of most of the control inputs to the rest of the retail traders in the coastal region. It is worth noting that Mombasa town has only three wholesale traders who trade in tsetse related control inputs.

4.3.3 Pharmaceutical Firms Analysis

Degree of seller concentration

Table 4.3.7 shows the gross margin results for the 14 wholesale traders analysed in descending order. The market share controlled by the first 4 and 8 largest pharmaceutical firms was found to be 62.2 and 82.7 percent respectively. Table 4.3.8 shows the sales share of the first 4 and 8 pharmaceutical firms in the sample as well as the total number of pharmaceutical firms interviewed.

Table 4.3.7: Gross Margins for Pharmaceutical Firms in Descending Order

RANK	LOC. OF BUSINESS	GROSS MARGIN	CUM. GM	% CUM. GM	% SHARE OF TRADER
1	NAIROBI	404,126,075	404,126,075	26.0	26.0
2	NAIROBI	213,808,800	617,934,875	39.8	13.8
3	NAIROBI	173,887,000	791,821,875	50.9	11.2
4	NAIROBI	173,843,125	965,665,000	62.2	11.2
5	NAIROBI	122,929,500	1,088,594,500	70.1	7.9
6	NAIROBI	105,597,100	1,194,191,600	76.9	6.8
7	NAIROBI	90,692,500	1,284,884,100	82.7	5.8
8	NAIROBI	65,730,000	1,350,614,100	86.9	4.2
9	NAIROBI	58,478,400	1,409,092,500	90.7	3.8
10	NAIROBI	41,614,500	1,450,707,000	93.4	2.7
11	NAIROBI	36,562,840	1,487,269,840	95.7	2.4
12	NAIROBI	34,811,000	1,522,080,840	97.9	2.2
13	NAIROBI	25,851,500	1,547,932,340	99.6	1.7
14	NAIROBI	5,467,100	1,553,399,440	100	0.4

Table 4.3.8: The Bain (1968) industry classification model on the basis of the first 4 and 8 largest firms involved in delivery of tsetse and trypanosomosis control inputs

Type	% share of the 4 Largest firms	% share of the 8 largest firms	No. of sellers	Description
III	62.2	82.7	14	High – moderate concentration

Results of analysis show that the first 4 largest pharmaceutical firms (Novartis, Bayer, Coopers and Hoersch) handled 62.2 percent while the first 8 pharmaceutical firms handled 82.7 percent of the transactions. These results therefore conclude that the market channel in this

category is high-moderately concentrated. This describes a monopolistic market situation. From the gross margin values for individual pharmaceutical firms shown in Table 4.7 above, it was evident that the largest pharmaceutical firm controlled 26.0 percent of the total market share in the marketing channel.

4.4 Analysis of Marketing Performance

This section presents the results of analysis on marketing performance with regard to the various channels in the tsetse and trypanosomosis control inputs delivery systems in Kenya. Market performance was analysed on the basis of the marketing costs encountered by the various players in the industry. An attempt has also been made to measure market performance in terms of the returns to capital. Table 4.4.1 shows the mean initial investment (capital) contributed by each group of traders in the tsetse and trypanosomosis control inputs trade. Performance has also been measured using prices at which transactions occurred.

Table 4.4.1: An analysis of the capital investments in tsetse and trypanosomosis control inputs trade per location of interview.

location of interview	All Units in Kshs	N	Minimum	Maximum	Mean	Std. Deviation
Kilifi	Initial investment	8	70,000.00	300,000.00	186,250.00	69,475.07
	Amount of initial investment	8	.00	100,000.00	27,500.00	40,266.96
Busia	Initial investment	12	5,000.00	150,000.00	48,666.66	43,113.66
	Amount of initial investment)	12	.00	150,000.00	45,416.66	51,144.10
Trans Mara	Initial investment	7	15000.00	500,000.00	123,571.42	171,189.81
	Amount of initial investment	7	.00	50,000.00	14,285.71	24,397.50
Mombasa	Initial investment	3	1,000,000.00	2,500,000.00	1,666,666.66	763,762.61
	Amount of initial investment (Kshs)	3	.00	500,000.00	166,666.67	288,675.13
Kisumu	Initial investment	4	1,000,000.00	5,000,000.00	3,125,000.00	1,652,018.96
	Amount of initial investment	4	.00	2,500,000.00	1,000,000.00	1,080,123.44
Nairobi	Initial investment	14	.00	15,000,000.00	5,428,571.42	4,376,586.05
	Amount of initial investment	14	.00	5,000,000.00	1,500,000.00	1,732,050.80

4.4.1 Variable Marketing Costs

These include direct costs which vary with the volume and level of business transacted. These are costs which suppliers face while making transactions and include: local transport costs, drug losses, handling and packaging costs, electricity/power costs, telephone costs, water costs, e-mail costs, faxing costs, vehicle maintenance costs, cost of maintaining casuals, contributions made to public functions, and other variable cost items (which are the average of any unlisted variable costs but which are important in determining variable expenses incurred in transacting the business).

Firms must consider the random nature of demand for their products over the short run and this is important in illustrating that the competitive assumption of "zero transaction costs" is not likely to be fulfilled in the real business world. Various costs do prevent markets adjusting promptly and consequently, in the real business world, we should observe not only the systematic influence of supply and demand but also disequilibria caused by the existence of transaction costs. As mentioned earlier, variable marketing costs component comprise of a significant factor in the consideration of marketing efficiency in the tsetse and Trypanosomosis control inputs marketing system in Kenya.

Table 4.4.2: Analysis of marketing costs and margins for retail traders in Kilifi District (1999)

Cost to retail trader		Revenue to retail trader	
Cost item	Kshs	item	Kshs
1. Local transport costs[1]	10,420.00	Total Revenue[10] (drug sales	71,238.75
2. Drug losses[2]	3,433.75	and pour-on sales)	
3. Electricity/power costs[3]	4,002.50		
4. Water costs[4]	2,517.50		
5. Telephone costs[5]	8,515.00		
6. Vehicle maintenance costs[6]	4,843.75		
7. Public function contributions[7]	4,009.40		
8. Other variable costs[8]	4,818.75	Gross Margin[11]	28,678.10
Total Variable Costs[9]	42,560.60	Return to capital[12]	6.7 %

NOTES (as a foot note):
[1] This is calculated by summing the transport costs per annum for the eight traders and getting the mean
[2] This is calculated by summing the drug losses per annum for the eight traders and getting the mean
[3] This is calculated by summing the electricity costs per annum for the eight traders and getting the mean
[4] This is calculated by summing the water costs per annum for the eight traders and getting the mean
[5] This is calculated by summing the telephone costs per annum for the eight traders and getting the mean
[6] This is calculated by summing the vehicle maintenance costs per annum for the eight traders and getting the mean
[7] This is calculated by summing the costs of contributing to public functions for the eight traders and getting the mean
[8] This is calculated by summing the costs to other variable costs for the eight traders and getting the mean
[9] This is calculated by summing the mean values of all the variable costs of the eight traders
[10] Arrived at by summing (quantity of drugs*price of drugs+ quantity of pour-ons*price of pour-ons) for the eight traders and getting the mean
[11] This is calculated by getting the difference between the value of the mean total revenue and the value of the mean total variable cost
[12] This is calculated by getting the ratio between mean initial investment capital and mean gross margin multiplied by one hundred

From the results of analysis in table 4.4.2 above, it is clearly conclusive that the returns to capital for retail traders in Kilifi district were 6.7 %. When compared to the benchmark level of 13.3 % when the capital would have been invested in the 91 day treasury bills, it can be concluded that traders in Kilifi district obtained a significantly lower returns in their business.

Table 4.4.3: Analysis of marketing costs and margins for retail traders in Busia District (1999)

Cost to retail trader		Revenue to retail trader	
Cost item	Kshs	item	Kshs
1. Local transport costs[1]	2,818.00	Total Revenue[11] (drug sales and pour-on sales)	719,734.20
2. Drug losses[2]	2,592.10		
3. Electricity/power costs[3]	3,640.70		
4. Water costs[4]	678.00		
5. Telephone costs[5]	5108.30		
6. Vehicle maintenance costs[6]	1,791.70		
7. Public function contributions[7]	1,851.70		
8. Other variable costs[8]	2,362.90		
9.Handling and packaging costs[9]	787.50	Gross Margin[12]	698,103.30
Total Variable Costs[10]	21,630.80	Return to capital[13]	371 %

NOTES (as a foot note):

[1] This is calculated by summing the transport costs per annum for the twelve traders and getting the mean
[2] This is calculated by summing the drug losses per annum for the twelve traders and getting the mean
[3] This is calculated by summing the electricity costs per annum for the twelve traders and getting the mean
[4] This is calculated by summing the water costs per annum for the twelve traders and getting the mean
[5] This is calculated by summing the telephone costs per annum for the twelve traders and getting the mean
[6] This is calculated by summing the vehicle maintenance costs per annum for the twelve traders and getting the mean
[7] This is calculated by summing the costs of contributing to public functions for the twelve traders and getting the mean
[8] This is calculated by summing the costs to other variable costs for the twelve traders and getting the mean
[9] This is calculated by summing the handling and packaging costs per annum for the twelve traders and getting the mean
[11] Arrived at by summing (quantity of drugs*price of drugs+ quantity of pour-ons*price of pour-ons) for the twelve traders and getting the mean
[12] This is calculated by getting the difference between the value of the mean total revenue and the value of the mean total variable cost
[10] This is calculated by summing the mean variable cost items
[13] This calculated by getting the ratio between the mean initial investment capital and the mean gross margin multiplied by one hundred

From table 4.4.3, we can conclude that traders in Busia district obtained the highest returns to capital of 371 % when compared to the opportunity cost of capital which had a returns to capital value of 13.3 %. Therefore, trade in these inputs was significantly profitable in Busia district.

Table 4.4.4: Analysis of marketing costs and margins for retail traders in Transmara (1999)

Cost to retail trader		Revenue to retail trader	
Cost item	Kshs	item	Kshs
1. Local transport costs[1]	11,000.00	Total Revenue[10] (drug sales	308,328.60
2. Drug losses[2]	9,288.60	and pour-on sales)	
3. Electricity/power costs[3]	1,294.85		
4. Water costs[4]	204.85		
5. Telephone costs[5]	2,932.60		
6 Vehicle maintenance costs[6]	3,077.10		
7. Public function contributions[7]	1,622.10		
8. Other variable costs[8]	2,701.40	Gross Margin[11]	275,607.00
Total Variable Costs[9]	32,721.60	Return to capital[12]	99.96 %

NOTES (as a foot note):
[1] This is calculated by summing the transport costs per annum for the seven traders and getting the mean
[2] This is calculated by summing the drug losses per annum for the seven traders and getting the mean
[3] This is calculated by summing the electricity costs per annum for the seven traders and getting the mean
[4] This is calculated by summing the water costs per annum for the seven traders and getting the mean
[5] This is calculated by summing the telephone costs per annum for the seven traders and getting the mean
[6] This is calculated by summing the vehicle maintenance costs per annum for the seven traders and getting the mean
[7] This is calculated by summing the costs of contributing to public functions for the seven traders and getting the mean
[8] This is calculated by summing the costs to other variable costs for the seven traders and getting the mean
[9] This is calculated by summing the mean values of all the variable costs of the seven traders
[10] Arrived at by summing (quantity of drugs*price of drugs+quantity of pour-ons*price of pour-ons) for the seven traders and getting the mean
[11] This is calculated by getting the difference between the value of the mean total revenue and the value of the mean total variable cost
[12] This is calculated by getting the ratio between the mean initial investment capital and the mean gross margin multiplied by one hundred

From the results of analysis in table 4.4.4 above, we can conclude that the retailers in Transmara district enjoyed high gross margins equivalent to the returns to capital of 99.6 %. When compared with the opportunity cost of capital of 13.3 % we can conclude that the tsetse and trypanosomosis control inputs trade is significantly profitable in Transmara district.

Table 4.4.5: Analysis of marketing costs and margins for wholesale traders in Mombasa(1999)

Cost to wholesale trader		Revenue to wholesale trader	
Cost item	Kshs	item	Kshs
1. Local transport costs[1]	43,333.30	Total Revenue[12] (drug sales and pour-on sales)	5,535,500.00
2. Drug losses[2]	34,166.70		
3. Electricity/power costs[3]	7,000.00		
4. Water costs[4]	4,300.00		
5. Telephone costs[5]	16,600.00		
6. Vehicle maintenance costs[6]	23,333.30		
7. Public function contributions[7]	4,666.70		
8. Other variable costs[8]	6,250.00		
9. Handling and packaging costs[9]	8,166.70		
10. Faxing costs per year[10]	12,100.00	Gross Margin[13]	5,375,583.30
Total Variable Costs[11]	159,916.70	Return to capital[14]	146.6 %

NOTES (as a foot note):

[1] This is calculated by summing the transport costs per annum for the three traders and getting the mean
[2] This is calculated by summing the drug losses per annum for the three traders and getting the mean
[3] This is calculated by summing the electricity costs per annum for the three traders and getting the mean
[4] This is calculated by summing the water costs per annum for the three traders and getting the mean
[5] This is calculated by summing the telephone costs per annum for the three traders and getting the mean
[6] This is calculated by summing the vehicle maintenance costs per annum for the three traders and getting the mean
[7] This is calculated by summing the costs of contributing to public functions for the three traders and getting the mean
[8] This is calculated by summing the costs to other variable costs for the three traders and getting the mean
[9] This is calculated by summing the packaging and handling costs per annum for the three traders and getting the mean
[10] This is calculated by summing the faxing costs per annum for the three traders and getting the mean
[11] This is calculated by summing the mean values of all the variable costs of the three traders
[12] Arrived at by summing (quantity of drugs*price of drugs+ quantity of pour-ons*price of pour-ons) for the three traders and getting the mean
[13] This is calculated by getting the difference between the value of the mean total revenue and the value of the mean total variable cost
[14] This is calculated by getting the ratio between the mean initial investment capital and mean gross margin multiplied by one hundred

From table 4.4.5, we can conclude that the returns to capital in Mombasa for the wholesale traders is greater than the opportunity cost of capital. This is therefore a profitable investment.

