STRUCTURAL REFORM OF VETERINARY SERVICES IN NORTH-WESTERN NIGERIA: HERDERS' RESPONSE TO SERVICE COST AND FEASIBILITY OF PRIVATE DELIVERY

BY

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DECLARATION

I, Kpotun Mohammed Baba, hereby declare that this Dissertation was written by me and that it is a record of my own research work. It has not been presented before in any previous application for a higher degree. References made to published and unpublished literature have been duly acknowledged.

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CERTIFICATION

This Dissertation entitled "Structural Reform of Veterinary Services in North-Western Nigeria: Herders' Response to Service Cost and Feasibility of Private Delivery" by Kpotun Mohammed Baba meets the regulations governing the award of the degree of Doctor of Philosophy (Agricultural Economics) of Ahmadu Bello University, and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

To Mustapha, Jiyah and Fatima

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Abstract

It appears that the present economic crisis has caused inadequate funding of veterinary services leading to their ineffectiveness, high livestock morbidity and mortality and the consequent low productivity in the livestock sub-sector. In an apparent effort to ensure better funding of veterinary services, some donor-assisted projects in north-western Nigeria, have started experimenting with structural reform by introducing cost-recovery and inviting private veterinarians to establish practices.

While there is inherent logic in making those who use veterinary services to pay for them, it appears that the full implications of privatization of veterinary services have not been sufficiently examined. The objectives of this study, therefore, were to examine the response of pastoralists to the cost of veterinary services, the economic feasibility of private practice and the institutional environment necessary for the success of privatization. The study also compared the effectiveness of veterinary services between an area where reform in terms of cost-recovery has been attempted and where no reform has been made.

A field survey covering Fulani pastoralists and veterinary personnel was conducted in north-western Nigeria between 1996 and 1997. Cluster sampling, based on the major provider of veterinary services, was used in selecting 150 herders in the Zamfara Grazing Reserve (covering Kaura Namoda, Zurmi and Birnin Magaji Local Government Areas) where Zamfara Environmental Protection Agency has introduced cost-recovery, and 150 from Wurno, Rabah and Goronyo Local Government Areas where the Sokoto State Ministry of Agricultue is the major provider. The veterinary personnel who were randomly sampled consisted of six professional veterinarians and nine paraprofessionals working with the Sokoto State Ministry of Agriculture, Usmanu Danfodiyo University Sokoto and Zamfara Environmental Protection Agency. The data collected were analysed using descriptive statistics, multiple regression and farm (break-even) budgeting.

The study revealed that the provision of veterinary services in the area was dominated by the three state governments (that is, Sokoto, Kebbi and Zamfara) working through their respective ministries of agriculture or through donor-assisted projects such as the Zamfara Environmental Protection Agency and the Second Pilot Livestock Development Project (SPLDP), The services of the state governments, however, is now mainly reduced to annual vaccination campaigns with the exception of skeletal curative services provided by zonal veterinary clinics located in the three state capitals.

There was one professional to 53,315 veterinary livestock units (VLUs) and one paraprofessional to 15,328 VLUs; both ratios exceeded the recommended ratios suggesting under-supply of veterinary personnel.

It was found that veterinary services, as measured by proximity to a functional veterinary service post, number of sick animals,as well as calving and calf mortality rates, were more effective where cost-recovery has been attempted. Majority (75%) of the herders considered it proper for them to pay for veterinary services and some even paid for goods with negative or positive externalities suggesting that a wide range of veterinary services could be suitable for privatization. The demand functions estimated revealed low response of herders to cost of service which is a further indication of their willingness to pay.

The study revealed that private provision was potentially feasible since the actual veterinary livestock units per unit area exceeded the number of units required to break-even. Infact, providers could make reasonable additional incomes

Some of the necessary institutional mechanisms examined were with respect to the determination of who should be allowed to establish a private practice, provider selection and regulation procedures, provision of basic infrastructural facilities, information dissemination mechanisms, and provision of take-off capital. Regarding the selection and regulation of private providers, short-term competitive franchise bidding in which herders or their cooperatives and the Nigerian Veterinary Medical Association would play active roles was advocated

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CHAPTER ONE

INTRODUCTION

1.1 The Economic Situation in Nigeria

The economic fortunes of Nigeria were dramatically transformed following the discovery of oil and its commercial exploitation in the early 1970s. Since then, petroleum became the most dominant factor in the economy, replacing agriculture as the leading revenue and foreign exchange earner and contributing in most parts of the late 1970s more than 90% of total exports (FOS, 1979). During this period of oil boom, government was able to provide most public services fairly well. By the early 1980s, however, the Nigerian economy began to experience severe economic crisis due mainly to a sudden decline in the international prices of crude oil. The economy was further weakened by the faltering world economy whose reverberating effects were felt most severely in African economies.

Some of the first casualties of the economic crisis were public services which government could no longer support with the level of funding required for effective performance. Consequently, many public services (including livestock support services) became ineffective.

The initial policy response to the economic crisis was external borrowing, and by 1986, the country's external debts stood at N41.16 billion. This increased to N133.96 billion in 1988 and to N648.81 billion in 1994 (CBN, 1988, 1994). This measure, however, did not seem to have salvaged the situation. If anything, it further weakened the economy since the country now had to commit a major proportion of its declining foreign exchange earnings to debt servicing. Alternative solutions to the economic problem, therefore, had to be explored.

In 1986, prodded by creditors, the government introduced the Structural Adjustment Programme (SAP). The components of SAP include privatization of public holdings, introduction of cost-recovery, currency exchange and interest rates deregulation,

trade liberalization, promotion of non-oil exports and debt conversion. This study is concerned mainly with the first of these components (i.e privatization) as it affects provision of veterinary services.

The argument for privatization, a strategy especially favoured by the creditors, is usually predicated on:

(1) the notion that markets perform more efficiently than public hierarchies,
(2) the desire to reduce public spending by cutting the size of an apparently "over-extended" public sector, and
(3) the need to generate revenue for government.

On the basis of these arguments, several public responsibilities and services in Nigeria have been devolved to the private sector. In the livestock support services sub-sector, government has introduced projects based on cost-recovery and has encouraged more private sector participation in the delivery of veterinary goods and services, with the apparent aim of partially withdrawing from the provision of these services ultimately. But there is no evidence to suggest that these moves have been supported by necessary institutional build-up to guarantee their success.

1.2 *The Livestock Sub-Sector and the Economy*

The livestock sub-sector plays a crucial role in the Nigerian economy. It provides animal protein (in the form of meat, milk and egg) to the populace and serves as a source of revenue and foreign exchange to the country. In addition, it provides employment to those who are engaged in livestock production, processing and/or marketing. For many people, livestock is also a form of stored wealth, a cushion against starvation when food is scarce, a source of fertilizer (organic manure), a means of transportation, and a source of traction in crop production. Livestock also serves as a source of raw materials for some industries and has socio-cultural value as well. The benefits of the livestock sub-sector are, therefore, numerous.

It is generally believed, however, that the sub-sector has not performed some of the above-stated roles satisfactorily. This is particularly evident in the case of protein provision and that of revenue and foreign exchange generation. For instance, the rate of growth in the supply of livestock products (estimated at about 1.8% per annum) continues to lag behind the growth in demand (estimated at about 5.1% per annum) (Mokah, 1990). Consequently, the protein intake of the populace remains a far cry from the recommended rate. Per capita daily animal protein intake in Nigeria has been variously estimated at 5g (Isitor, 1990), 6.8g (FAO, 1988), 7g (Nwosu, 1990), 7.5g (Oyenuga, 1975), and 8g (Umunna, 1990). Regardless of the rate chosen to be correct, it is evident that animal protein intake in Nigeria is far below the Food and Agriculture Organization (FAO) recommended minimum requirement of 35g per capita per day.

In terms of revenue and foreign exchange generation, the sub-sector does not fare better. Livestock presently contributes about 40% of national income from agriculture and about 6.5% of the total GDP. The latter figure represents a decline from over 10% of the GDP in 1960. The sub-sector's contribution to exports has also declined from over 1.82% in 1967 to as low as 0.02% in 1985 (FOS, 1967, 1985). It is widely believed that livestock could make more significant contribution to both the GDP and exports particularly in line with the current efforts being made to diversify the economy in order to reduce the dependence on oil.

The rather dismal performance of the livestock sub-sector would seem surprising considering the relatively large livestock population in the country. Nigeria has an estimated 13 million cattle, 13 million sheep, 26 million goats, 240 million fowls, one million pigs, 250,000 horses, 700,000 donkeys, and 18,000 camels (Suleiman, 1990; Kela, 1991). These figures compare favourably with what obtains in some developed countries (Umunna, 1990). What then accounts for the poor performance of the Nigerian livestock sub-sector?

The answer to this question probably lies in the low productivity of the livestock. The low productivity, in turn, has been attributed to several unfavourable characteristics of the predominating nomadic production pattern (Oyenuga, 1973; Alao, 1973; Allan,

1975; Gefu, 1989). But perhaps, the most important of these factors is livestock diseases whose effects are aggravated by poor nutrition and bad management This assertion is in agreement with Sansi (1975), who observed that the poor state of health of the national livestock population accounts for the high mortality and morbidity rates which, in turn, account for the low productivity.

It would appear from the foregoing, therefore, that the full potentials of the Nigerian livestock sub-sector cannot be realised without effective disease prevention and control in the national livestock population.

1.3. The Role of Veterinary Services

Sansi (1975) lucidly underscored the significance of veterinary services when he noted that the health of an animal is crucial to its productivity either in the form of food conversion to put on flesh or in the production of milk or in the production of young ones. Without an effective veterinary services, the health of the animal cannot be preserved which implies that productivity will be low.

In Nigeria, veterinary services appear to have become ineffective, leading to high rates of mortality and morbidity in the livestock sub-sector. Evidence from literature suggests that mortality rate in traditionally raised livestock could be as high as 15% and sometimes even more (Pullan, 1980; Green Revolution Committee, 1981; Mohammad-Baba and Abdullahi, 1988; Tekdek and Goje, 1988). The economic losses caused by livestock diseases, as suggested by the scanty information available on the subject, are quite enormous. For instance, the annual economic losses associated with bovine tuberculosis alone in Nigeria has been estimated to be more than N14 million at 1984 prices (Alonge and Ayanwale, 1984), while the country lost more than N1.2 billion as a result of the reappearance of rinderpest in the country between 1980 and 1983 (Lamorde, 1984; Wosu, 1989).

Given the widening supply-demand gap for livestock products, as well as the increased revenue and foreign exchange contribution expected from the livestock sub-

sector, the country cannot afford these and other losses caused by diseases. It is, therefore, necessary to bring livestock diseases under effective control. This could be achieved only through the provision of effective veterinary services. Such services would reduce mortality rates and minimise the effect of disease on animal growth and fertility, quality of livestock products, and work output of draught animals.

Veterinary services include curative and preventive measures, as well as the provision of veterinary drugs and supplies or inputs. Curative services include clinical intervention to provide veterinary care to sick animals, while preventive services consist of vaccination, vector control and eradication programmes, livestock health care research and extension, and other disease control measures such as quarantines, the slaughter of diseased animals, and movement restrictions. Livestock diseases are prevented from being transmitted to humans through veterinary inspection and quality control (Umali *et al.*, 1992).

It is evident, therefore, that veterinary services are essential not only for the realization of the full potentials of livestock, but also for preserving the health of humans. We can thus conclude, as did Uzoukwu (1974), that veterinary services are crucial in keeping animals healthy in order to ensure the health and happiness of man.

1.4 Problem Statement

The major provider of veterinary services in Nigeria since independence, has been the public sector (including the federal, state, and local governments) which perform veterinary functions free-of-charge or at subsidized rates to herders. Recent reports, however, indicate that governments at all levels have not been able to discharge these responsibilities effectively. The ineffective delivery of veterinary services probably accounts for the reappearance in the country, of such diseases as rinderpest and contagious bovine pleuropneumonia (CBPP) (which were formerly under effective control) in the 1980s. It also accounts for the high morbidity and mortality, as well as the concomitant low productivity in the country's livestock sub-sector (Suleiman, 1990; Kela, 1991).

The inability of government, to effectively deliver veterinary responsibilities, which it assumed almost exclusively since independence, could be attributed to poor funding. Funds for veterinary services are mainly provided through annual budgetary allocation to the livestock sub-sector. It appears, however, that such allocations have become inadequate and have maintained a declining trend probably due to the current economic depression.

In north-western Nigeria (that is, the erstwhile Sokoto State, comprising the present Kebbi, Zamfara and Sokoto States) for instance, approved budgetary estimates for the Veterinary Division, in real terms, decreased from N423,772 in 1987 to N162,226 in 1990 (or by nearly 62%). Following the state creation of 1991, the funding increased momentarily to N547,658 in 1992 for just the present Sokoto and Zamfara before plummeting again to N330,312 in 1994 (MANR, 1996). Discussions with personnel of the Division suggest that actual release of funds over this period had witnessed an even more drastic decline. This decline in funding portends several negative consequences for veterinary services.

For instance, transportation facilities are lacking as all vehicles in the Veterinary Services Divisions of the three states have become unserviceable while no capital projects have been undertaken since 1987 as plans to establish a model clinic in Sokoto and properly equipped clinics in other locations had to be abandoned due to non-availability of funds (MANR, 1996). In addition, supply of drugs is limited mainly to whatever assistance is obtained from the Federal Department of Livestock and Pest Control Services (FDLPCS), while most veterinary equipment are either not available or non-functional.

With these constraints, the function of the state governments' veterinary services has been reduced mainly to the annual vaccination campaigns against rinderpest and CBPP. It should be noted that even the vaccination coverage has been on the decline due to inadequate funding. For instance, vaccination figures obtained from the Sokoto State Ministry of Agriculture and Natural Resources showed a decline from 1,770,837 heads of cattle in 1980 to as low as 290,605 in 1991 (MANR, 1996).

A cursory look at the present government veterinary services in the area reveals a picture in which government is saddled with the responsibility of paying salaries of veterinary personnel whose skills it cannot effectively employ because of non-availability of funds for purchasing drugs, veterinary equipment, transport facilities and materials necessary for meaningful veterinary service delivery. The near-collapse state of veterinary services probably accounts for the continuing high morbidity and mortality, and the consequent low productivity in the livestock sub-sector of the area.

It is against this background that arguments are being made for restructuring of veterinary services in the area and the country generally (Suleiman, 1990; Kela 1991; FDLPCS, 1994). The argument seems to be that, since the government is unable and/or unwilling to adequately fund veterinary services, there is no point in pretending that it is providing veterinary services free-of-charge, while nothing gets to the herder. Instead, it is reasoned, alternative means of finance should be explored in order to reduce the burden on government and improve the efficiency of veterinary services, with the ultimate aim of achieving the desired increase in livestock productivity. The arguments are mainly in favour of privatization (Suleiman, 1990; Kela, 1991).

The campaign for privatization of veterinary services has gained considerable attention in recent times. The Federal Department of Livestock and Pest Control Services (FDLPCS), which formulates livestock disease control policies in Nigeria, added further weight to the debate when it commissioned a study of the state of veterinary services throughout Nigeria and the feasibility of their privatization. The report of the study recommended privatization as the only way out of the present situation (Kela, 1991). In Zamfara State, the European Economic Community-assisted Zamfara Environmental Protection Agency introduced full cost-recovery in the provision of veterinary services as a first move toward the market. The Second Pilot Livestock Development Project in Sokoto State also introduced cost-recovery, and moved a step further by establishing a credit programme in collaboration with the Nigerian Agricultural and Cooperative Bank (NACB), for veterinarians wishing to establish private practices in the State.

While the privatization of veterinary services may possess the potential for increasing their effectiveness in the area, judging from the prospects of better funding and its reported success elsewhere in Africa (Umali *et al.*, 1992, 1994), it appears that no careful planning has been done to guarantee its success. Without careful planning, privatization may create more problems than solutions. There are certain pragmatic questions which must be answered before embarking on privatization of veterinary services. Such questions would include:

(1) *Given their economic nature, are veterinary services suitable for privatization?*
(2) Are Fulani pastoralists, whose production systems are generally not commercialized, able and willing to pay the full cost of veterinary care?
(3) What would be the effect of privatization on the quality of veterinary services?
(4) How economically feasible is private veterinary provision in the area?
(5) What institutional arrangements are required to ensure that veterinary services under privatization produce the most desirable social and economic outcomes?

This study is an attempt to provide answers to these and related questions that emerge as one previews the scenario of a privatized veterinary care in north-western Nigeria.

1.5 Objectives of the Study

The broad objective of this study is to empirically examine the manner in which Fulani pastoralist herders in north-western Nigeria respond to the cost of veterinary services and the economic feasibility of private provision of veterinary services in the area. The specific objectives of the study are:

(1) to describe the present state of veterinary services in north-western Nigeria,
(2) to compare the effectiveness of veterinary services in an area where cost-recovery has been attempted with an area where no reform has been attempted,
(3) to determine the herders' ability and willingness to pay for veterinary services and their degree of responsiveness to cost of veterinary care,
(4) to ascertain the economic feasibility of private provision of veterinary services in the area,

(5) to identify veterinary services suitable for privatization and those that have to be publicly provided, and

(6) to determine the appropriate institutional framework necessary for the success of privatization,

1.6 Justification of the Study

Poor funding over the years has rendered ineffective, the veterinary services provided by governments in north-western Nigeria. This has triggered a debate on restructuring of the services toward privatization, to ensure better funding and increased effectiveness. At the forefront of this argument are the country's creditors, led by the World Bank. Apparently yielding to donor pressure, some government projects in the area of study have begun to experiment with privatization and cost-recovery. However, there is no evidence to indicate that the arguments being made for the structural reform of the veterinary services are based on empirical information or even any economic theory of organization. The underlying arguments seem to be rooted in the so-called "miracle of the market". But there is no assurance that privatization haphazardly pursued would necessarily result in a more efficient delivery of services. The simple assumption of the efficacy of the market over government has to be supported by empirical evidence. This is particularly necessary in a domain such as veterinary care where moral hazard and market failure problems could hinder the smooth operation of the market.

Umali *et al.* (1992) underscored the importance of empirical information in structural reform when they warned that privatization of animal health services should never be pursued as one broad policy, but rather on a case-by-case basis, and only after the response of the herders to the additional cost has been empirically studied. This warning is instructive since willingness and ability of herders to pay for veterinary services is crucial to the privatization strategy. If they are unwilling or unable to pay, or exhibit high demand elasticity for veterinary services, privatization would be a failure. It would also have little chance of success if private veterinary practice is not lucrative enough to attract and sustain private veterinarians. Information on the extent of economic viability of private practice is, therefore, important.

Also important, is empirical information on the type of veterinary services to be privatized. The economic nature of various veterinary goods and services would likely differ and the provision of some may be more prone to market failure than others. Empirical information would, therefore, be required on the criteria to employ in choosing what goods and/or services to privatize. Privatization with any chance of success would also demand that certain institutions (or rules) be established for selection of providers, dissemination of information, regulation of providers, and so on.

Notwithstanding the obvious significance of empirical information on ability and willingness of herders to pay, economic feasibility of private provision, criteria for choice of services to privatize, as well as the necessary institutional environment, such information have not featured in the privatization debate. This is probably due to the paucity of such information, particularly about Nigeria, in the literature. The present study, therefore aims at contributing to the available scanty knowledge on these issues using north-western Nigeria as a case study.

The choice of north-western Nigeria for the study appears also to have some advantages. Firstly, the area habours a large proportion of livestock population in Nigeria, being second only to the erstwhile Borno State in terms of livestock population (Abdullahi, 1985; FDLPCS, 1992). Therefore, if solutions are found to the veterinary problems in the area, productivity of a large population of livestock could be improved Secondly, the herders in the area are mostly Fulani pastoralists. The Fulani are said to control up to 80% of the national ruminant livestock population in Nigeria (Awogbade, 1986). Hence, experiences from this study could serve as a guide for dealing with the animal health care problems of the Fulani in other areas in Nigeria.

1.7 Organization of the Dissertation

The dissertation is organised into five chapters. The first chapter introduced the study and provided background information on the economic environment of Nigeria. the role of the livestock sub-sector in the economy and the role of veterinary services in the

livestock sub-sector. The chapter also included the statement of the research problem, objectives and justification.

Chapter two is the Literature Review and it provides theoretical background to the study. It reviews veterinary policy trends in Nigeria and establishes the economic basis for structural reform. Some of the economic theories relevant to structural reform are also presented. The last section of the chapter reviews the findings of previous studies on structural reform of veterinary services.

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

Chapter four presents and discusses the results of the study. The chapter is divided into five sections. The first section describes the state of veterinary services in north-western Nigeria, while the second section examines the relative effectiveness of veterinary services provided by two organizational arrangements in the area. The third section determines the ability and willingness of Fulani pastoralists in the area to pay for veterinary services and their degree of responsiveness to the cost of veterinary care. The economic feasibility of private provision of veterinary services in the area is presented in the fourth section. Section five examines the institutional mechanisms necessary for the success of privatization of veterinary services.

Chapter five presents a summary of the study, the policy implications of the findings and the conclusion. The references and appendices to the study are presented after chapter five in that order.

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CHAPTER TWO

LITERATURE REVIEW

2.1 A Review of Veterinary Policies and Programmes in Nigeria

The history of veterinary services in Nigeria is perhaps as old as the history of the country itself. It dates as far back as the beginning of the colonial rule. According to Gefu (1989), the colonial era can be dated between the establishment of the Protectorate in 1900 and the attainment of political independence in 1960. The British colonial administration had taken at least indirect control of the area inhabited by the pastoral Fulani by 1903. Gefu captures the veterinary policy thrust of the colonial administration noting:

> At this time the ravages of the rinderpest epidemics were still very evident, so one of the first concerns of the colonial administration was to bring bovine diseases under effective control. The colonial government initiated disease control programmes in order to raise livestock production and ultimately generate higher income through the imposition of a cattle tax...In 1909, veterinary services were established within the then newly constituted Agricultural Department. Veterinary services offered included both curative and preventive care, through campaigns against diseases as well as the control and treatment of outbreaks. Vaccination and dipping centers were established for the treatment and care of animals as well as the prevention of serious bovine diseases. Initially, the services were provided at minimal or no cost to the pastoralist. In later years, token fees began to be charged for certain veterinary services (Gefu, 1989).

The colonial administration's policy on veterinary services took an even more organised form in 1914 when the first two veterinary surgeons were appointed. The veterinarians were located in Zaria where the animal disease control policy of the colonial government evolved (Sansi, 1975) The policy thrust continued to be on the control of rinderpest which was seen as the major threat to livestock production. By 1924, the small veterinary unit in Zaria moved to Vom which became the national headquarters of veterinary services (Wosu, 1989).

The strategy adopted for the rinderpest control policy was the Voluntary National Rinderpest Vaccination Scheme introduced in 1924. By 1930, a network of vaccination

centres and camps had been established to support the Scheme. In 1950, vaccination against rinderpest became compulsory (Wosu, 1989). Later on, the control of CBPP and trypanosomiasis were added, while legislative measures such as movement control and quarantines were introduced (Kela, 1991).

Constitutional changes in the early fifties led to the division of the country into three regions. Veterinary services were thereby decentralized and became the responsibilities of the new regional governments. The federal government, however, retained the responsibilities of research and training while the regional governments concentrated on the control of rinderpest, CBPP and trypanosomiasis. The veterinary services provided by the federal and regional governments were mostly free-of-charge, although governments obtained revenue from the livestock sub-sector through a cattle head tax called *jangali* (Kela, 1991).

During the decade that followed independence, there were a few policy changes such as the introduction of clinical and extension services in the regions, in addition to the control of the three diseases earlier mentioned. To support the newly introduced services, a network of Livestock Investigation and Breeding Centres (LIBCs) were established in the regions (Kela, 1991). This period also witnessed an international cooperation on immunization among West African countries known as Joint Project 15 (JP15). Under this Project, all cattle above six months of age were vaccinated against rinderpest in 1962/63, 1963/64 and 1964/65. This reduced the incidence of rinderpest in the country to zero, until 1980 when a major outbreak was again recorded.

The provision of veterinary services continued to be the responsibility of the regions until 1967 when they were replaced by 12 states. Thereafter, veterinary services formerly provided by the regions became the responsibility of states. As in the case of regions, the states provided veterinary services free-of-charge. The period from 1970 witnessed major organizational changes in the country. The 12 states increased to 19, then to 21, 30, and finally to 36. As each new state was created, it automatically assumed the veterinary functions of the old ones. In some states, the local governments have also assumed certain veterinary responsibilities.

Between 1970 and 1980, there was considerable expansion in the range of animal health services provided at federal, state and local government levels. The disease control policy accommodated such other diseases as anthrax, black quarter, brucellosis, Newcastle, and gumboro, in addition to the former three. This period also saw the establishment of the Nigerian Institute for Trypanosomiasis Research (NITR) and the Federal Livestock Department at the federal level (Sansi, 1975). The eventual establishment of the NITR was a culmination of the concern government had expressed about the limitations posed by tse-tse flies on livestock production in the country. For instance, in the Second National Development Plan, it was stated that "Among the most serious deterrents to the breeding and improvement of cattle is the presence of tse-tse fly in the southern well-watered part of the country" (Federal Republic of Nigeria, 1970). Therefore, the NITR was to research into methods of control of tse-tse fly and its ultimate eradication.

The animal health programmes of the states now included the establishment of control posts, initiation of veterinary meat inspection, setting up of more vaccination centres and establishment of cattle dips.

Today, the provision of veterinary services is still the major responsibility of the three tiers of government. The organizations which perform veterinary functions at the federal level include the FDLPCS, the National Veterinary Research Institute (NVRI), the National Animal Production Research Institute (NAPRI), the Nigerian Institute for Trypanosomiasis Research (NITR), and some universities.

With headquarters formerly in Lagos (now in Abuja), the FDLPCS undertakes disease surveillance and formulation of national animal health policies. It also designs and coordinates the implementation of national disease control and eradication programmes including vector control.

The NVRI has its headquarters in Vom (near Jos) and out stations in various locations in the country. Although the primary mandate of the Institute is to research into problems of animal production and diseases, it is the major producer of vaccines in

Nigeria. It also provides diagnostic support to the states and trains para-veterinarians and laboratory technicians at certificate and diploma levels. It is reputed to have been the institution that trained the first batch of graduate veterinarians in the country, although this function has since shifted to the universities.

The NAPRI, located in Zaria, primarily undertakes research into animal production and improvement. To a lesser extent, it also deals with animal health problems. The lead responsibility of NITR, with headquarters in Kaduna, is to research into the problems and control of trypanosomiasis, although its mandate has recently extended to onchocerciasis.

Some Nigerian universities are involved in training high level veterinary manpower at undergraduate and graduate levels. They include Ahmadu Bello University Zaria, University of Ibadan, University of Maiduguri, University of Nigeria Nsukka, and Usmanu Danfodiyo University Sokoto. Jointly, these universities graduate about 150 veterinarians in a year. The universities also conduct research in various veterinary disciplines and operate veterinary care on partial cost-recovery basis.

Perhaps, the most visible providers of veterinary care in Nigeria are the state governments. Most of the state governments have veterinary divisions in their ministries of agriculture. The staff profile of the state services include professional veterinary officers (vets), paraveterinarians (paravets) and livestock superintendents. The functions undertaken by the state veterinary divisions include field control of the major epidemic diseases of livestock present in Nigeria, the provision of extension and clinical services to the livestock sub-sector and services connected with the quality control of livestock products and public health. In addition, some of the states have developed their own laboratories for disease diagnostic work and their own institutions for training paravets.

In some states, attempts have been made to devolve some veterinary functions to the local governments, but this has not been successful in most others. To a limited extent, donor organizations also provide veterinary services initially at subsidized rates but recently at full cost-recovery.

In addition to the public sector services, the private sector is also involved in the provision of veterinary care but this has mainly been in the area of inputs supply. As far as clinical intervention for prevention or control of diseases is concerned, the role of private veterinary providers has been restricted to a few urban or peri-urban areas. In the past, it was argued that the involvement of the private sector at all, was not the result of any deliberate government policy on privatization (Kela, 1991), but in recent times, government has openly encouraged private sector participation (FDLPCS, 1994).

It is evident from the foregoing that the public sector has dominated veterinary provision since the colonial era. The services have also been provided either free-of-charge or at subsidized prices. Recent developments, however, show that the functions are not being effectively discharged by the government. Following this, arguments are being made for structural reform of veterinary services, with a view to transferring such responsibilities to the private sector.

2.2 Why Structural Reform?

Structural reform could be defined as a fundamental change from the old system of transaction or as an attempt to establish patterns of exchange that have not yet been institutionalised (Leonard, 1992). As used in this thesis, structural reform specifically refers to privatization of veterinary services or the transfer of veterinary responsibilities from government (public sector) to the market (private sector). The need for this transfer is usually rationalised on the grounds that markets are more efficient than governments. This argument is, in turn, grounded in the so-called *miracle of the market*.

The concept of the miracle of the market is perhaps as old as the history of modern economic thought. Quite early in the history of economics, some thinkers began to suspect that if economic transactions are left to the market forces, individual agents would organise their activities, as if guided by an unseen hand, such that the outcome would be in the overall best interest of the society. The market is said to transmit signals (especially in terms of prices and profits) which offer the agents incentive to operate efficiently.

In contrast, government is thought to offer no such personal incentives that could encourage efficient organisation of transactions or exchange. Wilson (1989) offers a number of explanations for the relative inefficiency of public organizations compared to private ones. He noted that, as against private organizations, public organizations:

(1) cannot lawfully retain and devote to the private benefit of their members the earnings of the organizations,
(2) cannot allocate factors of production in accordance with the preferences of the organizations' administrators - in most cases, this is dictated to them by the machinery of the state,
(3) must serve goals not of the organizations' choosing.

The basic question is: why put extra efforts to attain efficiency if you cannot keep the results of your efforts? In the case of Africa generally, and Nigeria particularly, the inefficiency of government organizations is further compounded by red-tape, corruption (Gould, 1980; Gould and Amaoro-Reyes, 1983; Klitgard, 1990; all cited in Leonard, 1993), and patronage (Joseph, 1987; Gros, 1993). These factors combine to raise the transaction costs of running public organizations exponentially and would appear to favour a pattern of exchange based on the market.

The above-stated arguments in favour of the market were initially challenged by observed market failure in a wide variety of circumstances, such as the presence of natural monopolies and in the provision of public goods or private goods with externalities (Friedman, 1962; Olson, 1965; Leonard, 1993). Under these circumstances, the conditions necessary for the perfect operation of the market are absent and the miracle of the market may be seriously constrained. Another threat to the miracle of the market is posed by the market's inability to address the problems of moral hazard or opportunism (to which most human agents are said to be subject) and distributional equity.

Notwithstanding the above-stated limitations of the market, however, some economists believed that even under imperfect conditions, the market still performs more efficiently than governments. Henry Sidgwick (as cited in Wolf, 1988) underscores this

point maintaining that "it does not follow that whenever *laissez faire* falls short, government interference is expedient; since the inevitable drawbacks of the latter may, in any particular case, be worse than the shortcomings of private enterprise". The case for the market is further strengthened by the emerging economic theories of organization which have provided insight into strategies for efficient organization of transactions under imperfect market conditions and in light of the moral hazard problems. Some of these theories which are later employed to discuss the findings of the study are outlined in the following sections.

2.3 Economic Principles Guiding Structural Reform

2.3.1 The New Institutional Economics

The New Institutional Economics (NIE) is one of the economic theories of organization that have recently received considerable attention in the structural reform literature. It deals essentially with how incentives work in social and economic systems (Leonard, 1993). As a fundamental departure from neo-classical micro-economics, NIE makes more realistic assumptions about human behaviour. It also recognises the existence of costs to transactions, which are ignored in the neo-classical doctrine. It offers a number of concepts about human and organizational behaviour under different institutional arrangements which are quite useful in the analysis of reforms. These include transaction *costs*, *bounded rationality*, *opportunism*, *incentives*, *principal-agent theory*, asset specificity, public and private goods, externalities, monopolies, game theory, and property rights. A few of these concepts which are relevant to this work are explained in the sub-sections that follow.

2.3.2 Behavioural Assumptions

According to Williamson (1985), the study of economic organization turns critically on two behavioural assumptions. The first of these assumptions has to do with the cognitive competence of man and maintains that the human agent is subject to *bounded*, as against *universal* rationality, which implies that his information or knowledge

about an exchange process, as well as his computational skills, are limited, leading him to behave in a routine, myopic, but reasonably adaptive manner. Williamson (1984, 1985) cites the work of Simon (1947) in which economic actors are assumed to be *intendedly* rational but only *limitedly* so. Probably due to this limitation, economic agents are said to *satisfice* rather than *optimise* (Leonard, 1992). Such limitation makes it impossible to fully anticipate all problems at the time of defining the terms of a contract or exchange and (therefore) create room for opportunistic behaviour (or moral hazard) by any of the parties involved in the process. This leads us to the second behavioural assumption which states that human economic agents are given to opportunism.

Opportunism has been described as the condition of self-interest seeking with guile and often involves incomplete or distorted disclosure of information in an attempt to mislead, disguise, obfuscate, or confuse. It complicates problems of economic organization or exchange by compounding uncertainty (Williamson, 1984, 1985). When examining privatization of veterinary services, it is crucial to recognise the limitations posed by bounded rationality and opportunism in any transaction (whether between veterinarian and herder, veterinarian and government, veterinarian and professional association, or government and professional association) and to design strategies to overcome them. Furthermore, because of the satisficing behaviour, some kind of resistance should be anticipated in structural reform.

2.3.3 Transaction Costs

Transaction costs have been defined as the costs of specifying and enforcing the contracts that underlie exchange (North, 1984, 1990). They have been likened to friction in physical systems in that they work against the efficiency of transactions (Williamson, 1985). These costs do not benefit any of the parties to the exchange and are, therefore, *dead losses* to the society (Leonard, 1997). Leonard (1997) considers distance as the most prominent transaction cost in veterinary services delivery in Africa. This is corroborated by Koma (1997) and Woods (1997) who, in separate studies in Africa, observed that where distance to veterinary providers was significant, demand for veterinary services was noticeably reduced. Other forms of transaction costs in veterinary

services include cultural distance, red tape and corruption. The efficiency of the exchange process is facilitated when transaction costs are minimised.

2.3.4 Private Goods, Public Goods, and Externalities

Generally, a good or service could be economically classified as either private, private with externalities, or public (Wolf, 1988). A good is said to be a pure private good where exclusion and rival principles apply. Exclusion applies where the individual consuming a service captures its full benefits, while the rival principle obtains when two or more individuals cannot consume the service at the same time (Wolf, 1988; Leonard, 1993). A pure public good or service, on the other hand, obtains where neither the exclusion nor the rival principles are at work. In between these two extremes (of pure private goods and pure public goods) is a spectrum of other goods which display varying degrees of private and public goods characteristics.

Externalities (also referred to as *spillover*, *third party*, or *external* effects) arise when an individual in the course of rendering (or consuming) some service for which payment is received (made), coincidentally also renders services or disservices to other persons for which payment cannot be exacted from the benefited parties or compensation enforced on behalf of the injured parties (Pigou, 1946; Umali *et al* , 1992). Because those who pay for a public good or a good with externality cannot prevent others who have not paid from benefitting, there arises a free-rider problem. In other words, nobody will take the initiative and pay for such services because everybody would want to wait and "free-ride". This results in market failure. Theoretically, therefore, government involvement is required in providing such services (Umali *et al* , 1992, 1994; Leonard, 1993). Private services with no market failure problem, on the other hand, could be outrightly privatized.

This economic distinction of goods and services are employed later in deciding which veterinary goods or services are suitable for privatization.

2.3.5 Agency Theory and Opportunism

Whenever one individual depends on the actions of another, an agency relationship arises (Pratt and Zeckhauser, 1985). According to Moe (1984), the principal-agent model is an analytical expression of the agency relationship in which one party, the principal, considers entering into a contractual agreement with another, the agent, in the expectation that the agent will subsequently choose actions that produce outcomes desired by the principal. It has been pointed out that it is rational for an individual to seek a professional agent to protect his interest in making decisions which require information that is costly and where the cost of error is high (Touhy and Wolfson, 1978). Some of the well-known agency relationships are lawyer-client, doctor-patient, politician-citizen, and employee-employer. In the same vein, the veterinarian is also agent to the herder, the principal

Wherever there exists an agency relationship, the problem of opportunism (moral hazard or hidden information) surfaces. This is mainly because there is usually information asymmetry in favour of the agent; often, the principal lacks the expertise to adequately monitor or evaluate the actions of the agent. According to Arrow (1985), the agency problem acquires interest when the information available to the two participants (in the agency relationship) is unequal. He noted that the economics literature has focused primarily on the case in which:

(1) the agent's action is not directly observable by the principal, and

(2) the outcome is affected but not completely determined by the agent's action.

He then identified two principal-agent problems which he termed *hidden action* and *hidden information*, respectively. The most typical hidden action problem, according to him, is the agent's effort. Effort is a disutility to the agent but it has value for the principal because the principal associates better outcome with more efforts. But the principal cannot observe the agent's effort because often he (the principal) lacks the expertise to do so. In the hidden information problem, the agent has made some observation which the principal has not made. The agent uses this information in making decisions however, the principal cannot check whether the agent has used his information in the way that best

serves the principal's interest. These two problems normally result in what has been referred to as *agency loss* (Dranove and White, 1987).