Table 4.4.6: Analysis of marketing costs and margins for wholesale traders in Kisumu,1999

Cost to wholesale trader		Revenue to wholesale trader	
Cost item	Kshs	item	Kshs
1. Local transport costs[1]	74,187.50	Total Revenue[13] (drug sales	3,818,625.00
2. Drug losses[2]	87,500.00	and pour-on sales)	
3. Electricity/power costs[3]	17,460.00		
4. Water costs[4]	4,185.00		
5. Telephone costs[5]	28,500.00		
6. Vehicle maintenance costs[6]	38,562.50		
7. Public function contributions[7]	7,187.50		
8. Other variable costs[8]	6,375.00		
9. Handling and packaging costs[9]	10,875.00		
10. Faxing costs per year[10]	15,675.00	Gross Margin[14]	3,518,805.00
11. Cost of maintaining casuals[11]	9,312.50		
Total Variable Costs[12]	299,820.00	Return to capital[15]	42.65 %

NOTES(as a foot note):
[1] This is calculated by summing the transport costs per annum for the four traders and getting the mean
[2] This is calculated by summing the drug losses per annum for the four traders and getting the mean
[3] This is calculated by summing the electricity costs per annum for the four traders and getting the mean
[4] This is calculated by summing the water costs per annum for the four traders and getting the mean
[5] This is calculated by summing the telephone costs per annum for the four traders and getting the mean
[6] This is calculated by summing the vehicle maintenance costs per annum for the four traders and getting the mean
[7] This is calculated by summing the costs of contributing to public functions for the four traders and getting the mean
[8] This is calculated by summing the costs to other variable costs for the four traders and getting the mean
[9] This is calculated by summing the packaging and handling costs per annum for the four traders and getting the mean
[10] This is calculated by summing the faxing costs per annum for the four traders and getting the mean
[12] This is calculated by summing the mean values of all the variable costs of the four traders
[13] Calculated by summing (quantity of drugs*price of drugs+ quantity of pour-ons*price of pour-ons) for the traders
[14] This is calculated by getting the difference between the mean total revenue and the mean total variable cost
[15] Arrived at by getting the ratio between the mean initial investment capital and mean gross margin multiplied by one hundred
[11] This is calculated by summing the costs of maintaining casuals per annum for the four traders and getting the mean

Table 4.4.6 indicates that the returns to capital of 42.3 % for Kisumu wholesalers is profitable.

Table 4.4.7: Analysis of marketing costs and margins for pharmaceutical firms in Nairobi (1999)

Cost to wholesale trader		Revenue to wholesale trader	
Cost item	Kshs	item	Kshs
1. Local transport costs[1]	79,517.85	Total Revenue[14] (drug sales and pour-on sales)	111,664,642.90
2. Drug losses[2]	46,892.85		
3. Electricity/power costs[3]	114,977.10		
4. Water costs[4]	25,714.30		
5. Telephone costs[5]	167,100.00		
6. Vehicle maintenance costs[6]	60,644.60		
7. Public function contributions[7]	2,757.10		
8. Other variable costs[8]	37,428.60		
9. Handling and packaging costs[9]	68,928.60		
10. Faxing costs per year[10]	74,828,60		
11. Cost of maintaining casuals[11]	21,044.60		
12. E-mail costs[12]	7,705.70	Gross Margin[15]	110,957,102.90
Total Variable Costs[13]	707,540.00	Return to capital[16]	89.79 %

NOTES (as a foot note):
[1] This is calculated by summing the transport costs per annum for the fourteen traders and getting the mean
[2] This is calculated by summing the drug losses per annum for the fourteen traders and getting the mean
[3] This is calculated by summing the electricity costs per annum for the fourteen traders and getting the mean
[4] This is calculated by summing the water costs per annum for the fourteen traders and getting the mean
[5] This is calculated by summing the telephone costs per annum for the fourteen traders and getting the mean
[6] This is calculated by summing the vehicle maintenance costs per annum for the fourteen traders and getting the mean
[7] This is calculated by summing the costs of contributing to public functions for the fourteen traders and getting the mean
[8] This is calculated by summing the costs to other variable costs for the fourteen traders and getting the mean
[9] This is calculated by summing the packaging and handling costs per annum for the fourteen traders and getting the mean
[10] This is calculated by summing the faxing costs per annum for the fourteen traders and getting the mean
[11] This is calculated by summing the mean values of all the variable costs of the fourteen traders
[12] This is calculating by summing e-mail costs per annum for the fourteen traders and getting the mean
[14] Calculated by summing (quantity of drugs*price of drugs+ quantity of pour-ons*price of pour-ons) for the traders
[15] This is calculated by getting the difference between the mean total revenue and the mean total variable cost

Table 4.4.8a: Calculated mean returns to capital for Retailers, Wholesalers and Pharmaceutical firms (1999)

LOCATION OF BUSINESS	RETURNS TO CAPITAL
Kilifi District (Retail trader) Busia District (Retail trader) Transmara District (Retail trader)	**159.22 %
Mombasa Town (Wholesale trader) Kisumu Town (Wholesale trader)	*94.6 %
Nairobi City (Pharmaceutical firms)	89.79 %

**Simple mean for the three groups of retail traders

* Simple mean for the two groups of wholesale traders

4.5 The Returns To Capital Investment

Traders involved in the marketing of tsetse and trypanosomosis control inputs usually invest significantly in financial capital in order to engage in the sale of these inputs in one form or another. Appendix III shows the mean initial investment (capital) of each group of traders in this trade. Traders also incur direct marketing costs in the process of performing marketing services. Appendix II shows the mean variable marketing costs incurred by each group of traders in the trade during the trading period ending 1999. In the context of this research, gross returns to capital is the ratio between the mean gross margins obtained and the amount of the mean initial

investment capital of each group of traders expressed as a percentage. Since this difference is less the significant costs of marketing, it is an appropriate indicator and measure of market performance.

After the analysis is done, a comparatively high value implies that the seller gets a disproportionately higher profits and hence an indication of low efficiency, of which the converse is true.

From the results analysed in Tables 4.4.2 to 4.4.7, it can be concluded that retailers in most analysed channels realize a very high return to capital when compared to the opportunity cost of capital i.e. alternative investment in the 91 day Treasury Bills with a return to capital of 13.3 percent as indicated in table 4.4.8b. The results show that the mean return to capital for retailers in Kilifi, Busia and Transmara Districts is 159.22 percent. This shows that a significantly high share of the marketing cost goes to the retailer as shown by the summary analysis in Table 4.4.8a. From this figure, it is doubtful whether there is any justification on the basis of the risks involved and the operation conducted.

The mean return to capital for the wholesale traders who purchase their stock of these control inputs from the pharmaceutical firms for onward marketing to the retail traders stood at 94.6 percent as shown in Table 4.4.8a which is significantly high when compared to the opportunity cost of capital. In the context of this research, the opportunity cost of capital was identified as the optimum interest rate that would be obtained by the traders if the capital were invested in the purchase of the 91-day Treasury Bills from the Central Bank of Kenya. According to available statistics from the Central Bank of Kenya, the average interest rate on the 91-day treasury bills was 13.3 percent in the period running 1999. When the value is annualised and assumed constant at the given rate, the rate of return on Treasury Bills per year becomes 13.3 percent as indicated

in table 4.4.8b. This value is used as a benchmark for comparison to the calculated rate of return on capital invested in the tsetse and trypanosomosis control inputs trade by the various traders.

This relatively high rate of return was explained by the integration of marketing functions done by the wholesale traders. The survey found out that, wholesalers were also involved in re-packaging, branding and transportation of the tsetse and trypanosomosis control inputs and this marketing function increased returns enormously. Even when fixed costs like rent, licenses, taxes, wages and depreciation of plant and machinery are taken into account, the return to initial investment capital for the wholesale traders would still be high and this is an indicator of the existence of inefficiencies in the marketing process.

In the analysis of the mean marketing costs and margins for the pharmaceutical firms at Nairobi town, the returns to initial capital investment stood at 89.79 percent as shown in Table 4.4.7. Although this value is comparatively lower than the previous two values of retailers and wholesalers as indicated in table 4.4.8a, it significantly surpassed the opportunity cost of capital if the money was invested in Treasury Bills with a yield of 13.3 percent per year as indicated in table 4.4.8b. It is evident from the analysis that the high returns to capital figure obtained for this group of traders emerged from the high turnovers of individual pharmaceutical firms. The total revenue for pharmaceutical firms was found to be considerably high when compared to the results obtained from the analysis of the retail traders and the wholesale traders.

In most of the surveyed sampling units (56.3 percent), there was a significant presence of informal trading in the control inputs on a willing buyer willing seller basis hence lack of transparency. This in itself affects the overall performance of the marketing system. It was also noted that, the market for tsetse and trypanosomosis drugs in areas around the borders had been flooded by generic and fake drugs and this had greatly affected the operations of the existing

formal marketing institutions viz. a viz. the retail traders and the animal health input service providers. This phenomena explains the reason why traders in the formal marketing system hiked their prices to recoup from the reduced demand which they were experiencing as a result of the divergence of business to the informal markets represented by generic and fake veterinary products.

Table 4.4.8b: Treasury Bills Interest Rates (%) for the period Jan-Dec 1999

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
rates*												
s TB's	10.70	8.95	8.85	9.03	9.63	11.44	14.47	14.84	15.78	17.63	18.14	19.97
rate for the year**												**13.30**

* Simple average of all auctions in the month

** Simple average of all auctions for the year

Source: Central Bank of Kenya, 2000.

4.5.1 Comparative Analysis Of Variable Costs

According to the results obtained in the analysis as shown in table 4.4.1, Kilifi district posted the highest values for mean variable costs amounting to Kshs 42,560.60, followed by Transmara district with a total of Kshs 32,721.60 (see table 4.4.1) while Busia district came last with a mean value of Kshs 21,630.80. (see table 4.4.1). These values correspondingly impacted on the calculated values for 'returns to capital'. It was therefore conclusive from the analysis that the higher the value for total variable costs the lower the value obtained for returns to capital. Accordingly, Kilifi district, which recorded the highest values for total variable costs, had the lowest value for returns to capital of 6.7 percent (see table 4.4.2) while Busia district, which

recorded the lowest value for the total variable costs, had the highest value for returns to capital of 371 percent (see table 4.4.3).

The results of analysis for the wholesale traders depicted the same trend in variable cost analysis. It is conclusive from the tables that Kisumu town wholesale traders recorded lower returns to capital than their Mombasa counterparts due to the variance in total variable costs. From the tables it was clear that the wholesale traders in Kisumu town had a mean variable cost value of Kshs 299,820, (see table 4.4.1) while the Mombasa wholesaler's value was 159,916.70 as shown in table 4.4.1. In the analysis of returns to capital for the two wholesale outlets, the Mombasa wholesalers recorded returns to capital value of 146.6 percent while their Kisumu counterparts recorded a mean value of 42.65 percent.

Therefore from these variations, it can be concluded that variable costs have a strong influence on the returns to capital for the various types of traders. The analysis thus concludes that there is an inverse relationship between variable costs and returns to capital meaning that gross margins in trade increase with low levels of variable costs with a resultant increase in the returns to capital.

4.5.2 Testing Of The Hypotheses

Hypothesis One

Statistical test:

In the analysis of market structure for the various types of traders involved in the tsetse and trypanosomosis control inputs and services marketing system, the following results were obtained ;

The first four wholesale traders (Faiz, Health Care, Badar and Hoersch) had a market share of 87.7 percent as shown in table 4.3.6. According to the benchmark percentages indicated in table 3.6.1, this value falls into the "highly concentrated" market structure bracket, implying that the market structure for this group of traders has a tendency towards oligopilistic competition. This implies that these traders have more market power in controlling prices and setting profit margins.

The first four and eight retail traders had a market share of between 52 and 75 percent while the first four and eight pharmaceutical firms had a market share of between 62.2 and 82.7 percent. According to the benchmark values in table 3.6.1, these values fall into the "high to moderate" market structure bracket, signifying a tendency towards a monopolistic market structure. This implies that traders in this marketing channel have market control and influence on pricing decisions.

Therefore, according to the Bain (1968) industry classification model outlined in table 3.6.1, we can conclude that the above three classifications of market structure for wholesalers, retailers and pharmaceutical firms are inherently imperfectly competitive. From this analysis, we cannot therefore reject the hypothesis that the Kenyan tsetse and trypanosomosis control inputs and services marketing systems are non – competitive.

Hypothesis Two

Statistical test:

In the analysis of marketing performance for the various types of traders involved in the tsetse and trypanosomosis control inputs and services marketing systems, the following results were obtained;

Returns to investment capital for retail traders was 159.2 percent as shown in table 4.4.8a; returns to investment capital for wholesale traders was 94.6 percent while the returns to investment capital for the pharmaceutical firms was 89.8 percent. These margins were compared and measured against an index/benchmark of the Central Bank of Kenya's average value of the annual yield rate for the 1999 Treasury Bills, which had a mean value of 13.3 percent per annum as indicated in table 4.4.4b. This index was selected as a statistical test because the Treasury Bills floated by the Central Bank have less market fluctuation risk than ordinary bank interest rates, the margins from these bills are also greater. Therefore from the results we can conclude that;

RTC_R (159.2 %) > TBYR (13.3 %) per annum

RTC_W (94.6 %) > TBYR (13.3 %) per annum

RTC_P (89.8 %) > TBYR (13.3 %) per annum

Where by;

RTC_R = returns to capital for the retail traders

RTC_W = returns to capital for the wholesale traders

RTC_P = returns to capital for the pharmaceutical firms

$TBYR_{1999}$ = treasury bills yield rate for 1999

From this analysis, we cannot therefore reject the hypothesis that the traders involved in the tsetse and trypanosomosis control inputs and services marketing system receive significantly excessive margins.

4.6 Discussion

4.6.1 Descriptive Analysis of the Government Policy on Control of Tsetse and Trypanosomosis in Kenya

The Kenyan Government lists five major reasons why it is committed to controlling tsetse flies:

(i) Tsetse flies transmit human sleeping sickness

(ii) Tsetse flies transmit *nagana* in cattle

(iii) These diseases can kill

(iv) To open land in order to increase food production

(v) The bite of a tsetse fly is very painful

The Kenyan government integrates the following tsetse control technologies:

(i) Ground/Arial spraying

(ii) Traps

(iii) Targets

(iv) Pour-on

(v) Chemoprophylaxis

(vi) Appropriate land utilization

(vii) Trypanotolerance

(viii) Habitat destruction

(ix) Sterile insect technique

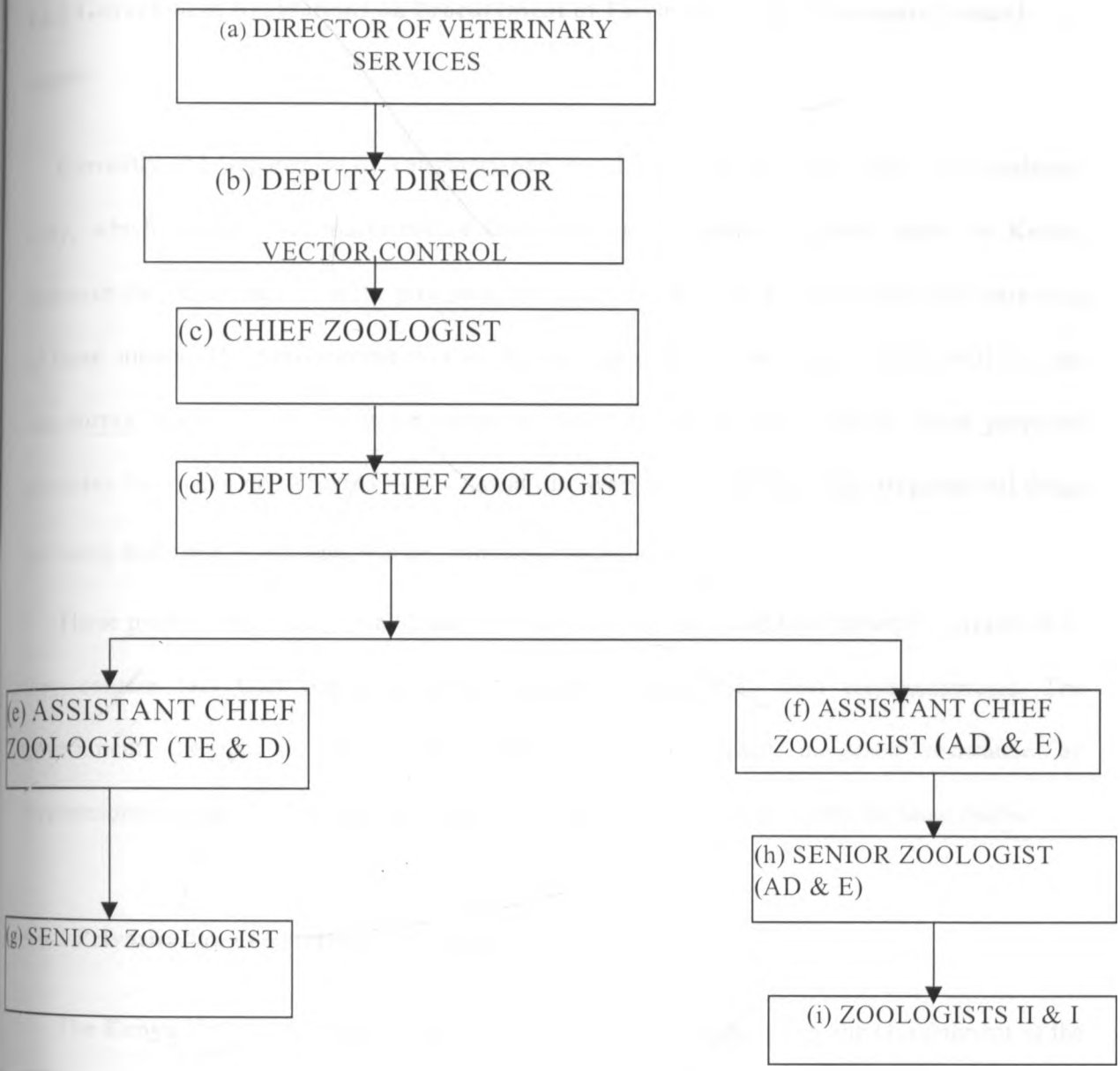
(x) Community education

(xi) Hand nets

(xii) Continuos surveillance

The Kenyan Government continuously monitors tsetse fly: to determine presence of fly, to determine fly distribution, to determine the extend of fly limit, to determine fly density, for species identification, to determine trypanosomosis infection and to assess control programs.

The mandate of tsetse and trypanosomosis control is under the Director of Veterinary Services. Under the Director is the Deputy Director in charge of vector control. The section under which tsetse and Trypanosomosis are controlled is headed by the Chief Zoologist, who is located at the head office from where he co-ordinates all national field activities. Under the Chief Zoologist is the Deputy Chief Zoologist also located at the head office. Below the Deputy Chief Zoologist are found two Assistant Chief Zoologist. The first one who heads the Technology Evaluation and Development is located at the head office while the remaining officer who heads the Administration and Extension activities is located in each of the Provincial Head Quarters. Below the line of Assistant Chief Zoologist is found the Senior Zoologists, of which one is located at the head office while the rest of the officers are located at the district quarters. Last in the hierarchy are the Zoologists found at the divisional head quarters from where all field extension activities are co-ordinated for the benefit of livestock farmers. This framework is shown in figure 4.6.1.



LEGEND:

TE & D = Technology Evaluation and Development

AD & E = Administration and Extension

a,b,c,d,e,g = Located at Head Office (Vet Labs Kabete)

f = Located at Provincial Head Quarters

h = Located at District Head Quarters

i = Located at Divisional Head Quarters

Fig. 4.6.1: Organisational framework for tsetse and trypanosomosis control in Kenya.

Source: Annual Reports. Department of Veterinary Services, Kabete, 1999.

4.6.2 Government Regulations on Procurement of Tsetse and Trypanosomosis Control Inputs

Currently, the Department of Veterinary Services does not have a clear policy nor regulatory body, which controls the marketing of tsetse and trypanosomosis related inputs in Kenya. However the Department is in the process of initiating mechanisms for monitoring the marketing of these inputs. The Government is also drawing up a policy document, which will see the monitoring of tsetse related control inputs as they flow in the local market. These proposed measures have been necessitated by the recent discovery by KETRI that fake trypanocidal drugs are being marketed in the local market from neighbouring countries.

These products have been evaluated and found to be inferior and thus harmful to livestock as they contain less than optimum active ingredients needed to treat trypanosomosis. The government through its monitoring institutions has recorded increased resistance by trypanosomosis and this has been attributed to the flow of fake products into the local market.

4.6.3 Privatisation of Veterinary Services

The Kenya Veterinary Privatisation Scheme (KVPS) was initiated by the Government in the early 1990's as a measure to reduce Government expenditure on clinical and AI services. This was necessitated by the structural adjustment programs, which were being implemented in the agricultural sector. The Kenyan Government states clearly that tsetse and trypanosomosis control remains the domain of the Department of Veterinary Services. However it is only the Artificial Insemination (AI) and the clinical services, which have been privatised by the Government. This will be positive for farmers in the sense that service delivery will improve due to the transfer of

responsibility from the public to private sector. It is also envisaged that only those livestock farmers who want delivery of these services effectively will do at cost. It should however be noted that the Government still maintains extension services for farmers who can acquire them at a small professional fee.

The Government however allows only qualified veterinary doctors and animal health assistants to practice animal medicine and also in the marketing of veterinary products in the Kenyan market. To this end the relevant Government organs are preparing a draft bill and which will see only qualified veterinary officers conducting the marketing of trypanosomosis control inputs and also in delivery of livestock services.

The Government has realised that quacks who pose as veterinary officers are causing a major damage to livestock production by either selling fake or generic drugs, selling expired drugs to unsuspecting livestock farmers, overdosing or under dosing animals and giving the wrong prescriptions to the farmers. This trend has been factored out as one of the main factors, which have negatively affected livestock farming in Kenya.

4.6.4 Privatisation of Tsetse and Trypanosomosis Control in Kenya

The Government clearly states that tsetse and trypanosomosis control has not been privatised. The argument given is that control of this problem is an excessive exercise, which involves commitment of large sums of money and other resources, which cannot be borne by the private sector. The second argument states that tsetse fly belts extend across the international borders spanning into Uganda, Tanzania and Somalia, which requires a collaborative undertaking by the political institutions from the affected countries. Individuals or the private sector cannot negotiate this.

For some time now, the governments of Kenya and Uganda have been collaborating through border harmonisation meetings in an effort to combat the deadly menace of tsetse flies. To this end. the Kenya Trypanosomosis Research Institute (KETRI) and its counterpart Uganda Trypanosomosis Research Organisation (UTRO) have been undertaking joint research activities in an effort to come up with affordable control technologies, which livestock farmers in the two countries can adopt for tsetse control.

4.6.5 Tsetse and Trypanosomosis Research Bodies Established by the Government

Kenya Trypanosomosis Research Institute (KETRI)

The institute's mandate is to improve on technology development and also to come up with new technologies, which can be adopted by livestock farmers for control of tsetse and trypanosomosis, related problems. Once KETRI has come up with technologies, they are forwarded to the Veterinary Department for evaluation through on farm trials. If the technologies are found to be feasible, the Department of Veterinary Services releases them to the farmers through the established institutional framework. At the moment, KETRI is developing traps and nets which it distributes to communities living in tsetse infested areas for catching of flies. The Institute is also liasing with other research centres in the breeding of sterile male flies which will then be released in the wild to control the breeding of tsetse flies.

KETRI works in collaboration with other research bodies notably the International Livestock Research Institute (ILRI) and the International Centre for Insect Physiology and Ecology (ICIPE) in conducting both applied research and social science research in an effort to find a lasting solution to the tsetse problem.

Kenya Veterinary Vaccines Production Institute (KEVEVAPI).

For over two decades the institute has been trying to develop a vaccine for control of trypanosomosis disease but in vain. However, through collaboration with ILRI it is hoped that the International Livestock Research Institute will keep on carrying out laboratory research through its high technology laboratories and renowned global scientists in an effort to develop the elusive vaccine by the turn of the decade.

At the moment, KEVEVAPI has given up on trying to find a vaccine, since the Government lacks the necessary resources to undertake experimentations and carrying out high-level research. KEVEVAPI is currently concerned with the production of other vaccines for livestock farmers.

4.6.8 Future Role of the Government in Tsetse Control

The role of tsetse control in Kenya firmly remains the domain of the Government. However the Government will in future invite private sector tsetse control services especially in areas where large scale livestock ranching has been firmly established. The Government is still committed to maintaining a reasonable budget especially for emergency operations in case of an outbreak of "fly" in new areas. The Government also maintains a budget to treat people who are infected by the sleeping sickness problem caused by tsetse fly bites in livestock keeping communities.

4.7 Conclusions

The results of analysis of the market structure indicate that the marketing and distribution channels were well established in some trading levels, while the other trading levels still lacked the necessary infrastructure to undertake the delivery process. From figure 4.1, which shows the movement patterns of the control inputs, it can be conclusive that the pharmaceutical firms operating in the country have the capacity and are well placed to supply the market with adequate control inputs.

It can also be observed that the wholesale traders operate at three levels (national, regional and local) and their business activities are dictated by the volume of transactions, location of premises (are strategically located to adequately serve the regions affected by the tsetse problem) and their nearness to the pharmaceutical firms (national wholesalers).

The retail traders and the animal health service providers were found to be competitively serving the livestock farmers, since both the traders were located mostly close to the livestock producers in the village centres. They mostly purchased their stock from the distribution channels above them in the marketing channel.

From the results of analysis of marketing performance, it was conclusive that all the traders involved in the tsetse and trypanosomosis control inputs marketing system exhibited characteristics of inefficiency.

CHAPTER FIVE

5.0 Summary, Conclusions and Recommendations

5.1 Summary

Tsetse and trypanosomosis control inputs sector makes up a significant portion of the national market for agricultural inputs going to the livestock sub-sector. In Kenya, livestock production in tsetse infested regions accounts for a very significant proportion of the national figure of livestock produced. Therefore trade in these control inputs is done on the same scale as the later, and this implies that traders involved in this business are widely distributed in all the major livestock producing areas, mainly the tsetse infested regions.