Both of the above-identified agency problems apply to the veterinarian-herder case. A herder is not in a position to observe the actions or information available to a veterinarian because he does not possess the skill or training to do so. Whether a veterinarian would exert sufficient effort on behalf of the herder will depend on whether the incentive between the two of them is compatible (Train, 1991). For instance, what would prevent a profit-driven veterinarian (agent) from providing sub-standard service to the herder (principal)? The principal-agent theory is a useful analytic tool in the design of mechanisms to align the incentive of the agent to that of the principal and "enforce" proper behaviour of the agent. Some of the agency theory postulates are as follows:

(1) a large stock of value that could be lost in a malpractice suit, such as reputation or assets subject to suit, is a strong incentive for good behaviour of the principal;
(2) long-term relationships develop the stocks of value needed for "enforcement" and make limited monitoring more effective; if the agent expects to make long-term repeated transactions, he/she is likely to behave properly since bad behaviour will be detected with time (Pratt and Zeckhauser, 1985);
(3) professional colleagues, through their associations, could undertake the monitoring mentioned in "(b)" above; (Touhy and Wolfson, 1978).

Agency theory is employed later in dealing with the problem of moral hazard in transactions between the various stakeholders in the veterinary services domain.

2.3.6 Monopoly and Franchise Bidding

A monopoly is said to exist where there is one and only one seller in the market. Two types of monopoly situations could arise in private provision of veterinary services, namely, the standard and natural cases. A characteristic feature of livestock production in Nigeria generally, is low livestock density. To obtain enough demand, it may be necessary to assign only one provider to a particular area. This would result in a standard

monopoly scenario.

A natural monopoly, according to Train (1991), arises from two sources: economies of scale and economies of scope. Economies of scale arises when the average cost of production decreases as output expands. In such a situation, there can be only one firm in the market, in the long-run; if there were two, one would expand to reduce cost and selling price, and (thereby) eliminate the other (Train, 1991; Demsetz, 1968; Leonard, forthcoming a). When more than one good is being produced, natural monopoly can arise from economies of scope as well. With several goods, there are sometimes shared equipment or common facilities that make producing them together less expensive than producing them separately (Train, 1991). Private veterinary provision appears to possess the features of a decreasing cost industry: it involves heavy initial investment in fixed assets (such as veterinary equipment and transportation facilities) but requires little fixed investment thereafter (Leonard, 1993).

A monopoly provider (regardless of the source of monopoly power) would charge prices that were higher, and produce output levels that were lower, than social optimum levels. The challenge then is how to make such provider behave in a manner consistent with optimality.

One of the solutions often proffered for the monopoly problem is direct regulation by the state or its appointed body through rate setting (that is, price control). A shortcoming associated with this method is that there may be information asymmetry between the firm and the regulating body which may not have detailed information (especially as regards cost structure) of the firm. Hence, there is no assurance that the price fixed by the regulator, would be the optimum. Another problem is the high transaction cost of enforcing price controls.

A second solution, often prescribed, is *ex ante* and *ex post* competitive franchise bidding, which is based on the theory of *contestable market* first postulated by Francois Perroux and developed by William Baumol (Wolf, 1988). The argument is that potential competition or the threat of competition, has the same effect as competition itself. In other

words, if providers are subjected to franchise bidding, they compete away their monopoly position. Thus, *ex ante* bidding is organized, and franchise awarded to the lowest bidder who will provide services at the prices quoted. Periodically, *ex post* bidding is organized and the lowest bidder is again awarded the contract. In this manner, it is argued, the monopolist will be disciplined to behave as if he were in a competitive market. The major threat to this proposition is the counter argument that the incumbent provider has advantages over others where there is high degree of asset specificity. Williamson's (1984) view on this problem is illuminating:

> Whether ex post competition is fully efficacious or not depends on whether the good or service in question is supported by durable investments in transaction specific assets. Where no such specialized investments are incurred, the initial winning bidder realizes no advantage over non winners. Although it may continue to supply for a long period of time, this is only because, in effect, it is continuously meeting competitive bids from qualified rivals. Rivals cannot be presumed to operate on a parity, however, once substantial investments in transaction specific assets are put in place. Winners in these circumstances enjoy advantages over non winners, which is to say that parity is upset...The reason why significant reliance investments (sic) in durable, transaction specific assets introduces contractual asymmetry between the winning bidder on the one hand, and non winners on the other is because economic values would be sacrificed if the on going supply relations were terminated... Not only is the supplier unable to realize equivalent value were the specialized assets to be redeployed to other uses, but the buyer must induce potential suppliers to make the same specialized investment were he to turn to an outsider.

But it has been argued that private veterinary service does not require substantial investments in transaction specific assets, with the exception of human assets. Leonard (1993) contends that the medical instruments, pharmaceutical supplies, laboratory equipment, refrigerators and vehicles all have a ready second hand market. Even in the case of human assets, he argues that an unsuccessful bidder could seek employment under a successful one to recoup the investment he had made in his own training.

Another approach to solving monopoly problem is through price discrimination, which is defined as the process of charging different prices to different consumers for the same service. Such charges are not based on differences in the production or marketing costs. It is argued that the supplier could base prices on the ability to pay. In other words, wealthy consumers should pay more than poor ones. The conditions required for successful price discrimination are differences in demand elasticity, ability to separate the

markets and the true value the consumer attaches to the commodity (that is, what he would be prepared to pay rather than go without the good).

The practical applicability of the various solutions to the monopoly problem with respect to private veterinary services delivery in north-western Nigeria are discussed in section 4.5.

2.3.7 Property Rights

Property rights establish the legal owner of a resource and specify how the resource may be used. Property rights are normally specified to avoid conflict of interests in an exchange process. According to Kenneth Leonard (forthcoming a), in order for property rights to be conducive to bargaining (exchange), they need to be extremely specific. He, however, lamented that in practice, laws and traditional rights generally tend not to be specific enough (thereby creating problems in the exchange processes).

An example could illustrate the significance of property rights to transactions. A probable problem in privatization of veterinary services is how to ensure sufficient demand to justify establishment of private practices. This problem could be real in north-western Nigeria, and, indeed, most of Africa, where most of the livestock is controlled by scattered nomadic small-holders. If, for example, in an attempt to ensure adequate demand, a provider is assigned to a given geographical area, or a specific population of herders, clear definition of property rights may be crucial to avoid encroachment into the area by others.

Another example could be drawn from the policy of various Nigerian governments on grazing reserves. In an attempt to settle the nomadic pastoralists, several patches of land have been designated as grazing reserves across the country which herders are supposed to use for grazing purposes. But probably due to the lack of appropriate specification and/or enforcement of the legal rights of the pastoralists to such facilities, the reserves sooner or later get converted into arable lands often resulting in conflicts between arable farmers and the herders.

In the reform of veterinary services, there are various interest groups and to avoid conflict, clear property rights definition and enforcement would be required.

2.3.8 Demand

The economist's concept of demand is rooted in the notion of what a person is willing and able to pay. It is seen to reflect both the strength of the person's desire to receive the service, that is, the value he places on it, and the amount he will sacrifice, in order to do so (Lee, 1983). Accordingly, demand has been defined as the quantities of a commodity that buyers are willing and able to buy, at alternative prices, in a particular market, within a specified period of time. Several factors, called demand determinants, affect the demand for a commodity. These determinants include the price of the commodity, income, availability and prices of related commodities, taste and preferences, and population changes. The quantity demanded of a commodity varies inversely with its price. This is the so-called universal law of demand which is said to be violated only in the infrequent case of commodities subject to the Giffen's Paradox (Gould and Ferguson, 1980). On the other hand, quantity demanded varies directly with income for normal goods and inversely for inferior goods. Prices of related commodities could have direct or inverse relationship with demand depending on the nature of the commodities in question. Prices of substitutes have direct relationship with the demand for a commodity, while those of complements are inversely related to demand. The commodity in fashion at any time normally records high demand. Therefore, taste is directly related to demand. The same is true for population changes.

To the above-mentioned determinants may be added other factors determined by the peculiar characteristics of the commodity in question. For instance, other factors that could play crucial roles in shaping the demand for veterinary services would include distance from veterinary post, herders' knowledge of disease symptoms, number of disease episodes, value (monetary and sentimental) attached to the animal, herders' perception of the effectiveness of veterinary interventions, herders' attitude toward risk, herd characteristics, and the virulence of the disease.

2.3.9 Demand Elasticity

The concept of elasticity describes the degree of responsiveness of demand to changes in the demand determinants, although it is frequently computed only for price of the commodity, income and price of related commodities. Price elasticity of demand measures the relative responsiveness of demand to changes in the price of the commodity while income elasticity refers to the relative responsiveness of demand to income. The response of demand to changes in the price of related commodities is called cross-elasticity of demand.

Notationally, the coefficient of price elasticity of demand can be defined as:

$$E = (q_2 - q_1)/(p_2 - p_1) \cdot (p_1 + p_2)/(q_1 + q_2) \quad \ldots\ldots (1)$$

where:

E = coefficient of price elasticity,

p_1 = initial price,

p_2 = final price,

q_1 = initial quantity, and

q_2 = final quantity.

Depending on the value of the elasticity coefficient, demand could be elastic, inelastic or unitarily elastic. It is said to be elastic if the absolute value of the coefficient is greater than one and inelastic if it is less than one. Demand has unitary elasticity if the coefficient is equal to one. Demand elasticity has a crucial relationship with revenue. If demand is elastic, a rise in price would be accompanied by a proportionately higher reduction in quantity demanded, leading to a fall in total revenue. If, on the other hand, demand is inelastic, a rise in price will cause a proportionately lower reduction in quantity and result in an increase in total revenue. Thus, the pricing policy adopted by a business will be influenced by the price elasticity of demand. Demand elasticity is important in analysing the effect of introduction of, or increase in, cost on level of consumption during structural reform.

2.3.10 The Break-Even Concept

The primary motivating factor of private enterprise is profit. A subject of concern to any entrepreneur, therefore, is the volume of output or sales where the financial returns from the business equals costs. This point is the break-even point (or the point of zero profit). Below the break-even point, a loss is expected and above the break-even point is profit. Notationally, the break-even volume of output is defined where:

$$TR = TC \quad \ldots\ldots (2)$$

where:

TR = total revenue and

TC = total cost.

Since TR at any given volume of output (Y) is

$$TR = UR.Y$$

and total cost is

$$TC = TFC + UVC.Y$$

then the break-even volume is the volume at which:

$$UR.Y = TFC + UVC.Y \quad \ldots\ldots (3)$$

where:

UR = unit revenue (output price),

TFC = total fixed cost and

UVC = unit variable cost.

Equation (3) can also be stated as:

$$Y = TFC/(UR - UVC) \quad \ldots\ldots (4)$$

(Anthony and Reece, 1979).

With respect to veterinary services provision, it is reasonable to state that no provider will be willing to establish a private practice where the population of livestock and/or prices that could be charged do not guarantee a break-even. The concept of break-even veterinary livestock units (that is, the number of veterinary livestock units that a veterinarian must treat in order to break-even) is employed later to determine the economic feasibility of private veterinary provision in the study area.

2.4 Review of Related Studies

2.4.1 Structural Reform of Veterinary Services

Relatively few empirical studies have been done on the economics of structural reform of veterinary services in Africa as a whole. In Nigeria, one of the few studies was conducted by Kela (1991) for the FDLPCS. The aim of the study was to identify problems militating against effective discharge of veterinary responsibilities in Nigeria and to suggest ways of alleviating them. After examining the veterinary scene, the study reported that most government veterinary services have collapsed, due to poor funding. It then recommended privatization of veterinary services as the best solution to the problems (Kela, 1991).

Using data obtained mainly from Kenya, Leonard (1987, 1993) examined structural reform of veterinary services in Africa. Employing the arguments of the NIE, he called attention to:

(1) the need to retain a central role for paraprofessionals during privatization,
(2) the desirability of competition between the veterinarians and paraveterinarians,
(3) the importance of developing state contracting procedures for assisting the private delivery of animal health that will avoid the problems of local monopoly, and
(4) the central role that new and strengthened professional associations will have to play in this area if collective goods and the public interest are to be served.

He, however, observed that excessive government presence in the veterinary services sector has discouraged adequate private sector participation.

Working in Cameroon, Gros (1993) investigated the issue of fair pricing in the private delivery of veterinary services. He noted a propensity of veterinarians in his country of study to practice in urban centers to the neglect of rural areas. This situation, according to him, has given rise to monopoly positions for the few who establish practices in the rural areas. After exploring different solutions prescribed for monopoly problem, he recommended price discrimination as the best.

Umali *et al.* (1992) have also examined veterinary services in various developed and underdeveloped countries of the world. In Africa, they studied structural reform of veterinary services in Central African Republic. They described the reform of veterinary services in that country as an example of donor-motivated transfer of the distribution of veterinary drugs and inputs from the government to independently operated farmers' association and noted that its successful transition provides a useful paradigm for other countries. By 1986, they noted, 99.5% of the budget of the National Agency for Livestock Development, which was the public provider of veterinary services, went to pay for the salaries of staff. Dissatisfied with this state of affairs, the government, aided by donors, began a transfer of some veterinary functions to non-governmental organizations. By the 1990s, several veterinary functions had been transferred from government to the National Federation of Central Livestock Producers.

While recommending privatization of some veterinary responsibilities in Africa, Umali *et al.* (1992) cautioned that it should not be pursued as one broad strategy. Instead, they advocated a policy of selective privatization which should be implemented only after farmer response to the additional cost involved has been carefully studied. This call is much in agreement with Sandford (1983), who stressed that cost-recovery measures in veterinary services have to be pursued on a case-by-case basis.

Animal health services in sub-Saharan Africa was also examined by de Haan and Nissen (1985), and by de Haan and Bekure (1991). They recommended privatization of

veterinary services to ensure their sustainability.

Umali *et al.* (1992, 1994) investigated the profitability of private veterinary provision in a number of African countries, including Cameroon, Guinea, Kenya, and Uganda, using the break-even veterinary livestock units as yard stick. They found that private provision displayed potential profitability under all production systems in the first three countries, because actual veterinary livestock units per unit area exceeded the break-even livestock units. For Uganda, however, private provision showed profitability only under intensive production system. In all countries, they stressed the need for private veterinarians to combine veterinary advice with drug sales to enhance profitability.

Woods (1997) investigated the importance of gender, proximity and transport availability as transaction costs in the use of veterinary services in Zimbabwe. She found gender bias in the demand for veterinary services as male farmers were less likely to request the services of women veterinary livestock technicians (VLTs) even though women VLTs were as competent as their male counterparts. She also found that proximity and availability of transport had positive effects on both demand for and supply of veterinary services.

Koma (1997) studied the possibility of private veterinarians surviving in Uganda and examined the factors determining demand for veterinary services. He found that private veterinarians could survive but that they will face stiff competition from paraprofessionals since herders in the area did not distinguish between providers on the basis of qualifications. The results of the multinomial logit models he fitted to his data identified cost of service, danger of loss of life, type of breed, as well as distance from provider as the important factors determining demand for veterinary services.

In a study in Senegal, Ly (1997a) analysed the working behaviour of veterinary professionals under privatization. He reported that private veterinarians paid greater attention to curative interventions, and less to enforcing public health regulations, than government veterinarians. He further discovered the existence of a *lemons* (substandard)

market for veterinary goods in the area and concluded that the professional self-regulatory board may have to step in with more stringent veterinary standards.

Ly (1997b), in a study in the Ferlo area of Senegal, investigated the impact of veterinary auxiliaries on the pastoral production. He compared three areas: the traditional area (where government is the sole provider of veterinary services), the first level transformation area (where there are other providers but still dominated by government) and the second level transformation area (which is dominated by NGOs). He found that the veterinary auxiliaries performed best in the second level transformation area where they were under better supervision and management.

Wamukoya *et al.* (1997) also examined the spontaneous private veterinary practices that have evolved in Kenya since 1988. They observed that the demand for the services of such practices was strong and that the profit margins of the practices have been on the increase. The spontaneous practices, according to them, were triggered by the discontinuation of government policy of automatically hiring every graduate veterinarian. Such a practice over the years had discouraged private sector initiative in veterinary services in Kenya. Leonard (1993) had reached a similar conclusion when he noted that the domination of veterinary services by government in Kenya had discouraged private veterinarians from establishing their own practices.

2.4.2 Mortality and Calving Rates

The relative effectiveness of providers in this study is determined by a number of variables amongst which are calf mortality and calving rates. A number of studies have been conducted to determine herd calving and mortality rates. Leonard (1993) has reported that calving rates of traditionally managed cattle in Africa is between 45% and 75% and that mortality rates vary from 6% to 25%. Pullan (1980), in a study among white Fulani cattle on the Jos Plateau, found a mortality rate of 11.2%. The National Green Revolution Committee (1981) also investigated productivity of cattle in Nigeria and reported calf mortality and calving rates of 15% and 45%, respectively. In a study of calf mortality among semi-settled Fulani herds in Zaria area of Kaduna State, Tekdek and Goje

(1988) found an overall calf mortality of 4.5% with individual herd calf mortality rates varying from 0 to 66.7%. Abdullahi (1987), as cited in Mohammed-Baba and Abdullahi (1988) reported calving rate of 57% and calf and adult mortality rates of 19% and 7%, respectively, among Fulani pastoralists in northern Nigeria.

2.5 Insights from the Reviewed Literature

Some of the literature reviewed in this chapter, particularly the NIE concepts, show that caution and careful planning are required for the success of structural reform. This is because market failure and moral hazard problems could hinder successful privatization of veterinary services. The significance of these problems was further underscored by the findings of various empirical studies in Africa, as cited in section 2.4.1. However, the literature also suggest ways of designing institutional mechanisms to mitigate the effects of these problems. The insights gleaned from the NIE concepts and the various empirical studies cited were useful in discussing the results of the study and in drawing policy implications from them.

The aspect of the literature review dealing with demand and demand elasticity provided the theoretical background to the demand functions estimated. In other words, it provided information which served as a guide in determining what explanatory variables to include in the models and what their expected relationship with demand should be. Similarly, the aspect on break-even concept (section 2.3.10) provided the theoretical background to the break-even model used to determine the economic feasibility of private practice. The practical application of the model also benefitted from the works of Umali *et al.* (1992, 1994) as cited in section 2.4.1.