Numerous studies undertaken on the livestock health sector have indicated that a large reservoir of livestock has not been treated due to ignorance and lack of information by livestock farmers on the value of livestock drugs and other control inputs. This study has particularly focused on the marketing of tsetse and trypanosomosis control inputs in Kenya, since the tsetse problem has traversed all the major livestock producing regions in the country. In addition, it is worthy noting that from the results of analysis, marketed tsetse and trypanosomosis control inputs do not match the potential output in terms of the number of livestock which have been infected by trypanosomosis, not forgetting those which are at very high risk of infection. From the results it was evident that some farmers (38 %) from Busia and Kilifi districts whose livestock had been diagnosed with symptoms of trypanosomosis either ignored to seek for treatment from veterinary doctors or if they did, they purchased cheap and readily available generic and fake drugs from across the border.

The study therefore attempted to identify areas where problems might be prevailing in the marketing process, which eventually lead to an inherently imperfect marketing environment. The

study shows that the major forms of organized marketing of livestock health control inputs in the country is through the pharmaceutical firms, the wholesale traders and the retail traders and this are the three major channels through which tsetse and trypanosomosis control inputs are distributed in Kenya.

The characteristics of the three marketing channels have been analysed and they show that in the retail-marketing channel, the four largest traders handled 52.0 percent of the market share while the eight largest retailers handled 75.0 percent of the market share. That for wholesale traders, since only seven were sampled, the first four largest traders handled 87.7 percent of the transactions, while for the pharmaceutical firms, the figure stood at 62.2 percent for the first four largest traders and 82.7 percent for the eight largest traders in the same category.

These results show that out of the three marketing channels, two of them recorded high to moderate concentration (pharmaceutical firms and retail traders) while the remaining one recorded a highly concentrated marketing channel (wholesale traders).

It was also observed that there was inefficiency in the marketing performance as evident by the significantly high returns to initial investment capital. The returns to capital ranged from 89.79 percent to 159.32 percent when compared with the opportunity cost of investing the initial investment capital in an optimum account, the later figures were found to have significantly surpassed the market rate of interest. Therefore, as for market performance, the results of the analysis show that market efficiency is low because of the relatively high returns to capital.

It was also observed that public sector management of the tsetse problem was not adequate. From the information obtained in the Department of Veterinary services of the Ministry of Agriculture and Rural Development, it was established that the Government's role has been decreasing over the years. Indicators of these trend include a reduced budget for tsetse control

and monitoring, scrapping of the vaccine research program at KEVEVAPI and the privatisation of clinical services in the Department of Veterinary Services. It was also established that although private sector involvement was strongly represented by ILRI and ICIPE's research programs, centre stage activities mainly focused on vaccine development, trypanotolerance and trap development respectively.

There was also evidence to suggest that collaborative undertaking between the Government research institutions and the private sector institutions had had a significant impact on the communities affected by the tsetse problem. Socio-economic research and other sensitisation activities have led to improved understanding of the nature of the tsetse problem and how to deal with it.

5.2 Conclusions

From the results of the analysis it can be concluded that there was a strong evidence of low competition among the traders of tsetse and trypanosomosis control inputs in the Kenyan market. The elements of low competition that were identified are:

1) Existence of a highly concentrated market among the wholesale traders i.e more tendency towards an oligopolistic marketing environment implying that traders in this channel have more market power to influence pricing decisions and to set profit margins at will.
2) Existence of a high to moderate market concentration among the pharmaceutical firms and the retail traders i.e a tendency towards a monopolistic market condition in which many traders with differentiated products existed. Therefore, in this channel, traders had less market power to influence pricing decisions and in setting profit margins at will.

There was also evidence of inefficiency in the market performance as shown by the existence of relatively high and disproportionate returns to capital in virtually all the channels. Out of all the channels analysed, the pharmaceutical firms were found to be more competitive and efficient as shown by the high to moderate market concentration and the comparatively lower returns to capital of 89.79 percent. The least efficient marketing channel was that of the retail traders shown by the very high returns to capital of 159.22 percent, while the least competitive market channel was that of the wholesale traders as shown by the highly concentrated market value of 87.7 percent. These rates of return are significantly greater than the opportunity cost of capital implying that traders are earning more tan what they should averagely earn i.e. returns to capital close to about 13.3 percent.

5.3 Recommendations

5.3.1 Specific Recommendations

The results show that there is relatively low competition in the Kenyan tsetse and trypanosomosis control inputs market. The four largest retailers controlled 52.2 percent of the market share while the eight largest controlled 75 percent of the market share implying that their was a high-moderate market concentration amongst these traders. Wholesale traders were highly concentrated in the market as can be depicted by the market share of the four largest traders who controlled a market share of 87.8 percent (highly concentrated). The first four and eight largest pharmaceutical firms controlled a market share of 62.2 and 82.7 percent respectively. There is also a clear indication that inefficiency especially in the wholesale market is prevalent in the country.

It is therefore recommended that in order to deal with the problem of ineffective competition and inefficiency in this marketing channel, there is need for more wholesale traders to enter this market. Research indicated that the biggest barrier to entry in this market was lack of market information, which can be obtained by a simple survey. The research survey indicated that there is high potential in many of the tsetse-infested regions as only a few wholesale traders operate in such areas. It is also suggested that national and regional wholesale traders should open up more business outlets in the districts to influence the stabilization of prices. The beneficiaries from this kind of process will be the poor livestock farmers who cannot afford the current price set-ups. It is also envisaged that new entrants into the wholesale market will increase the ability of the livestock farmers in choosing amongst the many brands that are prevalent in the market today. Tsetse and trypanosomosis control input brands prevalent in the Kenyan market are listed in Appendix VIII.

Results of analysis depicted a worrying trend in the retail trader performance in the market. This group of traders have been found to have the highest return on initial investment capital depicting low market efficiency. One of the suggested remedies of this worrying trend in the retail market is to educate livestock farmers on alternative markets other than the retailers viz. a viz. the wholesalers. If more and more livestock farmers are made aware of the existence of more cheaper markets for tsetse related products, then they can directly save on costs by buying from the wholesale traders. This will force the retail traders to reduce their profit margins by significantly lowering their prices.

The pharmaceutical firms have an obligation of reducing their inefficiencies by specializing in production and packaging alone and leaving the other marketing functions to the other middle men who can efficiently deliver these control inputs at a relatively affordable rate. It is suggested

that the pharmaceutical firms need to contract transport companies who are more specialized in the field to distribute these control inputs on their behalf. Results of analysis indicated that transportation costs for the pharmaceutical firms accounted for about 7.8 % of total variable costs. This cost was then put in consideration when setting prices for their products. An efficient transport system can significantly increase efficiency in the marketing process.

5.3.2 General Recommendations

It is noted that the Government's role in solving the tsetse problem is insufficient and that it has been declining over the years. Research results indicated that the trypanosomosis prevalence in the country had not been significantly reduced since independence. This was evident by a diminishing budgetary allocation for surveillance of tsetse belts, discontinuation of dipping services which significantly reduces incidence of fly bites on livestock and the halting of supply of free traps and nets to tsetse infested communities in Kenya. It is suggested that a better strategy would be for the Government to continue with the privatisation program for greater private sector participation in the future. However the essential role of the public sector in monitoring and tracking tsetse belts has to remain with the Government and this is inclusive of the veterinary service extension staff who should continuously educate and advice livestock farmers on proper livestock management in high-risk areas. The Government should also reduce the information gap experienced by livestock farmers by an agricultural market information bureau, which will be instrumental in releasing information bulletins to livestock farmers and other stakeholders so that proper strategies are outlined on how to fight the tsetse problem.

The Government has to put in place an enabling environment for aspiring investors in the livestock sub-sector by:

1) Improving the transport infrastructure especially in districts, which are prone to tsetse fly menace by improving the road network. A good example is the Transmara District, which does not have a single tarmacked road other than that entering the district headquarters. The district has one of the highest potentials in livestock production in the country and also, it has very high risk of trypanosomosis prevalence, and yet it has a tally of only four public transport vehicles! Traders in animal health control inputs have often complained of this problem. To compound it all there is no operational vehicle to support public sector extension activities. This has led to the decline of livestock figures over the years due to high incidences of trypanosomosis and a relatively small number of retail traders who do not seem to be satisfying the demand for animal health products. The district has only four-registered veterinary stockist outlets, with a very high population of livestock numbers. It is envisaged that an improvement in the road networks will encourage more private sector investment in transport businesses thus stimulating more traders to make an entry into this lucrative market.

2) The Government should speed up legislation in enactment of a law, which will define the limits, and requirements of persons who want to engage in the business of supplying animal health products. This will protect the qualified veterinary physicians and traders from competing with unqualified persons who are responsible for the current mess in the industry. Such a law should outline severe penalties to business men who are found selling sub standard veterinary health products to unsuspecting livestock farmers who have seen an increase in resistance to trypanocidal drugs by their animals.

3) The Government should provide an enabling environment to private sector participation by ensuring that policy instruments have no hindrance to research work. The stakeholders in the livestock industry should be assured of maximum security since most areas where livestock

production is undertaken has been prone to high banditry and this scares potential private sector participants from venturing in such areas to assist livestock farmers in overcoming the tsetse problem. For example, road trasport to Tana River and Lamu are risky and insecure.

5.3.3 Concluding Remark

It is recommended that more research has to be undertaken in the economic analysis of markets of tsetse and trypanosomosis control inputs, especially in understanding the activities of pharmaceutical firms in the country since there is very little literature about their pricing and marketing policies. Such research will enable the livestock producers to understand better about the various brands of trypanocidal drugs and pour-ons offered in the Kenyan market. Potential investors can also use the information to make entry decisions. There still exist an information gap on behaviour of traders operating in different districts across the country with regard to how they practice 'target marketing' and price discrimination in the sale of control inputs to exotic breed livestock producers on one hand and the indigenous livestock producers on the other hand. It is therefore recommended that future research efforts have to be directed towards studying the behaviour of these traders.

REFERENCES

Abila, R.O. 1995. " The Structure, Conduct and Performance of Kisumu Fish Marketing System. " Unpublished M.Sc. Thesis. Department of Agricultural Economics, Nairobi, University of Nairobi, Kenya. 78 pgs.

Andic, S. and A. J. Peacock, 1961 "The International Distribution of Income 1947-1957" Journal of Royal Statistical Society part II. UK.

Bain, J.S., 1968. Industrial Organization, New York, John Wiley and Sons. 2nd edition.

Bauer, B.; Kabure, I.; Liebisch, A.; Meyer, F. and Petrich-Bauer, J. 1992b. Simultaneous control of ticks and tsetse flies in Satiri, Bukina Faso by the use of flumethrin pour-on for cattle.Trop. Med. Parasitol. 43:41-46.

Bauer, B.; Kabure, I and Petrich-Bauer, J. 1992a. The residual effect of Deltamethrin Spoton when tested against *Glossina Palpalis* under fly chamber conditions. Trop. Med. Parasitol. 43:35-40

Central Bank of Kenya., 2000. Leading Economic Indicators, March 2000. government Press, Nairobi, Kenya.

Cornes, R. and Sandler, T. 1986. The Theory of Externalities, Public Goods and Club Goods. Cambridge University Press, Cambridge, UK, pp. 116-124

Republic of Kenya, District Development Plan, 1997-2001. Busia District, Kenya.

Republic of Kenya, District Development Plan, 1997-2001. Kilifi District, Kenya.

Republic of Kenya, District Development Plan, 1997-2001. Transmara District, Kenya.

Echessah, P. N.; Swallow, B. M.; Kamara, D. W.; and Curry, J. J. 1997. Willingness to Contribute Labour and Money to Tsetse Control: Application of Contingent Valuation in Busia Distric, Kenya, World Development 25(2): 239-53.

Ehui, S.K. and Lipner M.E. (Eds). 1993. Livestock and Resource Management Policy: Issues and Priorities for Research.International Livestock Centre for Africa: Addis Ababa, Ethiopia.

Ehui, S. K. and Lipner, M.. E. (Eds). 1993. Livestock and Resource Management Policy: Issues and Priorities for Research. International Livestocck Centre for Africa: Addis Ababa, Ethiopia.

Food and Agriculture Organisation, 1995. Livestock Development Strategies for Low Income Countries. ILRI, Nairobi, Kenya.

Farming in Tsetse Controlled Areas (FITCA), 1999. Draft Proceedings of the 15th Co - ordination meeting of the Farming in Tsetse Controlled Areas (FITCA) Project of Eastern Africa held in Busia, Kenya, 11th - 13th August, 1999.

Geerts, S. and Holmes, P.H. 1997. Drug Management and Parasite Resistance in Animal Trypanosomosis in Africa. Paper Presented at the International Scientific Council for Trypanosomosis Research and Control, Maputo, Mozambique, September 29th –October 4th , 1997.

Golletti F., and Alfano, A. 1995. "Agricultural Input Market Reforms: A Review of Selected Literature" MSSD Discussion Paper No. 4. Washington DC: International Food Policy Research Institute. 1995.

Griffin, and Allonby, E. W. 1979. Disease Synchromes in Sheep and Goats Naturally Infected With *Trypanosoma Congolense* J. Comp. Path. 89: 457-464

International Livestock Research Institute (ILRI) 1996. Annual Project Reports. ILRI, Addis Ababa, Ethiopia.