CHAPTER THREE

METHODOLOGY

3.1 The Study Area

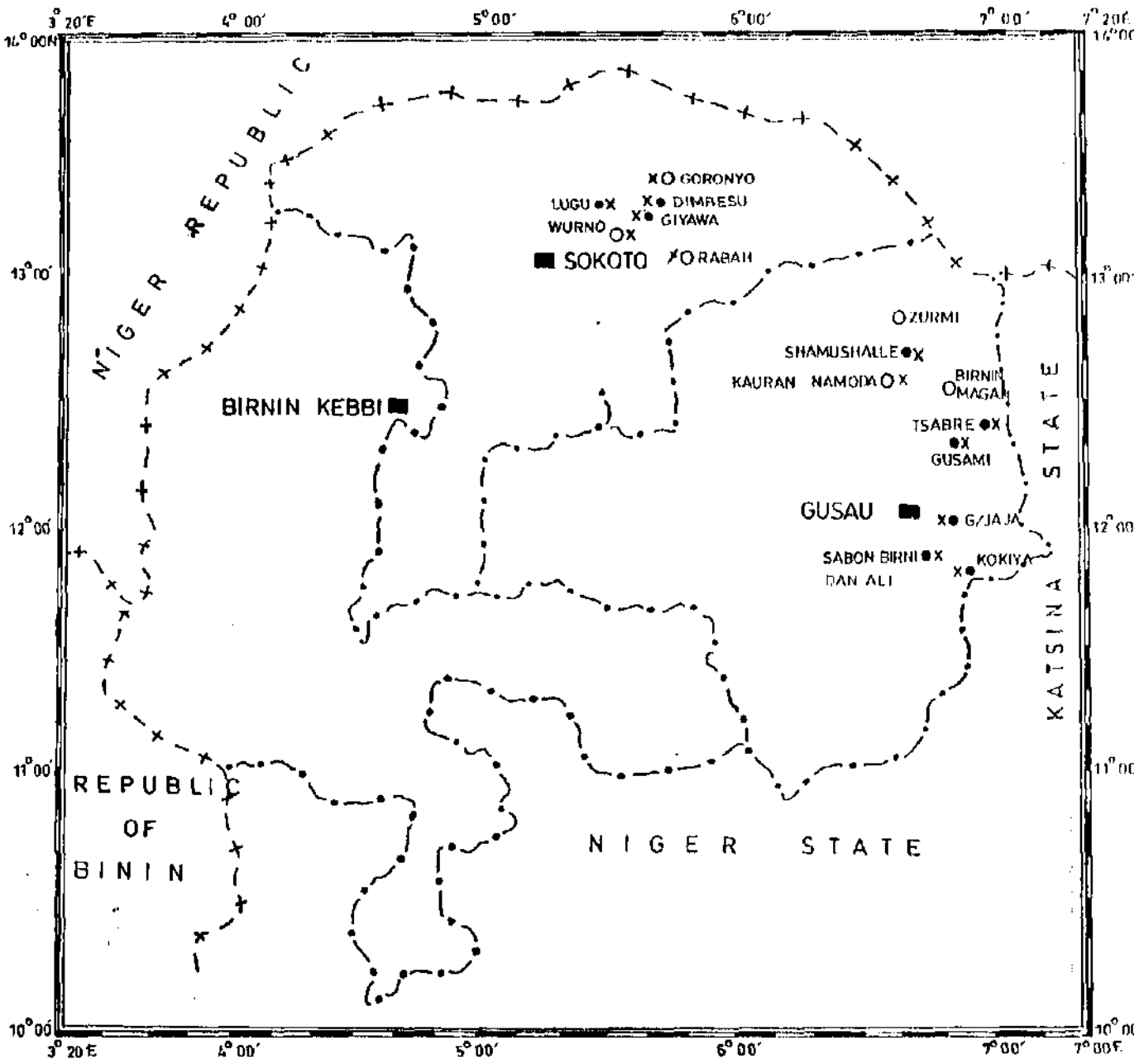
3.1.1 Location and Size

North-Western Nigeria as used in this study refers to Sokoto, Kebbi and Zamfara States, although the major primary data collection points were located in the last two, as can be seen in Figure 1. The area is located between latitudes 10° and 14°N, and longitudes 3° and 7°E (Abdullahi, 1985). It covers a total land area of 102,535 km^2 (FOS, 1989). The area shares international boundaries with the Republic of Niger in the north and Benin Republic in the West. It is bounded by the Nigerian states of Niger in the south and Katsina in the east.

3.1.2 Climate, Vegetation and Soil

The pattern of rainfall varies markedly across the area; in the south, the average annual rainfall is more than 1,000 mm while along the frontier with the Republic of Niger in the north, it is less than 500 mm. The rainy season is from April to September, with most rainfall received in July and August, although the length of the season may vary by up to six weeks (FDLPCS, 1992). The mean monthly temperature ranges between 13°C in December through February, and 38°C in April and May. The relative humidity in the area varies from 10% in February to 90% in August (Moco, 1981).

The vegetation of the area is savanna with the boundary between Northern Guinea Savanna and Sudan Savanna cutting across the center. The predominant tree species are *Acacia* spp., the desert date (*Balanites* spp.), *Isoberlinia doka* and the toothbrush tree (*Salvadora persica*). *Pannicum*, *Andropogon*, *Hyperrhenia*, and *Brachiaria* spp., are the common grasses (Abdullahi, 1985; FDLPCS, 1992). Most of the area consists of ferruginous tropical soils, except for the alluvial deposits found in the river valleys and the



SCALE— 1:2500000

FIG: 1 THE STUDY AREA, FORMER SOKOTO STATE (NORTH WESTERN NIGERIA)

KEY

■	State Capital
O	Local Govt HQ
•	Other villages
x	Data Collection Points
+ — +	International Boundary
— • — • —	State Boundary

undulating plains along the border with Niger Republic.

3.1.3 People and Occupation

The area is ethnically diverse, although the Hausa and Fulani people occupy most of its territory and minority groups are confined to relatively small areas. The minority groups include Tuareg, Zarma, Bariba, Kambari, Kabawa, Dakarkari, and a few others. The major occupation of the people is arable and livestock farming, with 65% of the land area devoted to agriculture, 20% to forests and the remaining 15% to rivers, mountains and buildings. Sorghum, millet, cowpea and groundnuts are the major rainfed crops, while rice, wheat, sweet potato and vegetable crops are cultivated mainly in the *fadama* (FDLPCS, 1992). Livestock production is undertaken by both settled and semi-settled farmers, and by pastoralists, but the pastoralists predominate. The pastoral peoples include the Fulani and the Tuareg and they control more than 80% of the total cattle population in the area (FDLPCS, 1992).

3.1.4 Livestock Production Patterns in the Area

Different types of livestock production patterns can be identified in the area. But they can be broadly grouped into two, namely, modern/commercial enterprises which are either partially or fully sedentarised, and traditional system in which animals are raised extensively by the pastoralists. However, the latter predominates and will be the main focus of this study. Information on traditionally managed livestock in the area is presented in Table 1. As can be seen from the table, various classes of livestock are traditionally managed at both village, urban, and pastoral levels. For cattle, with which this study is concerned, pastoral production accounts for over 80% of the total. In view of this apparent significance, the study focuses mainly on cattle raised pastorally by Fulani herders. Another reason for selecting pastoral herders is that they appear to be the most difficult to reach with livestock services, not only because they are often small-holders in remote locations, but also because they undergo migration in seasonal search for better feed and water.

Table 1. Traditionally managed livestock populations in north-western Nigeria, 1990 ('000)

Livestock	Pastoral	Village	Urban	Total
Cattle	1,426.43	342.95	3.45	1,772.83
Goats	142.95	2,305.59	17.94	2,466.48
Sheep	539.68	2,006.56	20.01	2,566.25
Donkeys	2.76	244.20	1.03	247.99
Horses	0.36	23.43	0.89	24.69
Camels	6.86	36.56	0.54	43.96
Pigs	0	3.20	0	3.20

Source: FDLPCS (1992)

3.2 Sampling and Data Collection

3.2.1 Sampling Procedure

The respondents studied include Fulani pastoral cattle herders, veterinary professionals (vets) and paraprofessionals (paravets). Cluster sampling was used in the selection of the herders. The area was initially divided into three clusters on the basis of the major provider of veterinary services. The three providers used were State Government, Zamfara Environmental Protection Agency (ZEPA) and the Faculty of Veterinary Medicine of Usmanu Danfodiyo University Sokoto (UDUS). Using the criterion of the type of provider, three local government areas (LGAs) - Wurno, Rabah and Goronyo Local Government Areas - located in the present Sokoto State, were sampled in the first cluster (zone 1) where only the State Government services were available. Kaura Namoda, Birnin Magaji and Zurmi LGAs were sampled from the second cluster (zone 2) in the Zamfara Grazing Reserve in the present Zamfara State, where Zamfara Environmental Protection Agency (ZEPA) was the major provider. The last set of LGAs chosen were Bodinga, Dange and Wamakko LGAs in Sokoto State, where it

was thought that UDUS was the major provider. After a preliminary survey, however, it was discovered that the State Government also provided services in this area and isolating the effect of a single provider, which was necessary for the envisaged paired-comparison of relative effectiveness of providers, would be impossible. This cluster was, therefore, dropped from the study. From each of the selected LGAs, 50 herders were randomly sampled. This brought the sample size to 150 herders per cluster (zone) or 300 herders in all. In zone 1, the respondents were sampled at the outskirts of Wurno, Lugu, Rabah, Dimbesu, Goronyo and Dejibe settlements. In zone 2, the herders were sampled at the outskirts of Kaura Namoda, Gidan Jaja, Sabon Birni Dan Ali, Kokiya, Gusami, Tsabre and Shamushalle settlements.

In addition to the selected herders, 15 professional and paraprofessional veterinarians were also sampled for the study. These included six veterinarians and nine paraveterinarians randomly sampled at Sokoto State Ministry of Agriculture and Natural Resources, ZEPA and Faculty of Veterinary Medicine of UDUS. However, one paraveterinarian was eventually dropped due to inconsistent responses. As used in this study, professional veterinarians refer to graduate veterinarians while the paraprofessionals are non-graduate veterinarians who have had at least two years post-secondary training in animal health.

3.2.2 Data Requirement and Collection

Three sets of data were collected. The first set comprised information from livestock producers (Fulani pastoralists) concerning mainly the medical and reproductive history of their herds, such as disease prevention measures taken, number of cattle that fell sick within the past one year, what diseases affected them, who treated them, how were they treated, at what cost, what was the repayment arrangement, how was the provider contacted, how many cattle had given birth, how many were alive, etc. Information was also solicited from the pastoralists on membership and benefits of cooperative societies, sources of information, willingness to pay, other work apart from livestock production, household expenditures, knowledge, availability and cost of traditional means of treatment, and so on. These information were obtained, by the researcher and two trained

enumerators, through interviews using questionnaire in 1996 and 1997. The information from herders and those obtained through participatory observation during the survey was used mainly in achieving objectives two and three, and parts of objective five.

The second category of data were obtained through interview of veterinarians and paraveterinarians at the Sokoto State Ministry of Agriculture and Natural Resources, ZEPA and UDUS. This survey was actually an expert opinion survey to obtain the views of the professionals on structural reform of their profession and the problems envisaged. Questions asked in the survey included what type of reform they thought was necessary, who should be allowed to establish a private practice, whether they thought herders were willing to pay, and what their channels of communication with the herders were. They were also asked to list materials required for a private practice and their estimated cost and life span. Furthermore, they were asked about the roles they expected professional associations to play in privatization of veterinary services. Specifically, they were asked whether they felt the associations were in a suitable position to select and regulate the activities of professional colleagues, and whether they currently wield sufficient power to do so, or further authority was needed. They were requested to provide information on the current relationship of their associations with government and the roles that paravets were to play in a privatized veterinary services. Finally, they were given the opportunity to comment on problems and prospects of privatization of veterinary services in the area. Data obtained during the interviews were supplemented by those contained in the official files and documents of the three organizations.They were used mainly in achieving parts of objectives one, four, five and six.

The third set of data were price information obtained through a survey of veterinary drugs, supplies and equipment markets in the area. This was achieved by attending a number of periodic rural markets and visiting several veterinary pharmacies in the area. The prices of some veterinary equipment which were not available on sale in the study area were obtained from Kaduna and Kano. Information from the price survey were used mainly in evaluating the economic feasibility of private provision as envisaged in the fourth objective.

3.3 Data Analysis

Descriptive statistics such as mean, range, frequency distribution, and cross-tabulation were used to achieve objectives one and two. Since in most of these cases comparisons between the two zones were made, relevant statistical tests of significance including *z-test for differences between two proportions, and chi-square test of* independence, were performed. The third objective was achieved by a combination of descriptive statistics and estimation of demand functions through multiple regression analysis (that is, ordinary least squares procedure). The fourth objective was achieved using a farm budgeting (break-even) model, while the fifth and sixth objectives were achieved by descriptive statistics and verbal description (applying some of the theoretical arguments of the New Institutional Economics to the empirical evidence on ground in the study area).

3.3.1 The Regression Model

Regression analysis was used to estimate demand functions for veterinary services. In specifying the demand functions, it was assumed that the herder's willingness and ability to pay, for veterinary services would be reflected in his actual expenditure on veterinary care. The demand is likely to be influenced by a large number of variables but only the cost of the service, herd size, number of sick animals, distance from veterinary provider and total annual expenditure were included in the model.

The function estimated was of the general form:

$$E_v = f(X_1, X_2, X_3, X_4, X_5, e) \quad \ldots\ldots(5)$$

Where:

E_v = total expenditure on veterinary services (naira/annum)

X_1 = price (cost) of veterinary service (naira/animal)

X_2 = herder's total annual expenditure (naira/annum)

X_3 = herd size

X_4 = distance from veterinary post (km)

X_5 = number of sick animals

e = error term

The demand function was initially estimated for all the herders. Thereafter, the herders were segregated according to herd size. Estimation was then done separately for 50 herders with the largest herd sizes and 50 with the smallest herd sizes. In each of the three cases, the above function was estimated in the linear, Cobb-Douglas (double-log), and quadratic functional forms. The linear model was specified as:

$$E_v = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + e \quad \ldots\ldots (6)$$

The Cobb-Douglas form was specified as:

$$E_v = aX_1^{b1}X_2^{b2}X_3^{b3}X_4^{b4}X_5^{b5}e \quad \ldots\ldots (7)$$

Equation (7) was, however, estimated in the double-log form:

$$\log E_v = \log a + b_1\log X_1 + b_2\log X_2 + b_3\log X_3 + b_4\log X_4 + b_5\log X_5 + e \quad \ldots\ldots (8)$$

The quadratic form was specified as:

$$E_v = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_1^2 + b_7X_2^2 + b_8X_3^2 + b_9X_4^2 + b_{10}X_5^2 + e \quad \ldots\ldots (9)$$

On estimation, the double-log form gave the best fit in each case and was chosen for further analysis.

3.3.2 Measurement of the Variables Included in the Regression Model

Expenditure on Veterinary Services (E_v)

The dependent variable in the model was herder's annual expenditure on veterinary

services. It was assumed that the strength of the demand for veterinary services will be reflected in the actual amount the herder spent on veterinary services. Expenditure was preferred to the physical quantity of veterinary goods and services as a measure of demand, because it permitted the use of a common denominator (naira) for the different goods and services bought by the herder. The use of physical quantities would have presented a problem of aggregation since even a single herder was likely to use several types of veterinary products. Obtaining a single measure of quantity demanded would have meant adding together products that were not the same. Besides, this approach has been used in a number of studies, including Olomola (1990).

To obtain the expenditure on veterinary services, the quantity of each product used by the herder was multiplied by its price. This was then added to the service charge of the person who administered the medicines to the animals if this was not done by the herder himself. This was then added together for all the veterinary products bought and all the veterinary services received throughout the year to obtain total expenditure on veterinary services.

Price (or Cost) of Veterinary Service (X_1)

In economic theory, price plays a dominant role in determining the demand for any commodity. *Ceteris paribus*, the demand is expected to be negatively related to price. Price was, therefore, included in the model to quantify the extent to which it influenced the demand for veterinary care in the study area. The price used was the cost of treating one animal obtained by asking the herder how much he paid each time an animal was treated (including drugs and service charges). These costs were added together for all the animals (cattle) treated within the year and then divided by the number of animals treated. In other words, the price used was the arithmetic mean of the cost of treating an animal. The information obtained was only with respect to cattle.

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Total Annual Expenditure (X_2)

Demand for veterinary services is expected to vary directly with herder's income It was discovered during the preliminary survey that the herders were unwilling to answer questions about their income. Due to the difficulties in obtaining reliable information on

income from the herders, their total expenditure within the year was used as proxy for income. It has been suggested that the Fulani herders do not sell their animals except when there is the need to spend (Isitor, 1990; Inuwa, 1990). If this is correct, then the annual expenditure may approximate annual income. On initial estimation, however, the variable was not significant in all cases and it was dropped from the models.

Herd Size (X_3)

Herd size was included in the model because it was thought to be a reflection of the wealth of the herder. It was expected that herder's expenditure on veterinary services would be directly related to his wealth status. As herd size increases, the veterinary cost per animal is expected to decrease (because of economies of scale). Therefore, herders with larger herds can afford more veterinary care. Herd size was, therefore, included as an explanatory variable in the model to quantify its effect on demand expenditure. Herd size was determined from the responses of the herders which were verified by the field veterinary personnel in the areas of study. Physical counting of some herds was also undertaken.

Distance from Provider (X_4)

Distance is a transaction cost in the demand for and supply of veterinary services. It is expected that the herder will demand more veterinary care, the nearer he is to the veterinary service post. In other words, distance was expected to be negatively related to demand. Distance from the veterinary provider was, therefore, included in the model to quantify its effect. Distance between the location of the herder and the nearest functional veterinary post was estimated in kilometres from the speedometer of the Range Rover vehicle used during the survey.

Number of Cattle Falling Sick Within the Year (X_5)

When many animals in a herd fall sick, the demand for veterinary care is likely to be higher than if only a few were sick. It was, therefore, anticipated that the number of cattle falling sick will have a direct relationship with the demand for veterinary services The number of sick animals were obtained from the medical history of the herd provided by the herders.

3.3.3 Obtaining Price Elasticities

The degree of responsiveness of herders to changes in the cost of veterinary care (demand elasticities) were obtained from the estimated equations. Recall that price elasticity was earlier defined in equation (1), page 27, as:

$$E = (q_2 - q_1)/(p_2 - p_1) \cdot (p_1 + p_2)/(q_1 + q_2)$$

Bearing this definition in mind, the elasticity could be obtained from an estimated regression equation by recognising that the first term of the right hand side of the equation (that is, $q_2 - q_1/p_2 - p_1$) is actually the slope of the demand function with respect to price while the second term ($p_1 + p_2/q_1 + q_2$) is the average of price divided by the average of quantity. Thus, if the following linear equation is a demand function:

$$Y = a + b_1X_1 + b_2X_2 + \ldots + b_nX_n \quad (10)$$

where:

Y = demand expenditure,

X_1 = price,

$X_2..X_n$ = units of other determinants,

b_1 = parameter estimate for price,

$b_2..b_n$ = parameter estimates for other determinants and

a = intercept term,

the price elasticity would be defined as:

$$E = dY/dX_1 \cdot X_1/Y = b_1 \cdot X_1/Y \quad (11)$$

where:

X_1 = mean of price and

Y = mean of demand expenditure.

The derivation of elasticities from a quadratic function follows the same procedure as in the linear case. It is obtained by multiplying the first partial derivative of the demand function with respect to price by the ratio of mean of price to mean of demand expenditure.

For a double-log (Cobb-Douglas) function, however, the demand elasticity is the same as the parameter estimate with respect to price or service cost. Since the double-log function was chosen for further analysis in this study, the parameter estimates with respect to price were used directly as price elasticities of demand for veterinary services.

3.3.4 The Farm Budgeting or Break-Even Model

The fourth objective of the study was achieved through a farm (break-even) budgeting model. The aim was to determine whether or not private veterinary provision is economically feasible in the study area. To achieve this, there was the need to determine the number of livestock units that a provider must treat and the prices he must charge, to break-even, and whether such could be obtained in the area of practice.