International Livestock Research Institute(ILRI) 1997. Annual Project Reports. ILRI, Addis Ababa, Ethiopia.

Jahnke, H.E.G.; Tacher, P. , Keil and Rojat, D. 1988. "Livestock Production in Tropical Africa, With Special Reference to the Tsetse Affected Zones". In ILCA/ILRAD Livestock Production in Tsetse Affected Areas of Africa. Proceedings of a meeting held in Nairobi

Kamara, D.; Echessah, P.; Swallow, B.; Curry, J. 1999. Assessment of the Socio-economic Factors Affecting Implementation of Community Based Tsetse Control in Busia, Kenya.

Karugia, J. T. 1990. Competition and Efficiency in Beef Retailing in a Metropolitan Area: The Case of the City of Nairobi. Unpublished M.Sc. Thesis, Nairobi, University of Nairobi, Department of Agricultural Economics. 82 pgs.

Katondo, K. M. and Ford, J. 1977. Maps of Tsetse fly (Glossina) Distribution in Africa 1973, According to sub-generic Groups on "Bulletin of Animal Health and Production in Africa, 15: 187-93.

Kenya Tripanosomosis Research Institute (KETRI), 1995. Proceedings of the Fourth KETRI Internal Annual Scientific Review. 5th –9th June, 1995

Kenya Tripanosomosis Research Institute (KETRI), 1998. Proceedings of the Seventh KETRI Internal Annual Scientific Review, 22nd-26th June 1998

Kidane, H. 1978. Seasonal Supply Patterns and Pricing Efficiency for Milk in Kenya With Particular Reference to Kiambu District-Kenya. Unpublished M.Sc. Thesis. University of Nairobi.

Kruska, R.L.; Perry, B.D. and Reid, R.S. 1995. Recent Progress in the Development of Decisions Support Systems for Improved Animal Health. In: Proceedings of the African GIS 1995 meeting "Integrated Geographic Information Systems Useful for a Sustainable Management of Natural Resources in Africa" March 6-9, Abijan, Cote d' Ivore.

Kuzoe, F.A.S. 1991. Prospectives in Research on the Control of African Trypanosomosis. Annals of Tropical Medicine and Parasitology 85(1): 33-41.

Leak, S.G.; Mulatu, W.; Rowlands,G.J. and D'Iteren, G.D.M. 1999. A Trial of a Cypermethrin Pour-on Insecticide to Control *Glossina Pallidepes, G. fuscipes and G. morsitans sub morsitans (Diptera: Glossinidae*) in South Western Ethiopia. Bulletin of Entomology. Research in Press.

Mugera, G.M.; Bwangamoi,O.; Wandera, J.G. 1979. Diseases of Cattle in Tropical Africa. Kenya Literature Bureau, Nairobi.

Mutayoba, M.B. 1986. Susceptibility of the Small East African Breed of Goats From Different Localities to *Trypanosoma Congolense* With Emphasis on Residual Fertility. Unpublished M.Sc. Tnesis. University of Nairobi, Nairobi. Department of Agricultural Economics. Pgs 110.

Muturi, L. K. 1994. "Economic Analysis of Coffee Co-operative Societies. A Case Study of Central Province in Kenya. Unpublished M.Sc. Thesis. University of Nairobi Nairobi. Department of Agricultural Economics. Pgs 112.

Ndirangu, S.N. 1992. "An Economic Analysis of Maize Marketing in Kenya: A Case Study of Nandi District. Unpublished M.Sc. Thesis. University of Nairobi Nairobi. Department of Agricultural Economics. Pgs 85.

Ngumi, S. 1976. Seasonal Supply Patterns and the Pricing Efficiency of the Kenya Meat Commission. Un publushed M.Sc. Thesis. University of Nairobi Nairobi. Department of Agricultural Economics. Pgs 78.

Norman, L., Turner, R.A.E., Wilson, K.R.S., 1985. The firm business. MacMillan Publications, London Press.

Nyangito, O,H. 1992. "Economic Evaluation of Alternative Livestock Disease Control Methods in Kenya." PhD dissertation, University of Tennessee, Knoxville. Pgs 278.

Oloo, G.; Muriuki, C. ;Wilson, D.B.; Stevenson, P.; Mukami, J. and Ndung'u, J. 1999. "The Tsetse Distribution Map of Kenya - Current Status." Proceedings of the International Scientific Council for Trypanosomosis Research and Control, Maputo, Mozambique. September 29- October 4, 1997. Nairobi: OAU / ISCTRC.

Reid, R. S. 1999. Impacts of Controlling Trypanosomosis on Land-use and Environment: State of our Knowledge and Future Directions." In Proceedings of the 24th Meeting of the International Scientific Council for Trypanosomosis Research and Control, Maputo, Mozambique, 29th September-3rd October, 1997.

Republic of Kenya, 1997. " National Development Plan 1997-2000. Nairobi ." Government Printer.

Republic of Kenya, 1998. Economic Survey, 1998, Nairobi, Government Printer.

Republic of Kenya. 1998. Ministry of Agriculture, Dept. of Animal production: Forwarding of the Report for the Senior Staff Meeting of the Dept. of Livestock Production. Nov. 3-4, 1998

Ruttan, V.W. 1969. "Agricultural Product and Factor Markets in South East Asia". In Anschel, K.G., Brannon, R.H., (Ed.) Markets in Developing Countries. NewYork-Washington-London.

Schmidt, G. 1979. The Functioning of the Kenyan Maize Market and Beans Marketing System With Regard to the Interaction of the Formal and Informal Sub-systems. Institute for Development Studies, Nairobi.

Schubert, B. 1979, "Some Considerations on Methods for Evaluating Marketing Systems for Agric. Products" Journal of Rural Dev. , VI (Nos 1and 2) pp. 39-54.

Serem, A,K. 1996. Beef Marketing in Baringo District, Kenya. Unpublished M.Sc. Thesis. University of Nairobi, Nairobi. Department of Agricultural Economics. Pgs 98.

Sturrock, F., 1982., Farm accounting and management. Oxford Press, London, UK.

Swallow, B.M. 1997. Impacts of Trypanosomosis on African Agriculture. Paper Presented at the International Scientific Council for Trypanosomosis Research and Control, Moputo, Mozambique, Sept. 29-Oct. 4, 1997.

Swallow, B.M.,; Woodyyalew, M.; Leak, G.A.S. 1995. Potential Demand for a Mixed Public-Private Animal Health Input; Evaluation of a Pour-on Insecticide for Controlling Tsetse-Transmitted Trypanosomosis in Ethiopia. Journal of Preventive Veterinary Medicine 24 (1995) 265-275.

Thompson, J.W.; Mitchell, M. Rees, R.B.; Shereni, W.; Schoenfield, A.H. and Wilson, A. 1991. Studies on the efficacy of Deltamethrin Applied to Cattle for the Control of Tsetse Flies (*Glossina species*) in Southern Africa. Trop. Animal Health Prod. 23:221-226.

Varali, D.L.; Feller, G. and De Haan, C. 1994. Animal Health Services: Finding the Balance Between Public and Private Delivery. World Bank Res. Observer, 9(1): 71-96.

VSF. 1995. Paper Presented on a Seminar on Privatization of Veterinary Services.

Wangila, J.; Swallow, B.M.; Tesfaemichael, N.; Okello, O.; Kruska, R. 1996. Factors Affecting Farmer Demand for Pour –on Treatments in Ethiopia.

Waswa-Wangia, C.W. 1977. Competition and Efficiency of Food Retailing to Low –Income Consumers in Nairobi. Unpublished M.Sc. Thesis. University of Nairobi, Nairobi. Department of Agricultural Economics. Pgs 89.

Whetham, E.H.1972. Agricultural Marketing in Africa. London Press, UK.

Wilson, S. G.; Morris, R. S. ; Lewis, I. J. and Krog, E. 1963. The Effect of Trypanosomosis on Rural Economy-With Special Reference to the Sudan, Bechuana-Land and West Africa. Bull. Wld. Hlth. Org. 28:595-613.

Winrock International. 1992. An Assessment of Animal Agriculture in Sub Saharan Africa. Winrock International: Morrilton, USA.

APPENDIX I

Table 6.1 Livestock figures per province as per the 1997 Livestock census.

INCE	DAIRY	ZEBU/BEEF	SHEEP	GOATS	CAMELS	DONKEYS	HORSES
STERN	13,500	737,000	972,000	490,384	27.000	–	–
T	61,309	938,510	571,314	800.470	42,754	–	–
NZA	145,500	1,104,638	392,269	589,320	–	30,470	–
ERN	132,000	820,600	160,000	131,900	–	–	–
RAL	850,701	81,330	251,407	268,135	–	17,597	151
RN	23,957	1,948,957	2,298,407	2,398,267	489,000	59,450	60
OBI	14,000	28,000	14,000	14,000	–	–	–
EY	1,390,659	3,583,364	4,062,067	5,671,578	170,459	–	–
L	2,531,626	8,242,399					

Source: Ministry of Agriculture, Department of Livestock Production, 1998.

APPENDIX II

Table 6.2: Agro-Ecological zones by Division (in Ha)

Division	LM1*	LM2	LM3	LM4	TOTAL
Nambale/Matayos	18240	4560	-	-	22800
Butula	25175	1325	-	-	26500
Funyula	-	2560	20480	2460	25600
Budalangi	-	-	7680	11520	19200
Township	1900	-	-	-	1900
Matayos	9900	6600	-	-	16500

Source: District Agricultural Office, Busia, (Kenya) 1996

LM*= Lower midland zone

APPENDIX III

Table 6.3: Livestock production by Division

Division	Area in sq.km	Household No.	Livestock being reared	Livestock products	Land carrying capacity
Kilgoris	445	2,588	Poultry Bees Cattle Sheep Goats	Honey Milk Beef Skins Hides Mutton Eggs	111
Keiyan	467	4,508	,,	,,	98
Pirrar	404	4,328	,,	,,	109
Kirindoni	632	6,576	,,	Honey Milk Beef Hides/skins Eggs	123
Lolgorian	640	3,605	,,	Hides/skins Beef Honey Eggs Mutton	58

Source: District Livestock Production Office, Kilgoris, 1996.

APPENDIX IVa

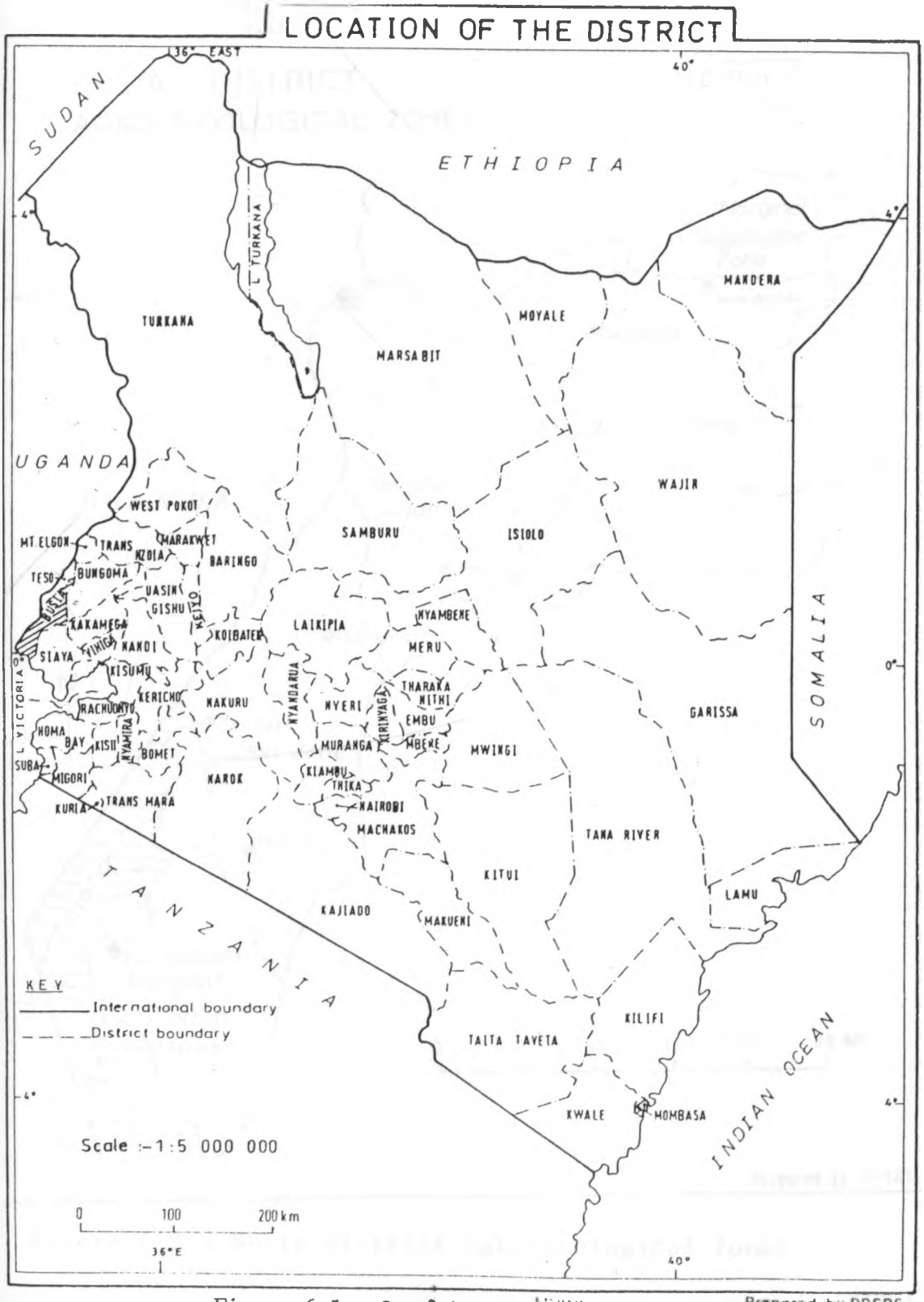


Figure 6.1 : Location of Busia District on the Kenyan map

APPENDIX IV b:

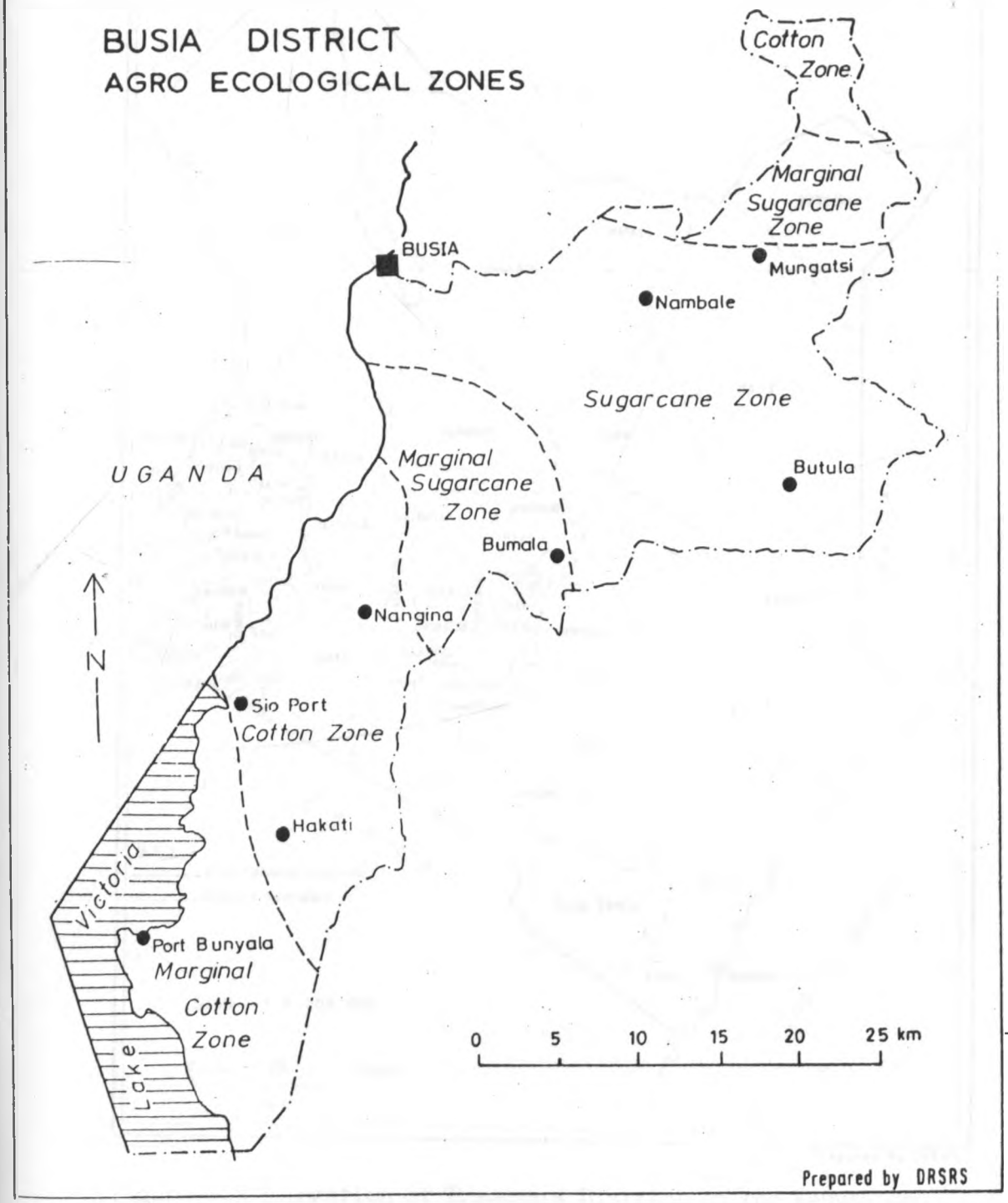


Figure 6.2 : Busia District Agro-Ecological Zones

APPENDIX IV c:

Figure 6.3 : Location of Transmara District on the Kenyan map

APPENDIX IV d:

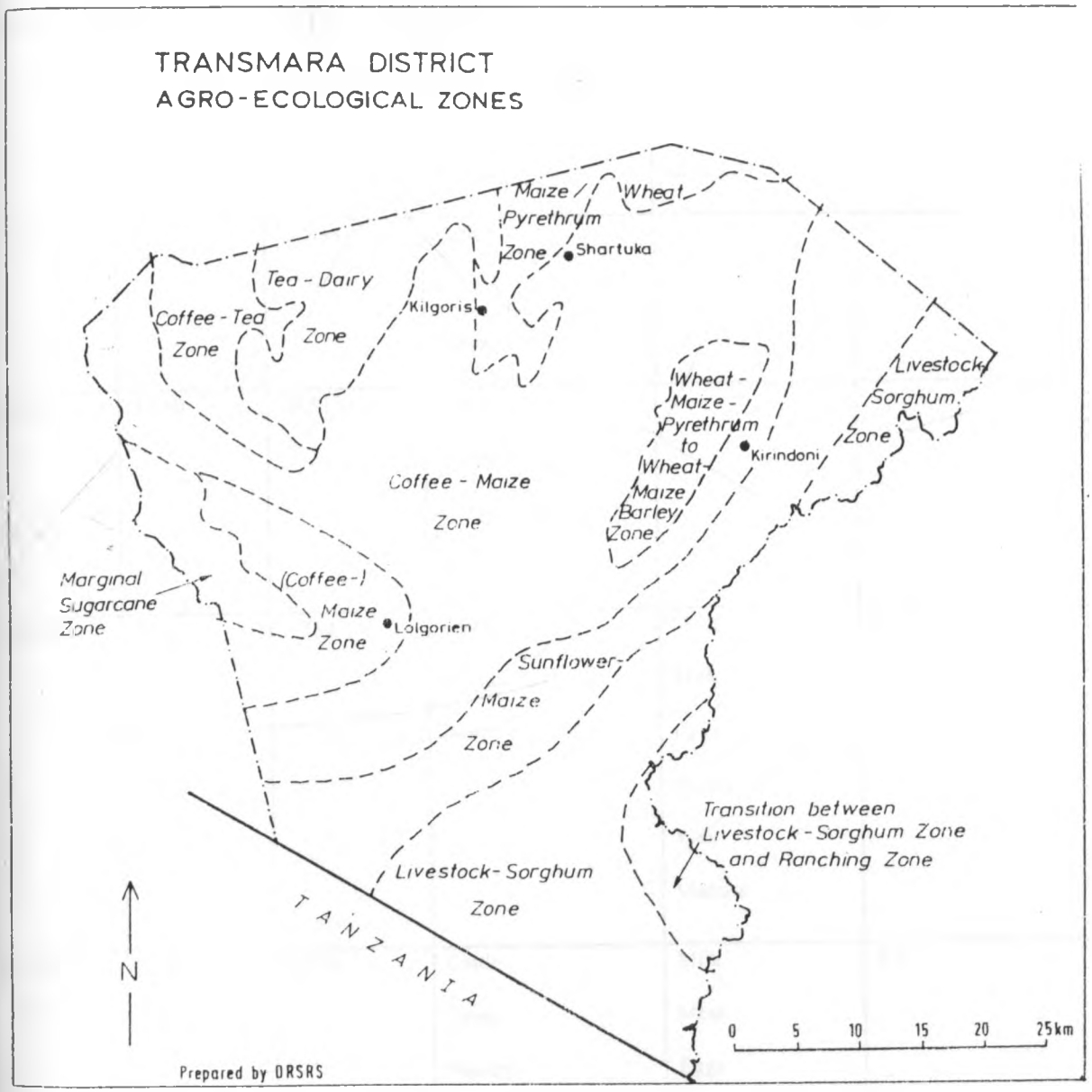


Figure 6.4 : Transmara District Agro-Ecological Zones

APPENDIX IV e:

Table 6.5: Livestock production by Division

Division	Area/sq.km	H. Hold No.	Main livestock reared	Livestock products	Land carrying capacity
Kaloleni	914	20,533	Cattle Poultry Goats	Milk Meat Eggs Manure	12
Baharini	827	29,898	Cattle Poultry Goats	„	1
Malindi	3,540	20,513	Cattle Poultry Grade goats Sheep	„	3-5
Magarini	729	5,752	Cattle Poultry Bees	Meat Milk Eggs Honey Wax Manure	3-5
Marafa	3,342	3,978	Cattle Goats Poultry Bees	Milk Meat Eggs Honey/wax Manure	4-5

Source: District Livestock Production Office, Kilifi, 1996

APPENDIX IV f

Figure 6.6 : Location of Kilifi District on the Kenyan map

APPENDIX IV g:

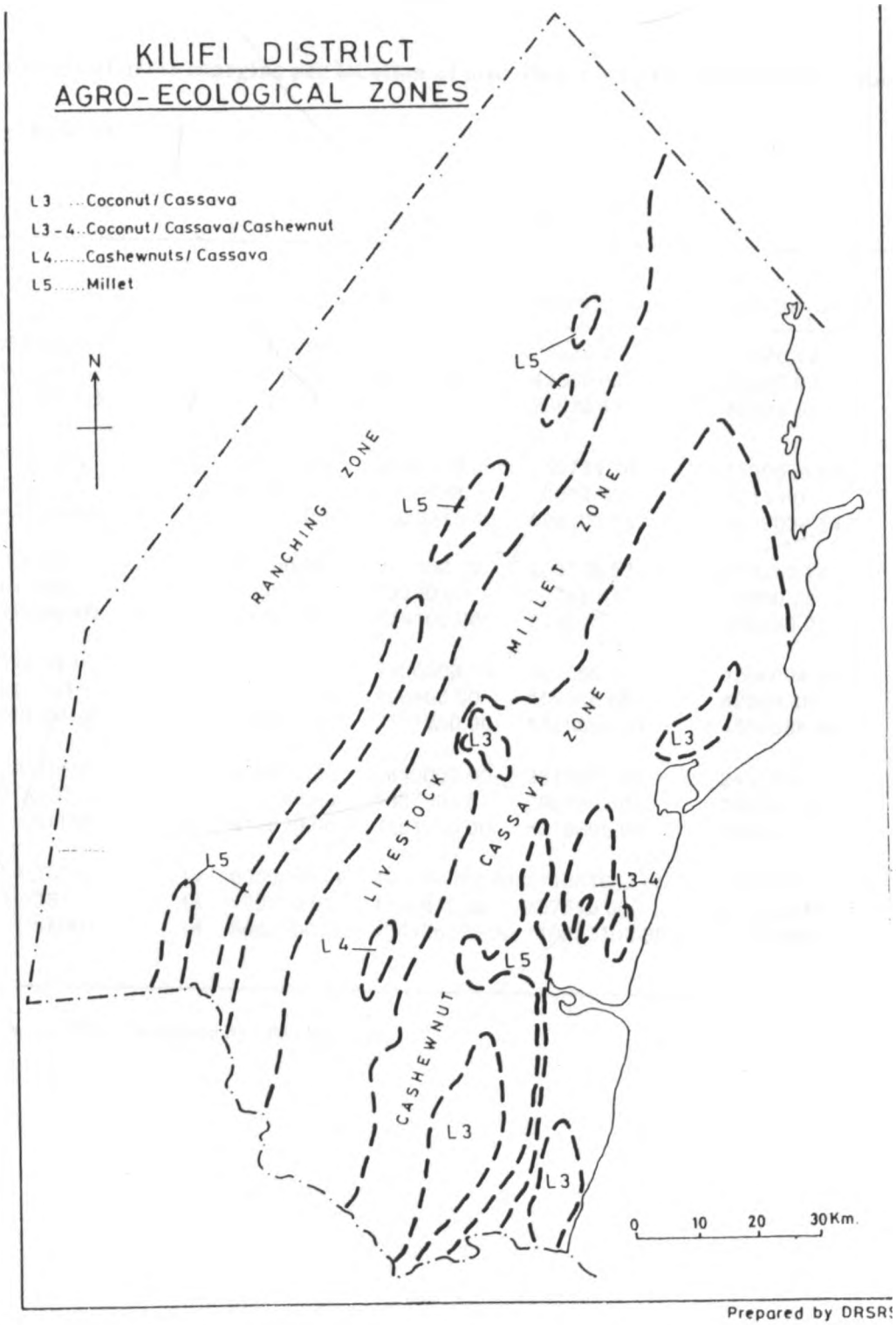


Figure 6.7 : Kilifi District Agro-Ecological Zones

APPENDIX V

Table 6.4: Analysis of gross margins per location of interview for tsetse and trypanosomosis control inputs traders