Recall that the break-even volume of sales was defined in Equation (3), page 28, as the volume where:

$$UR.Y = TFC + UVC.Y$$

Since UVC.Y is the same thing as total variable cost (TVC), Equation (3) can be written as:

$$UR.Y = TFC + TVC \quad \ldots\ldots (12)$$

In the present study, the issue is not volume of sales *per se* but the number of animals (NA) which a profit-oriented veterinary practitioner must treat to break-even. Therefore, the unit revenue will be the fee he can charge per animal treated and Y is the number of animals to be treated. Substituting UR with fee charged per animal (FPA) and Y with NA,

Equation (12) becomes:

$$FPA \cdot NA = TFC + TVC \quad \ldots\ldots (13)$$

Equation (13) can also be stated as:

$$NA = (TFC + TVC)/FPA \quad \ldots\ldots (14)$$

NA is, therefore, the number of animals a private provider must treat to break-even given the prevailing production costs and a particular level of FPA.

Since the veterinarian is likely to treat different classes of livestock, it may be necessary to find a common denominator for them. One concept that may prove useful in this respect is that of the veterinary livestock unit (VLU). A veterinary livestock unit has been defined as the equivalent of one cow or one camel or two horses or two donkeys or two pigs or ten small ruminants (sheep and goats) or 100 fowls (de Haan and Bekure, 1991). Replacing NA with BVLU (that is, break-even veterinary livestock unit) and FPA with FPVLU (fee per veterinary livestock unit), Equation (14) becomes:

$$BVLU = (TFC + TVC)/FPVLU \quad \ldots\ldots (15)$$

Since the veterinarian may also obtain revenue from sale of drugs and supplies, the margin on drug sales (MOD) can be incorporated into equation (15) to obtain:

$$BVLU = (TFC + TVC - MOD)/FPVLU \quad \ldots\ldots (16)$$

It is Equation (16) that was used to determine the break-even veterinary livestock units in this study. To determine the feasibility of private practice, the break-even veterinary livestock units was compared with the actual livestock density (i.e. number of VLUs per unit area in north-western Nigeria).

The problem is that the BVLU indicates the number of animals that must be treated to break-even and not the total number of animals available, since some animals may not require medical attention within a given year. The approach in this study was to conduct sensitivity analysis by creating several scenarios involving different assumptions about the proportion of animals that may require medical attention. The livestock densities computed under these scenarios were then compared with the BVLU.

3.3.5 Measurement of the Items in the Farm Budgeting Model

The Farm Budgeting model requires the estimation of costs and returns associated with private veterinary practice. The total costs include both the fixed and variable components. The relevant returns item include the fee charged per animal (or per veterinary livestock unit) and the mark-up on drugs and expendable supplies sales. The manner in which the value of the various items were determined is outlined as follows.

Veterinary Equipment, Furniture, Transport Facilities and Refrigerator

Most of the durable veterinary equipment required for a private practice were not available on sale in the three states covered. The prices used were obtained through a price survey in Kaduna and Kano which were the closest locations where the equipment were available. The items were depreciated using the straight line method and assuming zero salvage value.

The furniture required were pegged at two tables and six chairs. The prices were based on a price survey in Sokoto, Gusau and Birnin Kebbi in June, 1997. The furniture were assumed to have 10 years length of useful life and were depreciated by straight line method. The price of refrigerator was determined during the same survey as the furniture, and depreciation was equally by the straight line method.

Two alternative forms of transport facilities -a motorcycle and a four wheel drive vehicle - were considered. The price of the four wheel drive vehicle was obtained as average of prices of different brands of such vehicles contained in the price list of automobiles marketed by SCOA and CFAO in Sokoto town as of June 1997. The prices

of motorcycles were also obtained from the same sources. Both vehicle and motorcycles were assumed to have a useful life of five years and were depreciated using the straight line method. (Umali *et al.*, 1992, 1994, had assumed life spans of four years for both motorcycle and vehicle).

Fuel and Maintenance

The fuel consumption was estimated from the Land Rover vehicle used in the survey and the cost of maintenance was assumed to be the same as that of fuel. Fuel and maintenance cost for a motorcycle was assumed to be one half of that of a vehicle.

Rent and Utilities

The costs of renting a clinic in a peri-urban area were determined from estimates made by three real estate agents in Sokoto and Gusau. The costs estimated independently by the three sources turned out to be quite close and the average was used.

The utilities considered in the study were electricity and water. The cost figures used were the average of the annual bills of the states zonal veterinary clinics located in Sokoto, Gusau and Birnin Kebbi.

Drugs and Expendable Supplies

Since there were no full-time private providers in the area, data on the quantity of different drugs and supplies required by a practice were difficult to obtain. The zonal clinics visited in the three states were not prepared to disclose information on their drugs budgets. The combined drugs and supplies sales of the three veterinary posts of ZEPA in the Zamfara Grazing Reserve was about N165,000 (that is an average of about N55,000 per veterinary post) in 1997. It was, therefore, considered reasonable to hold the annual drugs and supplies budget of a private practice in the area at about N55,000. The mark-up on drug sales was arbitrarily assumed to be either 25% or 50% (after Umali *et al.*, 1992).

Fee Per Animal

All the key providers in the area do not charge service or consulting fees separate from cost of drugs, but some of the veterinarians, particularly those at UDUS undertake

part-time private practice and levy service charges. They provided information on the charges made specifically for cattle. The average of the amounts charged per cow (N150) was initially adopted as service charge in computing the break-even veterinary livestock units. Subsequently, a sensitivity analysis was conducted in which the fee per veterinary livestock unit was allowed first to drop to N100 and then to N50.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 State of Veterinary Services in North-Western Nigeria

4.1.1 Agencies Providing Veterinary Services

Veterinary services in north-western Nigeria are dominated by the public sector, particularly the states and local governments. Other agencies connected with veterinary services in the area include the Zamfara Environmental Protection Agency (ZEPA), the Second Pilot Livestock Development Project (SPLDP), the Faculty of Veterinary Medicine of Usmanu Danfodiyo University Sokoto, the Federal Department of Livestock and Pest Control Services (FDLPCS), the National Veterinary Research Institute (NVRI), importers and manufacturers, veterinary pharmacies (both urban and rural), human medicine stores, and weekly market retailers. These agencies provide one form of veterinary services or another directly or indirectly to herders and constitute what might be called the *veterinary matrix* of the area. Figure 2 presents information on the types of relationships and linkages among the various agencies. These relationships and linkages are further highlighted as the activities of the agencies are discussed in the following sub-sections.

4.1.1.1 State Governments

The three state governments in the area are perhaps the most prominent providers of veterinary services. The veterinary functions of the states are performed by the Livestock Services Division of the ministry of agriculture in each state. Such functions include vaccinations, curative treatment, movement control, quarantine, and to some extent, meat inspection. The organizational structure of Veterinary Services Division is quite similar in the three states (Sokoto, Kebbi and Zamfara) with the exception of slight modifications from one state to another. The structure for Sokoto State is presented in Figure 3. As can be seen from the Figure, the Livestock Services Division of the State

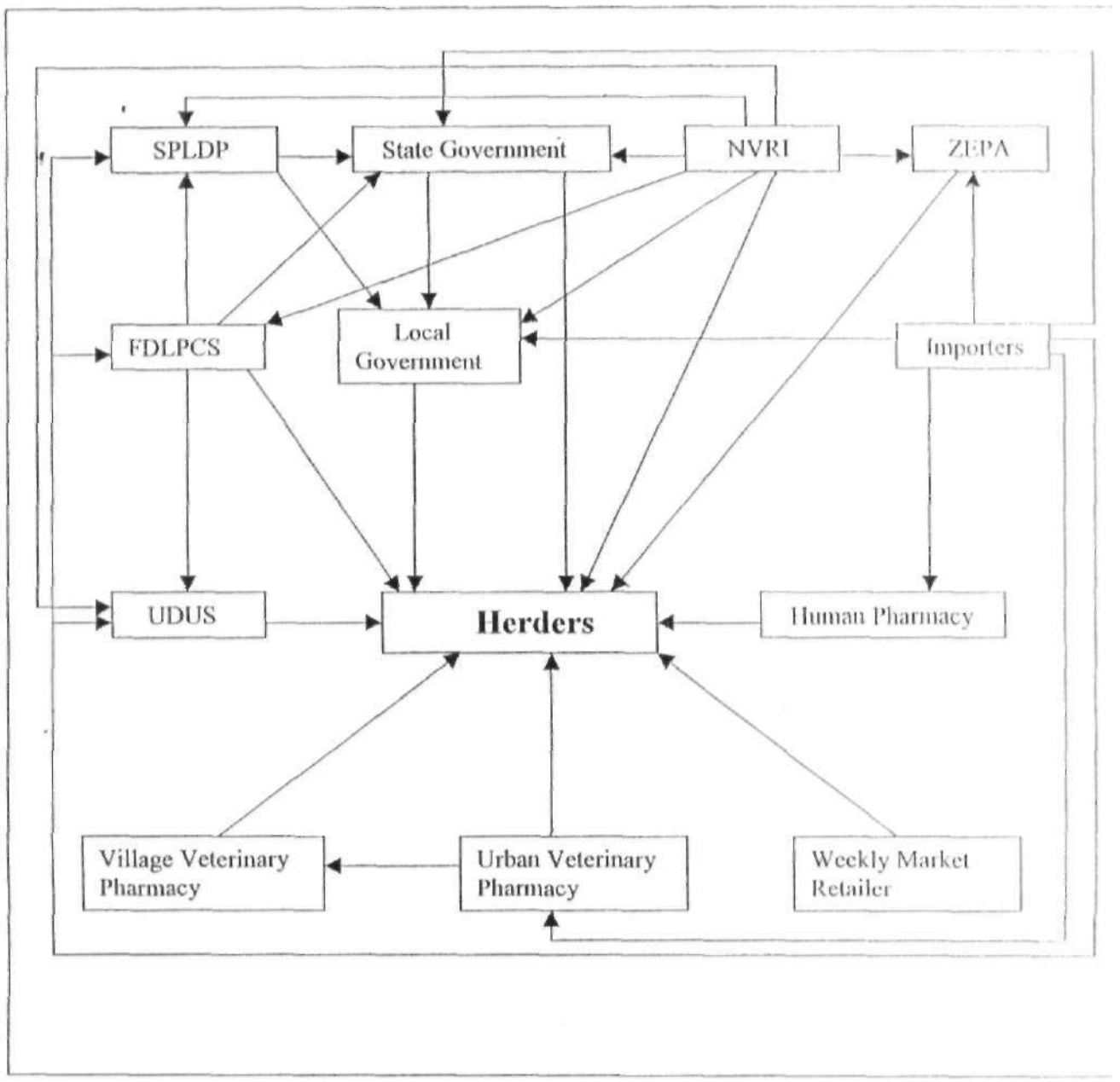


Figure 2: Linkages and relationships among agencies concerned with veterinary services in north-western Nigeria

Ministry of Agriculture and Natural Resources is headed by the Director of Livestock Services under whom are three Deputy Directors, one each for the Veterinary Services, Range Management, and Livestock Development Units. While the Animal Health Unit is charged with the role of ensuring disease prevention, control and eradication, the Range Management Unit is concerned with the management of the grazing reserves in the State. The Livestock Development Unit executes livestock projects planned by the state government.

Under the Deputy Director in charge of veterinary services, are three Assistant Directors in charge of animal health, livestock marketing, and hides and skin. Below the Assistant Director there are two career lines, namely the officer line and the superintendent line. The former is for those entering the state service with university degrees while the latter is for those with diplomas (either O.N.D. or H.N.D.). The superintendent cadre ranges from Chief Livestock Superintendent to Assistant Livestock Superintendent, while the officer cadre has Chief Veterinary Officer at the head and Veterinary Officer at the bottom.

The above-stated structure is similar for the other units and for all the states except that in Kebbi State, the Fisheries Unit is also attached to the Livestock Services Division which is, therefore, called Livestock and Fisheries Services Division. The Fisheries Unit is headed by the Assistant Director of Fisheries below whom are a range of fisheries officers and superintendents organised in a similar manner as the animal health unit.

Each of the states is divided into four livestock services zones. Information on the zones in each state as well as the local government areas covered by each zone is presented in Table 2. As is evident from the table, Sokoto State consists of Sokoto, Gwadabawa, Isa, and Bodinga zones, while Zamfara has Gusau, Talata Mafara, Kaura Namoda and Gummi zones. Kebbi State consists of Birnin Kebbi, Argungu, Yauri and Zuru zones. Each zone is headed by the Zonal Officer under whom are different categories of staff with expertise in the various disciplines of livestock services (i e animal health, range management, livestock development, as well as hides and skin). The ranks of zonal staff range mostly from Chief Livestock Superintendent to Assistant Livestock

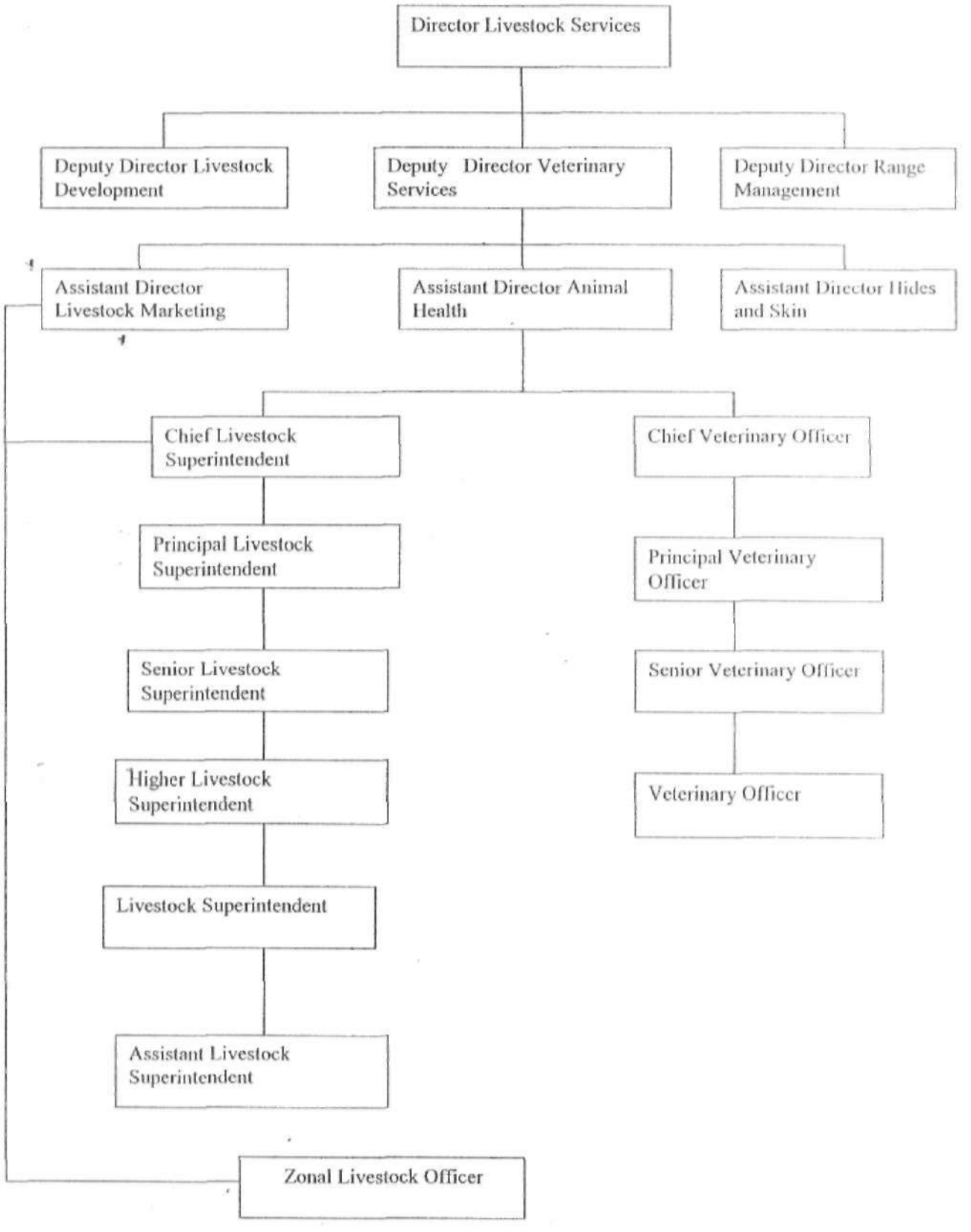


Figure 3: Organizational structure of the Sokoto State Veterinary Services Division

Superintendent, although some ranks of officer cadre were found in two zones in Kebbi State. The zonal staff are responsible to the Zonal Officer, who is in turn, responsible to the Assistant Director or the Chief Livestock Superintendent, depending on the Zonal Officer's rank, at the Headquarters.

Table 2: Veterinary services zones according to local government areas covered

State/Zone	Local government areas covered
Sokoto State	**23**
Sokoto	Sokoto North, Sokoto South, Kware, Wamakko, Dange/Shuni, Wurno, Tureta, Silame, Rabah
Gwadabawa	Gwadabawa, Tangaza, Gudu, Gada, Illela, Binji
Isa	Isa, Goronyo, Sabon Birni
Tambuwal	Tambuwal, Bodinga, Shagari, Kebbe, Yabo
Zamfara State	**14**
Gusau	Gusau, Bungudu, Maru, Tsafe
Talata Mafara	Talata Mafara, Bakura, Maradun
Kaura Namoda	Kaura Namoda, Zurmi, Shinkafi, Birnin Magaji
Gummi	Gummi, Bukuyyum, Anka
Kebbi State	**21**
Birnin Kebbi	Birnin Kebbi, Aliero, Bunza, Kalgo, Dandi, Jega, Maiyama, Suru
Argungu	Argungu, Arewa, Augie, Gwandu
Yauri	Yauri, Shanga, Ngaski, Koko Besse, Bagudo
Zuru	Zuru, Fakai, Danko/Wasagu, Sakaba

Source: Field data, 1996/97

Since the zonal offices are close to the livestock farmers, they are responsible for implementing veterinary strategies of the state governments. Although the clinics in the states are under the control of local governments, following the 1976 local government reforms, each zonal office has a building structure that serves the purpose of a clinic.

Thus, the zonal offices could be viewed as veterinary posts through which the state governments discharge their veterinary responsibilities, particularly preventive and curative care.

Disease prevention by the states comes in the form of annual vaccination campaigns with emphasis on rinderpest and CBPP. The vaccines used in such campaigns are normally purchased from the NVRI, although the federal government through the FDLPCS occasionally provides some, especially in emergency situations. The federal government sometimes also provide transport during such campaigns. The vaccinations are undertaken in collaboration with local governments.