Descriptive Statistics — All Units In Kshs

District of Interview	N		Minimum	Maximum	Mean	Std. Deviation
Kiffi	TOTALREV	8	23400.00	124250.00	71238.75	33670.14
	VARCOST	8	14250.00	66970.00	42560.62	19940.93
	GROSSMAR	8	9150.00	57280.00	28678.12	16193.03
Busia	TOTALREV	12	51780.00	6549700.00	719734.16	1839624.08
	VARCOST	12	6300.00	35400.00	21630.83	7211.80
	GROSSMAR	12	34368.00	6526215.00	698103.33	1839034.54
Trans Mara	TOTALREV	7	65250.00	741000.00	308328.57	279250.24
	VARCOST	7	6900.00	73240.00	32721.57	21880.28
	GROSSMAR	7	31760.00	734100.00	275607.00	292296.92
Mombasa	TOTALREV	3	725000.00	9790000.00	5535500.00	4558004.85
	VARCOST	3	132150.00	209400.00	159916.66	42960.45
	GROSSMAR	3	586800.00	9657850.00	5375583.33	4556688.09
Kisumu	TOTALREV	4	950000.00	6640000.00	3818625.00	2451180.17
	VARCOST	4	133380.00	563750.00	299820.00	204369.99
	GROSSMAR	4	816620.00	6281250.00	3518805.00	2426439.05
Nairobi	TOTALREV	14	6000000.00	405000000.00	111664642.85	105473792.94
	VARCOST	14	189000.00	1156875.00	707540.00	353410.13
	GROSSMAR	14	5467100.00	404126075.00	110957102.85	105369607.69

Source: Author's work, 2000 (Analysed by SPSS package)

APPENDIX VI

Table 6.5: Analysis of variable marketing costs for the traders in individual districts

strict erview	ofAll Costs In Kshs per annum	N	Minimum	Maximum	Mean	Std. Deviation
fi	Other variable costs	8	1500.00	9000.00	4818.75	2331.14
	Contributions made in public functions	8	1000.00	11375.00	4009.37	3259.16
	The cost of maintaining casuals	8	.00	.00	.0000	.0000
	Vehicle maintenance costs	8	.00	14000.00	4843.75	6031.07
	Fax costs	8	.00	.00	.00	.00
	E-mail costs	8	.00	.00	.0000	.0000
	Telephone costs	8	.00	35520.00	8515.00	11392.53
	Water costs	8	.00	4620.00	2517.50	1559.90
	Electricity costs	8	.00	8400.00	4002.50	2884.15
	Handling and packaging costs	8	.00	.00	.00	.00
	The drug losses	8	500.00	7000.00	3433.75	2319.66
	The local transport costs	8	1160.00	27000.00	10420.00	8145.84
sia	Other variable costs	12	900.00	5400.00	2362.91	1271.16
	Contributions made in public functions	12	750.00	5250.00	1851.66	1327.96
	The cost of maintaining casuals	12	.00	.00	.0000	.0000
	Vehicle maintenance costs	12	.00	9000.00	1791.66	3353.81
	Fax costs	12	.00	.00	.00	.00
	E-mail costs	12	.00	.00	.00	.00
	Telephone costs	12	.00	10800.00	5108.33	2879.87
	Water costs	12	.00	1800.00	678.00	708.81
	Electricity costs	12	.00	12600.00	3640.66	3168.95
	Handling and packaging costs	12	.00	3150.00	787.50	1215.45
	The drug losses	12	330.00	6300.00	2592.08	1614.50
	The local transport costs	12	980.00	10000.00	2818.00	2571.86
ans Mara	Other variable costs	7	900.00	3960.00	2701.42	1049.60
	Contributions made in public functions	7	.00	4455.00	1622.14	2052.54
	The cost of maintaining casuals	7	.00	.00	.00	.00
	Vehicle maintenance costs	7	.00	9900.00	3077.14	4072.30
	Fax costs	7	.00	.00	.00	.00
	E-mail costs	7	.00	.00	.00	.00
	Telephone costs	7	.00	7128.00	2932.57	3143.47
	Water costs	7	.00	840.00	204.85	356.99
	Electricity costs	7	.00	3564.00	1294.85	1668.10
	Handling and packaging costs	7	.00	.00	.00	.00
	The drug losses	7	1500.00	30000.00	9288.57	9684.26
	The local transport costs	7	4500.00	23000.00	11600.00	6737.21
mbasa	Other variable costs	3	3750.00	9000.00	6250.00	2633.91
	Contributions made in public functions	3	3000.00	6000.00	4666.66	1527.52
	The cost of maintaining casuals	3	.00	.00	.00	.00
	Vehicle maintenance costs	3	10000.00	30000.00	23333.33	11547.00
	Fax costs	3	9900.00	14400.00	12100.00	2251.66
	E-mail costs	3	.00	.00	.00	.00

	Telephone costs	3	12600.00	19200.00	16600.00	3515.67
	Water costs	3	3600.00	4800.00	4300.00	624.49
ppendixVI						
nt'd						
	Electricity costs	3	5400.00	9600.00	7000.00	2271.56
	Handling and packaging costs	3	4000.00	10500.00	8166.66	3617.08
	The drug losses	3	22500.00	50000.00	34166.66	14215.60
	The local transport costs	3	30000.00	60000.00	43333.33	15275.25
umu	Other variable costs	4	5000.00	7500.00	6375.00	1108.67
	Contributions made in public functions	4	4500.00	10000.00	7187.50	2357.39
	The cost of maintaining casuals	4	.00	18750.00	9312.50	8101.89
	Vehicle maintenance costs	4	10000.00	70000.00	38562.50	25379.10
	Fax costs	4	2700.00	30000.00	15675.00	13372.45
	E-mail costs	4	.00	.00	.00	.00
	Telephone costs	4	9000.00	48000.00	28500.00	17058.72
	Water costs	4	1440.00	7500.00	4185.00	2601.71
	Electricity costs	4	3240.00	45000.00	17460.00	18728.33
	Handling and packaging costs	4	3000.00	25000.00	10875.00	10427.32
	The drug losses	4	5000.00	175000.00	87500.00	76757.19
	The local transport costs	4	23250.00	162500.00	74187.50	62856.11
irobi	Other variable costs	14	10000.00	105000.00	37428.57	30505.89
	Contributions made in public functions	14	.00	9000.00	2757.14	3558.67
	The cost of maintaining casuals	14	.00	45000.00	21044.64	15173.64
	Vehicle maintenance costs	14	20000.00	135000.00	60644.64	33824.66
	Fax costs per annum	14	18000.00	162000.00	74828.57	50423.85
	E-mail costs per annum	14	.00	42000.00	7705.71	10401.48
	Telephone costs per annum	14	30000.00	375000.00	167100.00	117968.12
	Water costs per annum	14	3600.00	75000.00	25714.28	21869.60
	Electricity costs per annum	14	7200.00	420000.00	114977.14	123090.53
	Handling and packaging costs	14	.00	350000.00	68928.57	84584.47
	The drug losses per annum	14	10000.00	135000.00	46892.85	37402.27

APPENDIX VII

Table 6.6 : An analysis of the Capital Investments in tsetse and trypanosomosis control inputs trade per district. and town

District of Interview	All Units in Kshs	N	Minimum	Maximum	Mean	Std. Deviation
Kilifi	Initial investment	8	70000.00	300000.00	186250.00	69475.07
	Amount of initial investment	8	.00	100000.00	27500.0000	40266.9663
Busia	Initial investment	12	5000.00	150000.00	48666.66	43113.66
	Amount of initial investment)	12	.00	150000.00	45416.66	51144.10
Trans Mara	Initial investment	7	15000.00	500000.00	123571.42	171189.81
	Amount of initial investment	7	.00	50000.00	14285.71	24397.50
Mombasa	Initial investment	3	1000000.00	2500000.00	1666666.66	763762.61
	Amount of initial investment (Kshs)	3	.00	500000.00	166666.66	288675.13
Kisumu	Initial investment	4	1000000.00	5000000.00	3125000.00	1652018.96
	Amount of initial investment	4	.00	2500000.00	1000000.00	1080123.44
Nairobi	Initial investment	14	.00	15000000.00	5428571.42	4376586.05
	Amount of initial investment	14	.00	5000000.00	1500000.00	1732050.80

Source: Author's work, 2000 (Analyzed by SPSS package)

APPENDIX VIII

Table 6.7: List of trypanocidal drugs and pour-ons commonly sold in the Kenyan market

TRYPANOCIDAL DRUGS	POUR-ONS/INSECTICIDES
Samorin	Bayticol
Veriben	Spoton
Berenil	Steladon
Novidium	Triatix
Ethidium	Bovitraz
Norotryp	Sevin powder
Diminaphen	Almatix
Veridium	Tick graese
Dimaze	Taktick
Triquin	Pygrease
Diaminazine	Cypermethrin
Dimenil	Octopor
Fendona	

APPENDIX IX

Table 6.8: List of pharmaceutical firms and wholesale traders interviewed during the sample survey

PHARMACEUTICAL FIRMS	WHOLESALE TRADERS
Norvatis Pharmaceutical Ltd	Winam Chemists (Kisumu)
Sanofi Pharmaceutical Company Ltd	Hoersch Pharmaceuticals (Kisumu)
Highchem/Hoersch Pharmaceutical Ltd	Humana Pharmaceuticals (Kisumu)
Lesukut Pharmaceutical Ltd	Health Care (Coopers Bus.Partner)
Twiga Chemical Industries Ltd	(Kisumu)
Bayer Kenya Ltd	Faiz Pharmaceuticals (Mombasa)
Cooper Pharmaceuticals Ltd	Agro-Touch Pharmaceuticals
Mimea Mifugo Kenya Ltd	(Mombasa)
Nairobi Veterinary Centre	Badar Chemists (Mombasa)
Medipharm East African Pharmaceutical Ltd	
Jumbo Agrovet Pharmaceuticals Ltd	
Sigma Pharmaceuticals Ltd	
Licorne Pharmaceuticals Ltd	
Monks Medicare East Africa Ltd	

APPENDIX XI

A Study of the Structure and Performance of the Delivery Systems for Tsetse and Trypanosomosis Control Inputs and Services in Kenya.

Farmer Questionnaire

Date of interview: ----------

Location of interview: ----------

Name of interviewer: ----------

Name of farmer: ----------

2000

Section A: General Farm Information

1. How many separate farm plots do you have under your control? ----------

Please provide me with the following information for each farm.

Plot 1

Size of farm plot (area in acres)	
Is the farm plot owned or rented	
If it rented, what is the rental rate? (Kshs/acre)	
Area devoted to crops (acres)	
Area devoted to livestock keeping (acres)	
Area devoted to pasture (acres)	
Area left fallow (acres)	
Area devoted to buildings and roads (acres)	
Time taken to travel from homestead to plot (hours)	
Time taken to travel to nearest market center (hours)	
Distance to nearest market center (kms)	

Plot 2

Size of farm plot (area in acres)	
Is the farm plot owned or rented	
If it rented, what is the rental rate? (Kshs/acre)	
Area devoted to crops (acres)	
Area devoted to livestock keeping (acres)	
Area devoted to pasture (acres)	

Area left fallow (acres)	
Area devoted to buildings and roads (acres)	
Time taken to travel from homestead to plot (hours)	
Time taken to travel to nearest market center (hours)	
Distance to nearest market center (kms)	

Plot 3

Size of farm plot (area in acres)	
Is the farm plot owned or rented	
If it rented, what is the rental rate? (Kshs/acre)	
Area devoted to crops (acres)	
Area devoted to livestock keeping (acres)	
Area devoted to pasture (acres)	
Area left fallow (acres)	
Area devoted to buildings and roads (acres)	
Time taken to travel from homestead to plot (hours)	
Time taken to travel to nearest market center (hours)	
Distance to nearest market center (kms)	

Section B: Livestock Enterprise

1. Do you own any **cattle**? Yes ---------- No ----------

If YES, please complete the following table describing the **age and sex distribution** of your **cattle**

	Male (head)		Female (head)	
Age Group	Breed	Number	Breed	Number
<1 year	1		1	
	2		2	
	3		3	
	4		4	
1-4 years	1		1	
	2		2	
	3		3	
	4		4	
> 4 years	1		1	
	2		2	
	3		3	
	4		4	

Breed: 1= exotic; 2 = cross; 3 = indigenous; 4 = other (specify)

Please complete the following table showing cattle herd dynamics over the last one year.

	Male (head)						Female 9head)					
Age	Begin	Bght	Gift in	Sold	Gift out	Died	Begin	Bght	Gift in	Sold	Gift out	Died
< 1 yr												
1-4 yrs												
> 4 yrs												

If any of your cattle died over the last one year (as indicated in question no. 2 above), please complete the following table.

*Breed: 1 = exotic; 2 = cross; 3 = indigenous; 4 = other (specify)

** Cause: 1 = disease (specify if known); 2 = slaughter for home consumption; 3 = accident; 4 = calving; 5 = other (specify)

Please complete the following tables describing the numbers currently held and purchases , sales, and deaths over the past one year of your sheep, goats, and pigs of different ages and sexes.

Sheep

	Male (head)				Female (head)			
	Currently Held	Bought	Sold	Died	Currently Held	Bought	Sold	Died
< 12 months								
12-24 months								
24-48 months								

Goats

	Male (head)				Female (head)			
	Currently Held	Bought	Sold	Died	Currently Held	Bought	Sold	Died
< 12 months								
12-24 months								
24-48 months								

Pigs

	Male (head)				Female (head)			
	Currently Held	Bought	Sold	Died	Currently Held	Bought	Sold	Died
< 12 months								
12-24 months								
24-48 months								

Section C: Trypanosomosis and Tsetse Control

If you used **trypanocidal drugs** over the last one year, please complete the following table.