Although the state governments have kept up the annual vaccination campaign against rinderpest and CBPP over the years, the coverage appears to have been on the decline. Table 3 shows the vaccination figures for Sokoto State. It can be seen that the vaccination coverage for both diseases have maintained a general decreasing trend between 1980 and 1994. For instance, the number of cattle vaccinated against rinderpest has declined from more than 1,770,837 in 1980 to a mere 164,187 in 1994. This exceedingly sharp decline cannot be attributed solely to the fact that there was an outbreak in 1980, since the decline has continued even from one non-outbreak year to another. Neither could the decline be attributed to the reduction in overall livestock population in the State, following the carving out of Kebbi State. To be sure, the coverage has declined steadily from 290,605 immediately after the carving out of Kebbi State in 1991, to 164,187 in 1994. These are indications of absolute reduction in the effectiveness of a crucial aspect of animal health care, namely, disease prevention through vaccination.

Curative services, when available, are provided either through the zonal offices or through local government-controlled veterinary clinics which are sometimes jointly run by the state and local governments. This arrangement was, however, seen to be working only in the state capitals (Sokoto, Gusau and Birnin Kebbi). Other veterinary clinics in the area were generally non-functional. In addition, the states formerly operated ambulatory services in an attempt to bring curative and other services closer to the herders. Presently, however, these services are no longer in place due to lack of functional vehicles and

requisite veterinary equipment.

Table 3: Cattle vaccination figures for Sokoto State (1980-1994)

Year	T.C.R.V.	C.B.P.P.V.
1980*	1,770,837	1,770,837
1981*	1,048,627	1,048,627
1982*	1,389,202	844,413
1983*	1,548,204	1,032,156
1984	673,704	607,801
1985	856,485	836,414
1986	758,901	758,901
1987	663,670	664,478
1988	467,466	467,959
1989	228,472	272,368
1990	443,473	367,139
1991**	290,605	289,997
1992**	255,507	255,507
1993**	136,964	136,964
1994**	164,187	164,187

* Years of major rinderpest outbreak

** After creation of Kebbi State

Source: Field data, 1996/97

The movement restriction role of the state governments is achieved through a number of control posts and inspection stations in each state (Figure 4). In Sokoto State, there are control posts or inspection stations at Ilella, Sabon Birni, Dange, Sokoto, Tangaza, and Woru, while Kebbi State has its control posts at Argungu, Bachaka, Kamba, Birnin Kebbi, Daki Gari, Yauri, Zuru, and Bena. The main objective of control posts or inspection stations is to protect the livestock in each state from infection from outside, with particular emphasis on animals coming in from other countries. This explains why a good number of the control posts listed above are located at the international borders.



FIG : 4 LOCATION OF LIVESTOCK CONTROL POSTS & INSPECTION STATIONS IN FORMER SOKOTO STATE (NORTH WESTERN NIGERIA)

Some of the control posts also have quarantine stations although facilities needed for effective quarantine work are generally lacking.

Meat inspection is conducted to prevent the spread of zoonotic diseases of livestock to human beings. In the study area, it is generally a function of the local governments. However, the livestock services divisions of the states also have personnel at the abattoirs in the state capitals along with the local government staff.

Most of the drugs and supplies used by the state governments services are normally purchased from local manufacturers or importers, out of the annual budgetary allocations to the livestock services divisions by the state governments. These are then used to treat the animals free-of-charge to livestock owners. It would appear, however, that poor funding has resulted in the near-collapse of the state veterinary services, with the exception of a few skeletal services as outlined above.

Confronted with this virtual collapse of state veterinary services, it appears that governments in the area, are beginning a re-thinking of the "free-of-charge" approach to veterinary services provision. There seems to be a general agreement that a reform, in which the livestock owner pays part or all of the costs of treating his livestock, is necessary. Accordingly, Sokoto and Zamfara States are now experimenting with cost-recovery and privatization under the Second Pilot Livestock Development Project (SPLDP) and Zamfara Environmental Protection Agency (ZEPA).

4.1.1.2 The Second Pilot Livestock Development Project (SPLDP)

The SPLDP is a World Bank-assisted project of the federal government in six states of the federation, including Sokoto. In each state, the Project uses the existing state and local government infrastructures and personnel to execute its plans. As far as the animal health aspect of the project is concerned, herders pay the original purchase cost of the drug administered to their animals together with the handling costs, but do not pay service charges. The Project purchases its drugs from manufacturers and importers, but some are also provided by the FDLPCS. Vaccines are obtained from the NVRI. As far as

vaccination is concerned, emphasis of the Project is on small ruminants which have been neglected by other providers. The Project also operates a credit scheme in collaboration with the Nigerian Agricultural and Cooperative Bank for veterinarians wishing to establish private practices in the State. This is an indication of government's desire to promote private sector participation in veterinary services delivery in the area.

4.1.1.3 Zamfara Environmental Protection Agency (ZEPA)

The Zamfara Environmental protection Agency (ZEPA) is an off-shoot of the Sokoto Environmental Protection Project, an European Economic Community-assisted Project established in 1990. The donors withdrew in 1995 after the expiration of the project agreement, but the Sokoto State Government continued to operate it under the name Sokoto Environmental Protection Agency. Following the creation of Zamfara State, the Zamfara State Government took over the projects of the Agency located within its territory under the name Zamfara Environmental Protection Agency (ZEPA).

The ZEPA is concerned with protecting the environment of Zamfara State. One of the specific objectives of the Agency is to resuscitate the Zamfara Grazing Reserve. The activities of the Agency in the Grazing Reserve include, among others, provision of veterinary services to livestock farmers. Veterinary services provided include both preventive and curative care. While vaccines are sold at the cost price to herders, drugs are sold with some mark-up. The vaccines are obtained from the NVRI while drugs are purchased from manufacturers and importers.

To enhance coverage, the Agency operates three veterinary service posts in the Reserve. These are located at Gidan Jaja, Gusami and Sabon Birni Dan Ali, and serve the three local government areas covered by the Project in the Reserve. The veterinary posts at Gusami and Sabon Birni Dan Ali are equipped with motorcycles while the post at Gidan Jaja, which is the headquarters, has both motor-cycles and a four wheel drive vehicle. The Agency pays 10% commission on revenue realised to the staff operating the veterinary posts to encourage them to sell to herders at the official prices. There is a veterinarian at the headquarters and paraveterinarians at the three posts.

4.1.1.4 Local Governments

Sokoto, Kebbi and Zamfara States consist of 23, 21 and 14 local government areas, respectively. With the exception of a few newly created ones, each local government across the states has a veterinary section under the Department of Agriculture which discharge certain veterinary responsibilities. The veterinary functions performed by the local governments include preventive and curative care as well as meat inspection.

The preventive care is provided in collaboration with state veterinary services during the annual vaccination campaigns. During such campaigns, each local government constitutes a vaccination team consisting of local government and state zonal veterinary personnel, as well as the relevant district head. The team then draws out its itinery covering the entire local government area. Vaccines for the annual campaigns are obtained mainly from the state governments although the local governments may also procure some directly from the NVRI.

Curative services, when available, are provided by the local governments through their clinics. The number of clinics under the control of a local government in the study area varies from one to five, depending on the number of districts in the local government. However, most of the clinics are empty halls with no activity taking place and the local government veterinary staff are busy only during the vaccination campaigns. Furthermore, transportation and other requisite veterinary facilities are generally lacking at this level of government.

Meat inspection is mainly the responsibility of the local governments. Hence, local government veterinary staff could be seen at many abattoirs across the area. In some cases, the meat inspection function is shared with state and federal government veterinary personnel, particularly in the urban areas.

4.1.1.5 Usmanu Danfodiyo University Sokoto (UDUS)

The Veterinary Faculty of UDUS, in addition to its primary role of teaching and research, also provides veterinary services to livestock owners. It has a veterinary teaching hospital at the Temporary Site of the University where sick animals are taken for treatment. It also operates an ambulatory service particularly to nearby local government areas.

The veterinary services provided by the Faculty include preventive and curative care, as well as offering of professional advice on livestock production and health. These services are provided on a partial cost-recovery basis. In other words, herders are charged only a certain proportion of the original cost of drugs and supplies. Herders do not pay consulting fees.

Veterinary services at UDUS are funded partly by the University and partly by the FDLPCS. The University pays the overhead cost, including staff salaries, while the FDLPCS pays for drugs and vaccines. Vaccines are normally purchased from NVRI, while drugs are purchased from manufacturers and importers. The budget for drugs and vaccines was limited to about N50,000 per annum during the period of the study.

4.1.1.6 National Veterinary Research Institute (NVRI)

The NVRI is by far the most important source of vaccines to all providers in the area. With headquarters in Vom (near Jos), Plateau State, the Institute has a laboratory in Sokoto which serves as vaccine depot to the three states. In addition, the laboratory provides diagnostic support and epidemiological services to the states. It charges between *50 and 500 naira per sample depending on the type of analysis required.* Charges per dose of vaccines obtained from the laboratory are as presented in Table 4. Records show rather low demand for vaccines from the laboratory. This has been attributed to the fact that some of the states by-pass the laboratory and buy directly from Vom.

Table 4: Cost of vaccines at the National Veterinary Research Institute Laboratory in Sokoto

Vaccine Type	Price (naira/dose)
T.C.R.V.	4.50
C.B.P.P.V.	4.50
Black quarter vaccine	1.50
Anthrax spore vaccine	1.25
Antirabies vaccine	2.50
Newcastle disease vaccine intraocular (1/0)	1.25
Newcastle disease vaccine (lasota)	1.25
Newcastle disease vaccine (komarov)	1.50
Gumboro disease vaccine	1.13
Fowl cholera vaccine	1.13
Fowl pox vaccine	1.13
Fowl typhoid vaccine	2.50

Source: NVRI Laboratory, Sokoto, 1996/97

4.1.1.7 Federal Department of Livestock and Pest Control Services (FDLPCS)

The FDLPCS is one of the nine departments of the Federal Ministry of Agriculture. With headquarters in Abuja, the main objectives of the Department are to monitor and undertake surveillance of livestock diseases, and to formulate policies on prevention, control and eradication of livestock diseases throughout the country. To achieve these objectives, the Department is divided into a number of units including the Animal Health, Public Health, Veterinary Quarantine, Livestock Projects, Pasture Management, Data and Marketing Information, as well as Pest Control Units.

The Department has field offices across the country. In north-western Nigeria, there is a field office in Sokoto which serves the three states. Each of the units mentioned

above are represented in the field office. The Animal Health Unit collaborates with the three states in disease prevention, control and eradication programmes. The Unit also normally undertakes direct vaccination and sero-monitoring, as well as distribution of drugs and vaccines to the states. Since 1994, however, it has not performed any of these three functions. Even the distribution of drugs and vaccines to the states and veterinary faculties of universities is handled directly by the head office while the role of the field office is reduced to monitoring their use. Vaccines distributed by the Department are mostly obtained from the NVRI while drugs are obtained from importers and manufacturers.

The Veterinary Public Health Unit conducts *ante mortem* and *post mortem* meat inspection to prevent the spread of livestock diseases to humans. The Unit has staff at the abattoirs in Sokoto and surrounding local government areas who perform this function alongside staff of the state and local governments.

The veterinary quarantine unit controls the movement of livestock especially across international borders to protect Nigerian livestock population. Accordingly, the unit has staff at many land, water and air ports. In north-western Nigeria, staff of the unit are at the Ilella border to monitor livestock, livestock products, as well as veterinary drugs and supplies coming into the country.

The Data and Marketing Information Unit surveys and documents the prices of livestock and livestock products, as well as the quantities of these commodities traded. Such data are normally sent to the head office to be used in policy formulation.

The Livestock Projects Unit is responsible for executing direct livestock projects planned by the Department. In north-western Nigeria, there is only one such project. This is the Zugu Goat Project located at Zugu in Zamfara State. The objective of the Project is to aid the formulation of policies aimed at improving breeding methods in goat production. The project is run by staff of the Sokoto field office.

The Pasture and Range Management Unit is concerned primarily with development and management of grazing reserves. The Unit works in collaboration with the Range Management Units of the states ministries of agriculture.

The Pest Control Unit monitors and controls animal and crop pests and report regularly to the state ministries. Sometimes, the initiative may come from the ministries who may report cases of pest outbreak to the field office. There has been aerial spraying against quelea birds and locust in the area in the recent past.

4.1.1.8 Pharmacies

Three types of pharmacies can be distinguished in the area. These are human pharmacies, urban-based veterinary pharmacies and village pharmacies. The primary function of human pharmacies is to dispense human medicines, but some also stock veterinary drugs as well. The urban and village veterinary pharmacies specialise in veterinary drugs, supplies and equipment. The source of drugs for the veterinary pharmacies could be the manufacturers, importers or other pharmacies, while vaccines are obtained mostly from NVRI. All veterinary pharmacies in the area operate on small-scale, stocking a wide range of veterinary products.

4.1.1.9 Weekly Market Retailers

The weekly market retailers are itinerant drug hawkers who move from one rural market to another where they come into contact with herders. In the area, they are commonly referred to as *charlatans* or *quacks*. They dispense a wide range of veterinary drugs whose sources are not easy to determine. With the collapse of most government veterinary services, this category of providers is quite popular with the herders. They are popular also because they take their merchandise to the "door step" of the herders and also because they often know the identity of the herders and are able to exercise flexibility in fee collection. However, most of them are without any form of veterinary training and could not possibly accompany drugs dispensing with expert advice on their utilization. Furthermore, the quality of the drugs traded is uncertain as no evidence of special storage

facilities was seen with them. But their businesses flourish because they occupy a vaccum left by the collapsing government services. There is also no regulation of the activities of the weekly market retailers.

4.1.2 Staff Profile of Veterinary Services Providers

The personnel who shape the delivery of veterinary services include professional veterinarians and paraprofessional animal health workers. The distribution of the professional and paraprofessional veterinarians according to the various agencies responsible for veterinary services in the area are presented in Table 5.

Table 5: Number of veterinarians and paraprofessionals with Various Providers

State/Organization	No. of veterinarians	No. of paravets
Sokoto State	**34**	**44**
State Government	2	23
U.D.U.S.	29	0
L.G.A.s*	0	14
N.V.R.I.	1	0
F.D.L.P.C.S.	2	7
Zamfara State	**6**	**45**
State government	5	10
Z.E.P.A.	1	5
L.G.A.s*	0	30
Kebbi State	**6**	**71**
State government	6	31
L.G.A.s*	0	40
North-West total	**46**	**160**

* Paraveterinarian figures were estimated from a sample of six L.G.A.s in each state.

Source: Field data, 1996/97

There were 34 veterinarians in Sokoto State, while Kebbi and Zamfara had six each, bringing the total to 46 for the entire study area. The relatively high number of veterinarians in Sokoto State is attributable to the location of Usmanu Danfodiyo University there where there are up to 29 veterinarians at the Veterinary Faculty whose primary responsibility is teaching and research and not field veterinary work *per se*. Therefore, the number of veterinarians with the primary responsibility of field control or prevention of diseases is five. Two of these each are at State Ministry of Agriculture and Natural Resources and the FDLPCS while the remaining one is at the NVRI laboratory. Those at the Ministry are hardly involved in direct professional work. They are more concerned with administrative work and policy formulation.

The situation is quite similar in Zamfara and Kebbi States with six veterinarians each. All the professionals in Zamfara are with the State Government but with one on secondment to ZEPA in the Zamfara Grazing Reserve. Two of the remaining are at the Zonal Veterinary Clinic in Gusau while the rest are at the ministry headquarters also in Gusau where they are more concerned with policy formulation than professional practice.

In Kebbi State, all the six veterinarians are also with the State Government with two at the Zonal Clinic in Birnin Kebbi and one at a zonal office outside Birnin Kebbi. The remaining are at the headquarters engaged in administrative work.

Sokoto State has a total of 44 paraveterinarians as against 45 and 71 for Zamfara and Kebbi States, respectively. Of the paraveterinarians in Sokoto, 23 are with the State Government, 14 are with the local governments and the remaining seven are with the FDLPCS. The paraveterinarians in the three organizations are the field staff. For instance, most of the paraveterinarians with the state governments are to be found in the zonal offices where they implement the policies formulated at the headquarters and attend to the veterinary needs of the herders. This picture is similar in the remaining two States as well.

Thirty of the estimated 45 paraveterinarians in Zamfara State are with the local governments while ten are with the State. The remaining five are with ZEPA. With the exception of the zonal clinic in Gusau where there are veterinarians, all the other zonal

offices are operated by paraveterinarians. At ZEPA, a veterinarian is present only at the headquarters in Gidan Jaja. The remaining veterinary posts at Gusami and Sabon Birnin Dan Ali are run by paraprofessionals.

In Kebbi State, 40 of the 71 paraveterinarians are with the local governments while the remaining 31 are with the State Government. Nearly all the paraveterinarians with the State Government are to be found in the zonal offices or clinics.

It is note-worthy that all veterinary staff of the local governments in the three states are paraveterinarians. The foregoing results also show that the zonal offices or clinics where the actual delivery of services take place are run by paraveterinarians. This suggests that the paraprofessionals play a crucial role in the delivery of veterinary services in the study area.

The results also show the scarcity of veterinarians and the apparent relative abundance of paraveterinarians. This supports the arguments of Umali *et al.* (1992) and Leonard (1993) that paraprofessionals are in more abundant supply in Africa than veterinarians. The scarcity of veterinarians and the relative abundance of paraveterinarians could have major implications for deciding who should be allowed to establish a private practice during any reform. Whatever choice is made is also likely to have some implications for quality of service. These issues are explored further in section 4.5

The number of veterinarians and paraprofessionals available in an area could be used as a rough estimate of the availability of veterinary services in the area. To make such an estimate, Umali *et al.* (1992) has suggested the use of veterinary livestock units (VLUs) per veterinarian and per veterinary auxiliary. A VLU, you may recall, means one cow or one camel or two horses or two pigs or two donkeys or ten small ruminants or 100 fowls.

It is estimated that the area has 1.7 million cattle, 2.6 million sheep, 2.5 million goats, 6.5 million poultry, 250,000 donkeys, 40,000 camels, and 25,000 horses (FDLPCS, 1992). These figures give a total of 2,452,500 VLUs for the area. Using this figure and

the number of veterinarians and paraprofessionals presented in Table 6, it is evident that there are 53,315 VLUs per veterinarian and 15,328 VLUs per paraveterinarian in the area.

Sandford (1983), as cited in Umali *et al.* (1992), suggested 20,000 VLUs per veterinarian as the appropriate ratio for curative and preventive work in extensive production system found in Africa and the Middle East, 5,000 VLU's per veterinarian in intensive production systems found in Tropical Asia, and 2,500 VLUs per veterinarian in intensive production systems as is found in European countries. Since the production system in the area of study is the extensive type, the first of these ratios apply. The ratio of 53,315 VLUs per veterinarian determined in this study exceeded the recommended ratio for Africa by more than 167% thereby suggesting inadequate supply of veterinarians in the area. If we remove the 29 veterinarians at UDUS, on the grounds that their primary role is not field provision of services (even though they actually provide some services to a limited extent), the gap increases further to 144,265 VLUs per veterinarian or 621% above the recommended rate, further emphasising the shortage of professional veterinarians in the area.

For effective service delivery, Sandford (1983) suggested a ratio of 1,000 - 3,000 VLUs per auxiliary (paraprofessional). The ratio of 15,328 VLUs per paraprofessional for the study area exceeded even the upper limit recommended, by more than 400% implying that the paraprofessionals were also in short supply.