Name of animal treated	Age and breed* of animal	Brand name of drug used	Drug supplier	No. of treatments	Animal treated by whom?	Price of drug	Price of service

Breed: 1 = exotic; 2 = cross; 3 = indigenous; 4 = other (specify)

If you used **insecticide pourons** over the last one year, please complete the following table.

Name of animal treated	Months of year treated	Brand nanme(s) of pouron(s) used	Price(s) of pourons	Pourons applied by whom?	Equipment used if any

Did you use any **other drugs or chemicals** to treat your livestock over the last one year (including dipping)?

Yes---------- No----------

If YES, please complete the following table.

Name of drug or chemical	Usual source	Number of times bought/used over the past year	Most recent price paid (Kshs per unit)

4. Are there any **other arrangements** for Trypanosomosis control in your area?

YES ---------- NO ----------

If the answer is "YES" which ones?

Baits ----------

Bush clearing ----------

Tsetse traps ----------

Others, specify ----------

---

5 Which **agencies** provide the above services?

Government ----------

NGO's ----------

Community committees

Others, specify ----------

---

6 Are the **services** in (5) above provided at **cost** ?

YES ---------- NO ----------

If the answer is **YES**, please complete the following table.

TYPE OF SERVICE	**COST/CONTRIBUTION**
Tsetse traps	
Baits	
Bush clearing	
Other (specify)	

7 What **problems** do you face in procuring the above drugs and services

Timeliness ----------

Financial constraints ----------

Availability of drugs ----------

Information about the drugs ---------

Others, specify ----------

What **recommendations** can you make as pertains to how Tsetse and Trypanosomosis can best be controlled in your area?

APPENDIX XII

A Study of the Structure and Performance of the Delivery Systems of Tsetse and Trypanosomosis Control Inputs and Services in Kenya

Trader Questionnaire

Date of interview: ----------

Location of interview: ----------

Name of interviewer: ----------

Name/Title of Trader: ----------

2000

PART 1: ORGANIZATION/INDIVIDUAL CHARACTERISTICS

Please complete the following table about your characteristics (as an organization or individual).

Name of organization or individual	
Year of establishment	
Location of organization or individual (i.e. administrative region and city/town	
Nature of business/activities*	

Key:

*Nature of business/activities: 1= official/government agency; 2= parastatal; 3= private commercial; 4= private non profit; 5= local community organization; 6= other (specify)

In what specific activities (lines of business) are you currently involved?

Are you currently involved in selling trypanocidal drugs and insecticides/pourons)?

YES ---------- No ----------

If YES, complete the following table.

Control, technology	**Currently involved in delivery (tick as appropriate)**
Trypanocidal drugs	
Insecticides/pourons	

If NO, are you interested in selling any of these technologies?

Yes ---------- No ----------

If **YES**, why are you not doing so now? (Select from list below)

Lack of capital ----------

Lack of knowledge ----------

Lack of supplies ----------

Little profit ----------

Other: ----------

If you are currently NOT INTERESTED in delivering these technologies, please give a brief explanation. ----------

---

PART II: PROCUREMENT AND DISTRIBUTION OF TRYPANOCIDAL DRUGS

NOTE: Only complete this section if you are currently involved in selling trypanocidal ***drugs.***

In what year did your business begin to sell trypanocidal drugs? ----------

What was the initial investment in this line of business (in local currency)?

Amount of initial investment = ----------

Was any of these initial investment amounts borrowed?

YES ---------- NO ----------

If **YES**: Lender: ----------

Amount borrowed: ----------

If **NO**, please explain briefly: ----------

----------4 Is the

organization involved in any other line of business or trade?

YES ---------- NO ----------

If **YES**, please indicate which one(s) among the following possibilities apply,

1. Agricultural inputs ----------

Consumer non durables ----------

Consumer durables ----------

Research ----------

Aid/Development ----------

Others (specify) ----------

5 Please indicate the months in the year in which your sales of trypanocidal drugs are **high** (circle the appropriate months)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Specify month(s) with the **highest** sales ----------

6 Please indicate the months in the year in which sales of trypanocidal drugs are **low** (circle the appropriate months)

Jan Feb Mar Apr May J n Jul Aug Sep Oct Nov Dec

Specify month(s) with the **lowest** sales----------

7. Please provide a brief explanation of these seasonal changes in sales ----------

---

Please complete the following table for those trypanocidal drugs that you usually hold in stock.

Name of drug	**Typical units (e.g. 100gms packet**	**Current selling price per unit**	**No. of units currently in stock**	**Desired (preferred) no. of units in stock**	**Average length of time in stock before sale (days, weeks)**

9. From which among the following kinds of suppliers do your usually obtain trypanocidal drugs? (Please tick below as appropriate)

International drug companies ----------

Domestic agents of international drug companies ----------

Regional agricultural wholesalers ----------

Local agricultural wholesalers ----------

NGOs ----------

Government veterinarians ----------

Private veterinarians ----------

National agricultural research organizations ----------

International agricultural research organizations ----------

Other (specify)

---

10 Please provide the following information for the suppliers you identified in the previous question.

supplier	drug	Typical distance to the supplier in (km)	Typical mode of delivery	Usual duration of delivery (hours or days)	Usual delivery size(e.g no,kg,tons)	Frequency of purchases (e.g dailyy,week – ly-monthly

Delivery modes:1=airplane;2=rail;3=truck[specify capacity];4=car;5=motorcycle;6 =bicycle;7=donkey;8=foot;9=other[specify]

11. To which among the following possible kinds of customers do you sell trypanocidal drugs? (please tick below as appropriate)

Regional agricultural wholesalers ----------

Local agricultural wholesalers ----------

Local agricultural retailers ----------

NGOs ----------

Government veterinarians ----------

Private veterinarians ----------

National agricultural research organizations ----------

International agricultural research organizations ----------

Other[specify] ----------

Please provide the following information for the customers identified in the previous question.

customer	drug	Typical distance to customer (km)	Typical mode of delivery	Usual duration delivery(hours or days)	Usual delivery size (e.g no,of units ,kg,tons)	Frequency of delivery (e.g daily,weekly,monthly)

Delivery modes:1=airplane;2=rail;3=truck (specify capacity) 4=car;5=motorcycle;6=bicycle;7=donkey;8=foot ;9=other(specify)

13 Do you deliver any other products or services together with trypanocidal drugs?

Product:YES----------NO-------

Service:YES----------NO-------

If **YES**, please indicate which product and services and the prices that you charge in the table below.

product	Price charged for **product**	service	Price charged for **service**

14 Have the **quantities** you sell of trypanocidal drugs changed (i.e increased or decreased) significantly over the last five years?

YES---------- NO----------

If **YES**, please complete the following table

drug	**Direction of change in quantity sold**		**Percentage change in quantity sold**	
	increase	decrease	increase	decrease

15 Do you /your organization have any plans to expand sales of trypanocidal drugs in the next 12 months?

YES---------- NO----------

If **YES**, please explain briefly? ----------

----------16 Do you /your organization have any plans to **contract** your sales of trypanocidal drugs in the next 12 months?

YES---------- NO----------

If **YES**, please explain briefly? ----------

17.Have there been any major changes in your **sources of supplies** in recent years – i.e. any new suppliers entering the market or old suppliers leaving the market?

YES ---------- NO ----------

If **YES**, please complete the following table below.

Trypanocidal Drugs	**Organization(s) that recently began to supply to you**	**Organizations that recently stopped supplying to you**

Have these changes improved, worsened or left unchanged your overall business conditions? (Please tick where appropriate in the following table.

Criterion	Improved	Worsened	Unchanged
Prices paid			
Trading costs			
Reliability of supplies			
Packaging			
Access to credit			
Other(specify)			

Have there been any major changes in your **customers** in recent years-i.e. Any major new customers entering the market or old customers leaving the market?

YES ---------- NO ----------

If **YES**, please identify them in the table below.

Trypanocidal Drugs	Organization(s) that you recently began to supply	Organization(s) to which you recently stopped supplying

Have these changes improved, worsened or left unchanged your overall business conditions? (please tick where appropriate in the following table)

Criterion	Improved	Worsened	Unchanged
Prices changed			
Trading costs			
Reliability of demand			
Other (specify)			

PART III: PROCUREMENTS AND DISTRIBUTION OF INSECTICIDES/POURONS

*NOTE: Only complete this section if you **are currently involved** in selling **insecticides /pourons** used for tsetse suppression (pourons, sprays, e.t.c.).*

1. In what year did the individual /organization begin to sell insecticides/pour-ons? ----------

What was your initial investment in this line of business (in local currency)?

Amount of initial investment = ----------

Did you borrow any of these initial investment amounts?

YES ---------- NO ----------

If **YES**: Lender: ----------

Amount borrowed ----------

If **NO**, please explain why not: ----------

Please indicate the months in the year in which individual/organization's sales of insecticides/pour-ons are **high** (circle the appropriate months)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Specify month(s) with the **highest** level of sales: ----------

Please indicate the months in the year in which individual/organizations sales of insecticides/pour-ons are **low** (circle the appropriate months)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Specify month(s) with the **lowest** level of sales:----------

Please provide a brief explanation of these seasonal changes in sales. ----------

---

Please complete the following table for those insecticides/pour-ons that the individual/organization usually holds in stock.

Name of drug	Typical units (e.g. 100 gm packet)	Current selling price per unit	No. of units currently in stock	Desired no. of units in stock	Average length of time in stock before sale (days, weeks)

8 From which among the following kinds of suppliers do you usually obtain insecticides/pour-ons? (please tick below as appropriate)

a) Regional agricultural wholesalers ----------

b) Local agricultural wholesalers ----------

c) Local agricultural retailers ----------

d) NGOs ----------

e) Government veterinarians ----------

f) Private veterinarians ----------

g) National agricultural research organizations ----------

h) International agricultural research organizations ----------

i) International drug companies ----------

Other[specify] ----------

Please provide the following information for the suppliers you identified in the previous question.

Supplier	Drug	Typical distance to supplier (km)	Typical mode of delivery*	Usual duration of delivery (hours or days)	Usual delivery size (e.g. no. of units, kg, tons)	Frequency of purchase (e.g. daily, weekly, monthly)

Delivery modes:-1= airplane; 2= rail; 3= truck; 4= car; 5= motorcycle; 6= bicycle; 7=donkey; 8= foot; 9= other (specify)

To which among the following kinds of customers does the individual/organization sell insecticides/pour-ons? (please tick below as appropriate)

a) Regional agricultural wholesalers ----------

b) Local agricultural wholesalers ----------

c) Local agricultural retailers ----------

d) NGOs ----------

e) Government veterinarians ----------

f) Private veterinarians ----------

g) National agricultural research organizations ----------

h) International agricultural research organizations ----------

i) International drug companies ----------

j) Other (specify) ----------

Please provide the following information for the customers identified in the previous question.

Supplier	Drug	Typical distance to supplier (km)	Typical mode of delivery*	Usual duration of delivery (hours or days)	Usual delivery size (e.g. no. of units, kg, tons)	Frequency of purchase (e.g. daily, weekly, monthly)

Delivery modes:-1= airplane; 2= rail; 3= truck; 4= car; 5= motorcycle; 6= bicycle; 7=donkey; 8= foot; 9= other (specify)

Have the quantities you sell of insecticides/pour-ons changed (i.e. increased or decreased) significantly over the last five years ?

YES---------- NO

If YES please complete the following table.

Drug	Direction of change in quantity sold		Percentage change in quantity sold	
	increase	decrease	increase	decrease

Have the prices of the insecticides/pour-ons you sell changed significantly over the last five years?

YES NO

If YES, please complete the following table.

Drug	Direction of change in price		Percentage change in price	
	increase	decrease	increase	decrease

Do you/your organization have any plans to expand sales of insecticides/pour-ons in the next 12 months?

YES----------NO----------

If YES, please explain briefly? ----------

Have there been any major changes in your sources of supplies in recent years –i.e. any new suppliers entering the market or old suppliers leaving the market?

YES----------NO----------

If YES ,please identify them in the table below.

Insecticides/pour-ons	Organizations that recently began to supply to you	Organizations that recently stopped supplying to you

Have these changes improved, worsened or left unchanged your overall business performance? (please tick where applicable in the following table)

Criterion	Improved	Worsened	Unchanged
prices paid			
trading costs			
reliability of supplies			
packaging			
access to credit			
other (specify)			

Have been any major changes in your customers in recent years –i.e. any major new customers entering the market or old customers leaving the market?

YES NO

If YES ,please identify them in the table below.

Insecticides/pour-ons	Organizations that you recently began to supply	Organizations to which you recently stopped supplying

Have these changes improved, worsened or left unchanged your overall business performance? (please tick where applicable in the following table)

Criterion	Improved	Worsened	Unchanged
Prices charged			
trading costs			
reliability of demand			
other (specify)			

19 What local costs do you incur for the following per annum?

Transport----------

Rental/storage space----------

Drug losses----------

Handling and packaging----------

Tax----------

Other, specify. ----------

---

20 What type of distribution network do you face in the marketing of your drugs?

Importer----------⇒consumer

Importer ----------⇒wholesaler----------⇒consumer

Importer----------⇒wholesaler----------⇒retailer----------⇒consumer

Importer----------⇒retailer----------⇒consumer

Others, specify. ----------

---

17. What legal requirements do you face in the importation and sell of your drugs? ----------

---

What costs are associated with these legal requirements? ----------

---

---

18. Do you have sufficient information regarding market demand for your products?

YES----------NO----------

If the answer is NO, explain why not? ----------

---

19 What problems do you face in marketing your products?----------

---

What recommendations can you give regarding the solutions to the above problems?