Given these results, it seems that the supply of veterinary services in the area has not been generous due to inadequate supply of veterinary personnel. But the situation is critically worsened by the current under funding of the services.

4.2 Relative Effectiveness of Veterinary Services Providers

Attempt was made to compare the effectiveness of veterinary services between an area predominantly served by state government (zone 1) and that served by a donor-assisted project (ZEPA) where reform (cost-recovery) has been attempted (zone 2). This

is to determine whether or not the introduction of cost-recovery has improved the quality of service. To achieve this objective, a number of variables perceived to be related to effectiveness were examined and compared between the two areas. Some of the indicators used include cases of disease episodes reported, distance from a functional veterinary post or clinic, extent of vaccination coverage, calf mortality and calving rate. The results are presented in the following sub-sections.

4.2.1 Disease Cases

Information on the number of herders recording disease cases is presented in Table 6. The table shows that 36% of all the respondents recorded disease episodes in their herds within the past year. In zone 1, 30.67% recorded disease episodes as against 41.33% in zone 2. Also presented in Table 6, are the prevalent diseases in the herds as reported by the herders. *Foot and mouth disease* (F & MD), reported by 23.33% of all respondents, was the most prevalent. This was followed by *rinderpest* (14%), *anthrax* (11%), *liver cirrhosis* (6.33%), *liver fluke* (6%), "*kirchi*" or *dermatophilosis* and *trypanosomiasis* (5.33% each), *black quarter* or *black leg* (4.33%) and *CBPP* (3.67%). Other diseases appear to be of relatively little significance in the area.

A zonal analysis further underscores the significance of *foot and mouth disease* which was reported by 26.67% and 20% of the respondents in zones 1 and 2, respectively. It was the most frequently reported disease (in terms of number of herders) in the two zones. It was followed by *rinderpest* (19.33%), *liver cirrhosis* (6.67%), *liver fluke* (6%), and *trypanosomiasis* (5.33%), in zone 1. In zone 2, *foot and mouth disease* was followed first by *anthrax* (19.33%), then *rinderpest* (8.67%), *dermatophilosis* or "*kirchi*" (6.67%), and by *liver fluke* and *liver cirrhosis* each reported by 6%.

The relative importance of each of the diseases is further underscored by the number of cattle affected in the area. As shown in Table 7, the total number of sick animals recorded in zone 1 was 600 as against 495 for zone 2. This shows that more sick animals were recorded in zone 1 than zone 2, notwithstanding that more herds were affected by sicknesses in the latter. The proportion of the total number of sick animals

Table 6: Prevalent livestock diseases in the study area as reported by herders

	Zone 1		Zone 2		Total	
Disease	Freq	%	Freq.	%	Freq.	%
Recorded sick animals	46	30.67	62	41.33	108	36.00
Rinderpest	29	19.33	13	8.67	42	14.00
Black leg	5	3.33	8	5.33	13	4.33
F & MD	40	26.67	30	20.00	70	23.33
Anthrax	4	2.67	29	19.33	33	11.00
Liver fluke	9	6.00	9	6.00	18	6.00
CBPP	6	4.00	5	3.33	11	3.67
Trypanosom.	8	5.33	8	5.33	16	5.33
Fever	1	0.67	3	2.00	4	1.33
L.cirrhosis	10	6.67	9	6.00	19	6.33
Kirchi	6	4.00	10	6.67	16	5.33
Worms	1	0.67	3	2.00	4	1.33
Bloat	5	3.33	1	0.67	6	2.00
Unidentified	14	9.33	13	8.67	27	9.00

Chi-square = 35.37 (significant at P<0.01)

Source: Computed from field data, 1996/97

attributable to *foot and mouth disease* in zone 1 was 78%. This was followed by *rinderpest* (4.67%), *kirchi* (2.50%), as well as *trypanosomiasis* and *liver cirrhosis* (2.33% each). In zone 2, *Kirchi* was the most prevalent, accounting for 16.96% of the sick animals, followed by *foot and mouth disease* (14.55%), *liver cirrhosis* (11.92%) and *black leg* (10.10%). Overall, about 1,095 cattle were affected by different diseases out of which *foot and mouth disease* alone accounted for 540 or 49.32%. The other important diseases were *kirchi* (9.04%), *liver cirrhosis* (6.67%), as well as *fever* and *black leg* (5.11% each).

Table 7: Number of cattle affected by the various diseases

Table 7: Number of cattle affected by the various diseases

	Zone 1		Zone 2		Total	
Disease	No. of cattle	%	No. of cattle	%	No. of Cattle	%
Rinderpest	28	4.67	12	2.42	40	3.65
Black leg	6	1.00	50	10.10	56	5.11
F & MD	468	78.00	72	14.55	540	49.32
Anthrax	3	0.50	41	8.28	44	4.02
Liver fluke	10	1.67	15	3.03	25	2.28
CBPP	4	0.67	6	1.21	10	0.91
Trypanosomia.	14	2.33	28	5.66	42	3.84
Fever	3	0.50	53	10.71	56	5.11
L.cirrhosis	14	2.33	59	11.92	73	6.67
Kirchi	15	2.50	84	16.96	99	9.04
Worms	2	0.33	14	2.82	16	1.46
Bloat	10	1.67	6	1.20	16	1.46
Unidentified	23	3.83	55	11.72	78	7.12
Total	600	100	495	100	1095	100

Chi-square = 478.67 (sinificant at P<0.01)

Source: Computed from field data, 1996/97

Clearly, *foot and mouth disease* was the most serious disease in the area. To explain the widespread prevalence of *foot and mouth disease* (or *boro*) in the area, expert opinion was solicited. The veterinary professionals contacted at ZEPA and Sokoto State Ministry of Agriculture attributed the widespread prevelance of the diseases in the herds to the lack of vaccine for the disease in Nigeria. Being a virus disease, *foot and mouth disease* is best controlled by prevention through vaccination. Since vaccine for it is not available, animals are totally predisposed. Some of the herders claimed that rubbing the affected parts with left-over food reduces the effect of the disease but this was not verified in the study.

The analysis in terms of the number of herds (or herders) reporting cases of diseases might tempt one to conclude that the animal health situation in zone 2 was worse than in zone 1 because more herds were affected there. To make such conclusion, however, would be wrong, considering the fact that zone 2 had the least number of sick animals (Table 7). The higher proportion of herds with disease cases in zone 2 could probably be attributed to the fact that less herders vaccinated their cattle than in zone 1. As can be seen in Table 8, while 84% of herders in zone 1 vaccinated their herds, only 55.33% vaccinated in zone 2. The relatively low level of vaccination in zone 2 was not as a result of inadequate supply of vaccination services *per se*; it was due more to herder apathy toward vaccination. A vaccination campaign, presumably with substandard vaccines, a few years back led to the death of several cattle and herders have, therefore, become sceptical about vaccinations.

In spite of the fact that less herders vaccinated and more recorded disease cases in zone 2, however, the number of cattle affected was less in this zone than in zone 1. Perhaps, herders in zone 2 were more able to prevent the spread of the diseases within the herd as soon as a few cases have been noticed since they were located closer to functioning veterinary posts than those in zone 1. As can be seen in Table 8, herders in zone 2 were within 0-15 km radius of at least one ZEPA veterinary post located at Gidan Jaja, Gusami and Sabon Birni Dan Ali. This is to be contrasted with herders in zone 1 who had to travel a distance of 20-60 km to reach any of the Sokoto State zonal veterinary offices located at Sokoto, for herders in Wurno and Rabah L.G.A.s. and Isa, for those in Goronyo area.

Table 8 further shows that only 14% of all respondents (or 45.65% of herders reporting sick animals) contacted veterinary personnel for curative treatment in zone 1, as against 34% of the respondents (or 82.26% of respondents with sick animals) in zone 2. Again more herders contacted veterinary personnel in zone 2 probably because of their relative proximity to functional veterinary posts. Distance is a transaction cost to both the provider and the herder. It is, therefore, expected that more herders will contact veterinary personnel and get the services required the closer they are to the provider. That is to say, proximity reduces the transaction cost of seeking and delivering veterinary care.

Table 8: Some indicators of effectiveness of veterinary service

	Zone 1		Zone 2		
Variable	Freq	%	Freq	%	z-value
Contacted vet. personnel	21	14.00	51	34.00	3.534***
Self-medicated	39	26.00	28	18.67	1.496ns
Used ethnovet	35	23.33	10	6.67	4.036***
Vaccinated	126	84.00	83	55.33	5.420***
Vet. services are effective	135	90.00	144	96.00	0.632ns
Distance from Vet. post (km)	20-60		0-15		

+Test statistic = z test for differences between two proportions

*** = sinigficant at P<0.01; ns = not significant

Source: Computed from field data, 1996/97.

It is probably also due to the high costs involved in reaching veterinary posts located far away that more respondents (26% of all respondents or 84.47% of those with disease cases) in zone 1 self-medicated than those in zone 2 (18.67% of all respondents or 45.16% of respondents with disease cases). It should be noted here that a wide range of veterinary drugs were available for sale especially in weekly rural markets without restriction or control. This is true for both zones and the weekly retailers (hawkers) are quite popular.

In addition, more herders (23.33%) used ethnoveterinary (traditional veterinary) medicine in zone 1 than in zone 2 (6.67%) (Table 8). This is regardless of the widespread belief that modern veterinary intervention is superior to ethnoveterinary practices. For instance, 90% of the herders in zone 1 and 96% in zone 2 believed that modern veterinary intervention was more effective than ethnoveterinary practices. The question then is: what accounts for the popularity of ethnoveterinary practices, particularly in zone 1? The answer again lies in the lack of easy access to modern veterinary care in the area. This compelled some of the herders to use traditional methods as substitute to modern veterinary intervention.

From the foregoing results, it is apparent that modern veterinary services are more available in zone 2 than in zone 1. However, the relative efficiency of veterinary providers in the zones was further investigated using the criteria of calf-mortality and calving rate as suggested by Leonard (1990). The results are presented in the following sub-section.

4.2.2 Calf Mortality and Calving Rates

Table 9 presents the distribution of the respondents according to calf mortality. It can be seen from the table that the majority of the herders recorded calf mortality rates of between 0 and 10% in their herds. This represented 76.67% of respondents in zone 1 and 82% of those in zone 2. The other major calf mortality ranges in zone 1 were, 30 - 40, 40 - 50 and 10 - 20, with 5.33%, 5.33% and 4.67% of the herders, respectively. In zone 2, 4% each had calf mortalities ranging from 10 - 20, and 20 - 30. The mean calf mortality rates were 12.47% and 9.26% for zones 1 and 2, respectively. This gives an over all mean mortality rate of 10.88%. The mean mortality rate obtained in this study fall within the range of 6 to 25% estimated for traditionally managed cattle in the whole of Africa (Leonard, 1993). They also compare fairly well with the 11.2% found by Pullan (1980) among white Fulani cattle on the Jos Plateau. They were, however, well above the 4.5% reported by Tekdek and Goje (1988) among semi-settled Fulani herds in the Zaria area of Kaduna State, but quite below the 15% estimated for the whole of Nigeria (National Green Revolution Committee, 1981).

The findings of the study suggest that mortality rates were lower in zone 2 than zone 1. This is regardless of the fact that more herds in zone 2 experienced disease episodes than in zone 1. This could, again, be attributed to the relatively easy access of herders in zone 2 to veterinary services. Apparently, herders in zone 2 were able to avail themselves of veterinary services to cure most of their sick animals, while those in zone 1 suffered heavier losses because of difficulty in obtaining veterinary care.

Table 9: Distribution of herders according to calf mortality rate

	Zone 1		Zone 2		Total	
Mortality rate (%)	Freq.	%	Freq.	%	Freq.	%
0 - 10	115	76.67	123	82.00	238	79.33
11 - 20	7	4.67	6	4.00	13	4.33
21 - 30	4	2.67	6	4.00	10	3.33
31 - 40	8	5.33	3	2.00	11	3.67
41 - 50	8	5.33	3	2.00	11	3.67
51 - 60	1	0.67	2	1.33	3	1.00
61 - 70	2	1.33	0	0	2	0.67
71 - 80	1	0.67	0	0	1	0.33
81 - 90	1	0.67	2	1.33	3	1.00
91 - 100	3	2.00	5	3.33	8	2.67
Total	150	100	150	100	300	100

Mean zone 1 = 12.47%; Mean zone 2 = 9.26%; Chi-square = 7.851 (not significant).

Source: Computed from field data, 1996/97

Table 10 presents the distribution of herders according to calving rate. The Table reveals that majority (46.67% in zone 1 and 58% in zone 2) of the respondents recorded calving rates of between 90 and 100. In zone 1, 16.67% of the respondents had calving rates of between 40-50 while 9.33% had between 30-40.

In zone 2, 8.67% of the respondents had calving rates ranging from 80 - 90 while 6.67% were in the range of 70 - 80. Other important calving rate ranges in the zone are as presented in Table 10.

The mean calving rate was 72.27% in zone 1 and 81.11% in zone 2 giving an over all mean of 76.69%. The over all mean obtained in this study was slightly higher than the upper limit of the range of 45-75% estimated for Africa (Leonard, 1993) but well above the 57% reported by Mohammed-Baba and Abdullahi (1988)

Table 10: Distribution of herders according to calving rate

	Zone 1		Zone 2		Total	
Calving rate (%)	Freq.	%	Freq.	%	Freq.	%
0 - 10	2	1.33	1	0.67	3	1.00
11 - 20	1	0.67	0	0.00	1	0.33
21 - 30	0	0.00	5	3.33	5	1.67
31 - 40	14	9.33	6	4.00	20	6.67
41 - 50	25	16.67	3	2.00	28	9.33
51 - 60	7	4.67	5	3.33	12	4.00
61 - 70	9	6.00	7	4.67	16	5.33
71 - 80	7	4.67	10	6.67	17	5.67
81 - 90	10	6.67	13	8.67	23	7.67
91 - 100	70	46.67	87	58.00	157	52.33
Not included	5	3.33	13	8.67	18	6.00
Total	150	100	150	100	300	100

Mean zone 1 = 72.27%; Mean zone 2 = 81.11%; Chi-square = 29.66 (significant at $P < 0.01$).

Source: Computed from field data, 1996/97

The results presented above show that the calving rate was higher in Zone 2 than in Zone 1. This is not unexpected considering the fact that animals in zone 2 were healthier and were, therefore, more fecund.

Taking an over all view of the results presented in this section, it appears that veterinary services were more effective in zone 2, where cost-recovery has been attempted, than in zone 1 which is totally dependent only on services provided by the ministry of agriculture.

4.3 Ability and Willingness to Pay

The willingness and ability of livestock owners to pay for veterinary services is crucial in structural reform because private providers could survive only if services are paid for. The determination of willingness and ability to pay becomes even more significant in the case of herders in the study area since their production systems are not commercialised and they have been accustomed to receiving government veterinary services free-of-charge or at least at subsidised rates. Even if they are found to be willing to pay, the success of the reform will still depend on their elasticity of demand for veterinary services. If the demand is elastic, introduction of, or increase in fees will entail loss of revenue by the provider. A situation of inelastic demand will have the opposite effect. The following sub-section examines the attitude of herders towards paying for veterinary services.

4.3.1 Herders' Attitude Towards Payment for Veterinary Services

To determine the willingness to pay, herders were asked if they considered it proper for them to pay for veterinary services. Their responses are summarised in Table 11 which shows that 62.67% of herders in zone 1 and 87.33% of those in zone 2 considered it proper to pay. Together, these constitute 75% of all respondents suggesting that most herders in the area do not see anything wrong with paying for veterinary services; what they seem to emphasis is qualitative service to get their animals cured. Some herders in the study area even travel as far as to Jos (about 600 km from Sokoto town) in search of drugs which were not available in the study area.

It seems that herders are not only willing to pay, but they could pay surprisingly large amounts to treat their animals. In fact, 73.33% of herders in zone 1 and 72.67% of those in zone 2, together constituting 73% of all the respondents, indicated that they would be willing to pay more than the market value of an animal to save its life (Table 11). This suggests that herders in the area attach both monetary and sentimental values to their animals. It also indicates that the production goal of herders in the area might not be profit maximization. Discussions with them suggest that the number of animals owned at any

one time is a symbol of wealth and prestige, a status symbol which determines the level of respect commanded by an individual in the society. In view of this, it can be deduced that the goal of the herder is maximization of wealth in terms of the number of animals in the herd. Therefore, when an animal is sick, the issue is not so much how much it would cost to treat it *per se*, but how to get it recovered.

Table 11: Some indicators of herders' attitude toward payment

	Zone 1		Zone 2		
Indicator	Freq	%	Freq.	%	z-value+
Paying is proper	94	62.67	131	87.33	4.932***
Can pay more than market value	110	73.33	109	72.67	0.129ns
Paid for vaccination*	54	36.00	51	34.00	0.365ns

*Fee paid per animal ranged from N2.50-N180 with a mean of N32.72 in zone 1, and from N1-N20 with a mean of N7.25 in zone 2.

+Test statistic = z test for differences between two proportions

*** = Significant at P<0.01; ns = not significant.

Source: Computed from field data, 1996/97

The study further revealed that some of the herders in the area paid even for vaccinations. As presented in Table 11, 36% of the respondents in zone 1 (which is equal to 42.86% of those who vaccinated) paid for vaccination. Similarly, 34% of herders in zone 2 (or 61.45% of those who vaccinated) paid for vaccination. Table 11 further shows that herders in zone 1 paid between N2.50 and N180 per cow while those in zone 2 paid between N1 and N20. The mean amounts paid for vaccination per animal were N32.74 and N7.25 in zones 1 and 2, respectively. Some of the herders were charged directly on a rate per animal basis, while others were allowed to pay whatever amounts they considered appropriate. It should be noted that charging for vaccination especially in zone 1 was not an official policy of government; the field staff adopted this for their own benefit.

The fact that herders paid for vaccination is an interesting finding. Vaccination is a private good with externalities. Going by economic theory, such goods are subject to market failure because of the free-rider problems they create. However, the fact that herders were willing to pay even for vaccination is a favourable condition for the financial survival of private providers.

The foregoing indications of willingness of herders to pay confirm the findings of some studies in other parts of Africa which suggest that livestock owners are generally willing to pay for veterinary services, and could go to a great extent to do so, as long as they are sure of the quality of what they are paying for (Umali *et al*, 1992).

4.3.2 Estimated Demand Functions

To quantify the degree of responsiveness of herd owners to the price (or cost) of veterinary care, demand functions were estimated using the ordinary least squares procedure. Initially, a general model was estimated across all categories of respondents. The respondents were then segregated on the basis of herd size, and estimation was done separately for 50 herders with the largest herd sizes and 50 with the smallest. In all cases, the estimation was done in linear, quadratic and double-log (Cobb-Douglas) functional forms. The double-log form was ultimately chosen for further analysis because in each case, it gave the best fit in terms of the appropriate "signing" of the parameter estimates (regression coefficients), their levels of significance and the magnitude of the R^2. The results from the estimated double-log equations are presented in Tables 12-14, while those of the linear and quadratic forms are presented in Appendices A-F.

Table 12 presents the estimated double-log function for all herders. The R^2 presented in the table shows that 53.86% of the variation in the expenditure on veterinary services (demand) was explained by the variables included in the model. The joint explanatory power of the included variables was further confirmed by the F-value which was highly significant ($P<0.01$).

Table 12: Demand function for all herders using the double-log model

Variable	Parameter Estimate	t-value
Intercept	3.335	8.949***
Service cost (price)	-0.566	-3.718***
Herd size	0.331	4.131***
Distance	-0.419	-4.201***
No. of sick animals	0.326	3.225***

R^2 = 53.86%; F-value = 32.40***; *** = significant at < 0.01; ns = not significant.

Source: Computed from field data, 1996/97

The parameter estimate with respect to the cost (price) of veterinary service was negative which is quite in agreement with the law of demand of the neo-classical micro-economic theory. The value was significantly different from zero ($P<0.01$), suggesting that cost was one of the factors determining demand for veterinary services. This corroborates the findings of Koma (1997) who found, in Uganda, that the expected financial cost of service was a major factor determining the likelihood of herders calling a veterinary personnel when such need arose.

The fact that herders responded negatively to price may appear contradictory to the information presented in the preceding section which suggested that herders do not give much consideration to the cost of veterinary service when confronted with a situation in which veterinary intervention was required. There is not necessarily a contradiction, however. Herders are only behaving as rational economic agents by responding negatively to price. The earlier presentation should not be misconstrued to mean that herders do not respond to cost at all. It only implies that the response, when compared with the magnitude of the price change, is low. What is important here is not so much the response itself, but the magnitude of the response relative to the factor causing the response.

The regression coefficient with respect to herd size was also positive and significant. The positive sign is not unexpected, considering the fact that herders with large herd sizes are likely to encounter more sick cases, everything being equal, than those

with small herds. Furthermore, large-scale herders, could share the cost of veterinary services on many animals, thus reducing the unit cost. The reduced unit cost would then allow the herder to demand for more. This is quite in agreement with Umali *et al.* (1992) who observed that farmers with large herds can take greater advantage of veterinary services than small herders since their cost per unit is smaller and thus makes the services more affordable.

Distance from the veterinary post was found to have a negative and significant effect on demand ($P<0.01$). The negative relationship between demand and distance is not unexpected because distance is a transaction cost (dead wait loss) to both the herder and the provider. There is a major difference between animal health provision and human medical care in this respect. In the case of human medical care, the patient in most cases goes to the provider, but in the case of veterinary care, the provider goes to the herder. This has a major implication for the cost of veterinary services. From the provider's perspective, he has to travel to meet the herders most of whom are unable to bring their large animals to the veterinary post or clinic. The provider, therefore, incurs some expenses in terms of transport cost, time and cost of cold storage of veterinary drugs and supplies in transit.

The provider will normally shift the costs arising from trying to reach the herder on to the herder. In other words, the herder has to pay for the cost of transporting the provider and his drugs, vaccines and supplies, as well as for the provider's time and expertise. Usually, these costs are charged together as the cost of veterinary service. In a sense, therefore, the cost of distance, incurred by the provider is already captured in the cost of veterinary services earlier discussed. The effect of distance arising from the actions of the herder is, however, different. Distance captures not only the monetary expenses the herder must incur in traveling to inform the provider about his sick animal, but also the cost, in labour time, of doing so. The distance factor is particularly important in determining demand in this study because of the extensive nature of the production system (which consists mainly of scattered small-scale producers), coupled with the poorly developed transportation and communication systems. Thus, while a herder may have a genuine need to seek veterinary intervention, distance may deter him from getting it.

The negative effect of distance on demand as found in this study corroborates the findings of Koma (1997) in Uganda, and Woods (1997) in Zimbabwe, both of whom identified distance as a major transaction cost limiting demand for veterinary services. It appears that a solution is needed to the distance problem, in order to improve the efficiency of veterinary services delivery. Leonard (1993, 1997) has suggested that the trade-offs between the transaction costs of transport and the transaction costs of administering a system whereby animal health personnel travel a route system to treat sick animals at fixed times and places should be explored. If the transaction costs are found to be less for the route system, it may well be one of the strategies for reducing the negative effect of distance. In addition, small herders in the area could reduce the effect of distance and benefit from economies of scale if they form producer associations or cooperatives which employ veterinarians or other provider to provide veterinary services to members in a delineated geographical area.

The number of animals falling sick in the herd within the year had a positive and significant effect on demand ($P<0.01$). This is to be expected since a herder with higher number of sick animals will normally have more need to seek veterinary intervention. Therefore, the more there are sick animals, the higher the propensity to spend on veterinary services.

The results of the estimated double-log function for the large-scale herders are presented in Table 13. The R^2 was 40.48% while the F-value of 6.355 was highly significant ($P<0.01$). The coefficient with respect to cost of veterinary service was again negative and significant ($P<0.01$). The absolute value of the coefficient (0.407) was, however, slightly lower than that for all herders, suggesting that the large-scale herder responded slightly less to price than the average herder.

The regression coefficient for distance was negative and significant ($p<0.05$). The value of the coefficient (-0.460) was nearly at par with that for all herders (-0.419) although the level of significance of the former was less. As with the case of all herders, the number of sick animals had a positive and significant relationship with demand ($P<0.01$).

Table 13: Demand function for large-scale herders using the double-log model.

Variable	Parameter estimate	t-value
Intercept	4.078	10.172***
Service cost (price)	-0.407	-2.806***
Distance	-0.460	-2.517**
No. of sick animals	0.682	4.313***

R^2 = 40.48%; F-value = 6.355***; **, *** = significant at P<0.05, and P<0.01, respectively.

Source: Computed from field data, 1996/97

Table 14 presents the results of the estimated double-log function for the small-scale herders. The R^2 and F-value were 46.24 and 10.895, respectively. The latter was highly significant (P<0.01). The coefficient of the cost of service was negative and significant (P<0.01). It was higher than those of the large-scale and all herders, showing that the small-scale herders responded more to cost than other herders in the area. This is so because small-scale herders were likely to be confronted with higher unit cost than other farmers because of the small number of their animals.

Distance to the veterinary post or clinic, had a significant (negative) effect on demand by small herders. In other words, the farther away a small herder is from a functional veterinary post, the lower is his propensity to obtain veterinary care. The value of the coefficient for small-scale herders (-0.564) was higher than that of the large-scale herders (-0.460). This suggests that the large-scale herders were deterred less by distance than the small-scale herders in their demand for veterinary care. This is perhaps due to the fact that the large-scale herders could spread the transaction costs associated with distance on several animals. A veterinary personnel visiting a large herd is likely to treat more animals than the one visiting a small herd. Therefore, the unit cost of distance arising from both the action of the herder himself, and that of the veterinary personnel, in trying to attend to the animals is reduced.

Table 14: Results of the estimated double-log function for small-scale herders

Variable	Parameter estimate	t-value
Intercept	4.234	7.094***
Service cost (price)	-0.766	-2.759***
Distance	-0.564	-4.143***
No. of sick animals	0.401	2.390**

R^2 = 47.36; F-value = 6.478***; **, *** = significant at P<0.05 and P<0.01, respectively.

Source: Computed from field data, 1996/97

The coefficient with respect to the number of sick animals was positive and significant (P<0.05). The fact that similar results were obtained for the large-scale herders and for all herders shows that the number of sick animals is a major determinant of demand for veterinary services.

4.3.3 Demand Elasticities

Demand elasticity is a pure number which measures the degree of responsiveness of demand to change in the price of a commodity. It is the proportionate change in quantity divided by the proportionate change in price. In this study, demand elasticity was given directly as the regression parameter with respect to price or cost of veterinary care in the double-log function. From Tables 12-14, it can be seen that the price elasticities of demand were -0.566, -0.407, and -0.766, for all herders, large-scale herders and small-scale herders, respectively. This shows that in all cases, the demand for veterinary services was inelastic since the absolute values of the elasticity coefficients were below unity. This finding further confirms the earlier position that the response of herders to cost of service was relatively low, when the degree of change in demand is compared with the change in the price.

For instance, for all the herders, a one percent change in price will cause a 0 566% change in the demand for veterinary services, in the opposite direction. Similarly, a one percent change in cost of veterinary service will result in a 0.407% change in demand by

large-scale herders, while for the small herders, a one percent change in the cost will cause a 0.766% change in demand. These results indicate that the small-scale herders responded more to cost than any other category of herders while the large-scale herders had the lowest response.

According to economic theory, one of the most important factors determining demand elasticity is the proportion of consumer's income or wealth endowment that is expended on the commodity. The higher the proportion of income or wealth devoted to the commodity, the higher the elasticity of demand for that commodity (Gros, 1993). It is expected that expenditure on veterinary services is likely to constitute relatively small proportions of the total wealth of the large-scale herders. As a result of this, large-scale herders are expected to have lower elasticity of demand than the small-scale herders. Another closely related factor accounting for the relatively low response of large-scale herders is the economies of scale which has been mentioned earlier.

The relatively low response of herders generally to the cost of veterinary service has an important implication for the financial survival of private providers for it demonstrates that herders are generally willing to pay for veterinary services. With privatization of veterinary services, the cost of veterinary care is likely to increase and herders may reduce their demand. If demand were elastic, the reduction in demand would exceed the increase in cost, leading to a loss of revenue to the provider. In the case of this study, however, demand was inelastic suggesting that an increase in the cost will cause a decrease in demand, but the decrease will be proportionately less than the increase in cost. Hence, the total revenue of the provider will likely increase with increase in price.

The foregoing results suggest that as far as willingness of herders to pay is concerned, conditions in the area are quite favourable for private provision. It must be added quickly, however, that willingness to pay is a necessary, but not sufficient, condition for the financial survival of providers. Also crucial are the costs of establishing and operating a private practice *vis-a-vis* returns, as well as the number of animals required to break-even and whether such number is available in the area. Necessary institutional mechanisms to facilitate trade are also important. These issues are examined in sections

4.4 and 4.5, respectively.

The findings of the study also have some bearing on the strategy a provider may adopt particularly with respect to pricing. Large-scale herders have been shown to be less elastic than small-scale herders. This gives some room for the practice of price discrimination by the provider. Large-scale herders who are less responsive could be charged more than the small-scale herders for the same services. This suggestion is, however, tenable only to the extent that the provider is able to separate the markets. This may not be an impossible task, given the nature of veterinary interventions. In many cases, it would be difficult for a herder whose animal has received diagnosis and treatment by a veterinarian at a lower cost, to resell the diagnosis and treatment to another herder. Price discrimination could give a further boost to the revenue base of the provider.

4.4 Economic Feasibility of Private Practice

Private entry into the livestock services sector depends on whether an economically profitable practice can be sustained (Umali *et al.*, 1992). This study, therefore, investigated the economic feasibility of establishing a private veterinary practice in the study area. The approach was to determine the veterinary livestock units (VLUs) a provider must treat in order to break-even and whether such livestock density is available in the area. One approach would have been to survey a number of private veterinarians and determine the costs and returns of their practices. This approach was not adopted in this study for a number of reasons. First, there was no established private practice in the whole of the area, with the exception of very limited part-time practice by a few veterinarians at UDUS (within Sokoto town) and the dispensing of drugs by pharmacies and rural market retailers. Second, the results of such a micro study are likely to be highly location-specific and objective generalization is likely to be impaired. An indirect measure of profitability, such as the break-even livestock units used in this study, is likely to be more relevant to policy in the privatization process as it permits generalization once a number of key macro decision variables - such as the number of veterinary personnel, the population of livestock, and the general level of prices of facilities necessary for veterinary practice in a region - are known or could be reasonably

estimated. This informed the use of the break-even veterinary livestock units as a measure of economic feasibility of private practice in the study. The results of the analysis are presented in the following sub-sections.

4.4.1 Costs and Returns of a Private Practice

The data on the costs of a private practice in north-western Nigeria are presented in Tables 15-17. Tables 15 and 16 show the estimated initial investment in veterinary equipment and the other facilities necessary for a private practice in the study area, respectively. Also presented in Tables 15 and 16 are the life spans and annual depreciation values of the various assets listed. The list of the veterinary equipment and the other requisite facilities was obtained during the survey of veterinarians and para-professionals and was cross-checked with that used by Umali *et al.*(1992) for a number of African countries. The method used in determining the prices of the items are as described in Chapter 3. It is evident from Table 15 that a prospective private practice would require about N203,375 (at 1997 costs) to acquire requisite veterinary equipment alone. Some of the more costly veterinary equipment include instrument tray (with heater) and weighing balance (each accounting for 17.21% of the cost of veterinary equipment) as well as microscope which accounted for 12.29%.

Table 16 shows that the other requisite facilities essential for effective private practice include transport facility (a motorcycle or a four wheel drive vehicle), office furniture and refrigerator for storage of certain drugs and other biologicals such as vaccines. Among these other facilities, the cost of transport facility was the highest.

Figure 5 shows that veterinary equipment, transport, as well as refrigerator and furniture accounted for about 51%, 38% and 11% of the overall initial investment, respectively, if the means of transport is a motorcycle. This situation changes dramatically, however, if the means of transport is a four wheel drive vehicle. Under such a scenario, transport alone accounted for 91% of the initial investment cost leaving only about 7% for veterinary equipment and less than 2% for refrigerator and furniture (Figure 6).

Table 15. Initial fixed investments in veterinary equipment for a private practice (1997)

Item	Cost (Naira)	% of total	Life span (yrs)	Depr./yr (Naira)
Burdizzo	3,000	1.48	5	600
Surgical set	17,500	8.60	5	3,500
Microscope	25,000	12.29	5	5,000
Microscope slides, racks & stains	2,800	1.38	2	1,400
Hoof trimmer	10,000	4.92	3	3,333.33
Stethoscope	775	0.38	5	155
Automatic syringe	4,000	1.97	2	2,000
Sterilizer tray	35,000	17.21	2	17,500
Surgical table	18,000	8.85	8	2,250
Instrument tray	2,000	0.98	2	1,000
Auroscope	12,000	5.90	5	2,400
Foot rot shears plus blades	4,500	2.21	3	1,500
Restraint facilities	3,500	1.72	2	1,750
Drenching gun	3,000	1.48	3	1,000
Balance	35,000	17.21	5	7,000
Glass wares	2,800	1.38	2	1,400
Gloves and gloves rack	1,400	0.69	5	280
Protective clothing	1,500	0.74	2	750
Rain boots	800	0.39	3	266.67
Containers and boxes	1,000	0.49	5	200
Cryogenic flask	1,300	0.64	2	650
Thermos flask	1,400	0.69	2	700
Thermometer	100	0.05	2	50
Sprayer	5,000	2.46	5	1,000
Debeaker	12,000	5.90	5	2,400
Total	203,375	100		58,085

Source: Computed from field data, 1996/97

Table 16: Other fixed initial investments for a private practice*

Item	Cost (Naira)	% of total	Life span (yrs)	Depr./yr (Naira)
Motorcycle (vehicle)	150,000 (2,500,000)	77.32 (98.27)	5 (5)	30,000 (500,000)
Office furniture	4,000	2.06 (0.16)	10	400
Refrigerator	40,000	20.62 (1.57)	5	8,000
Total	194,000 (2,544,000)	100 (100)		38,400 (508,400)

* Figures in parentheses pertain to the purchase of a four wheel drive vehicle instead of a motorcycle.

Source: Computed from field data, 1996/97

Table 17 presents data on the annual costs of a private practice. The total costs are broken down into fixed and variable components. The fixed cost consists of the annual depreciation on the initial investment items presented in Tables 15 and 16, in addition to rent on clinic, cost of utilities and salary (it was initially assumed that the professional veterinarian will employ one paraprofessional). The variable costs include cost of fuel and maintenance of the means of transport, cost of drugs and expendable supplies and cost of capital. The variable costs were computed under three assumptions about the number of trips a provider will undertake in a year to meet his clients (that is, 100, 200 and 240 trips). Similar assumptions have been made by Umali and others in Kenya, Uganda, Cameroon and Guinea (Umali *et al.*, 1992).

For illustrative purposes, the relative contribution of each of the above-listed components of the fixed and variable costs to the total cost were determined for the assumption of 200 trips per year. Figure 7 shows that for a practice using a motorcycle, depreciation accounted for 30.8% of the total cost, followed by drugs and supplies (17.6%), cost of capital (17.4%), fuel and maintenance (14.1%), salary of paraveterinarian (12.8%) as well as rent and utilities (7.4%). In the case of a practice using a vehicle, depreciation alone accounted for more than 60%, while cost of capital, fuel and maintenance, drugs and supplies, salary and rent, and utilities accounted for 17.4%, 9.4%, 5.9%, 4.3% and 2.5%, respectively (Figure 8).

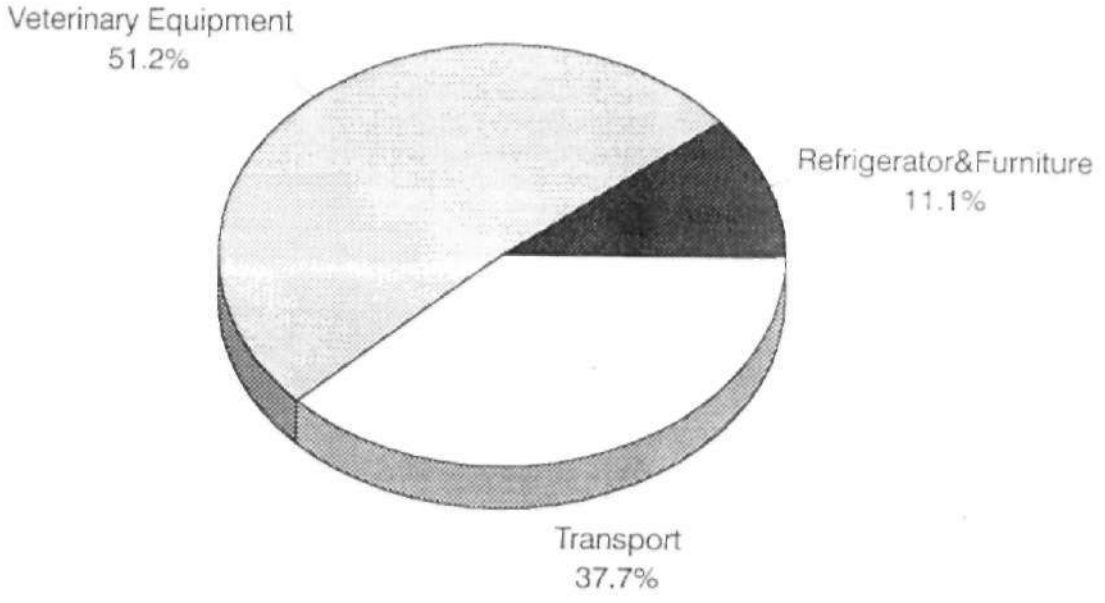


Figure 5: Components of initial investment (Motor-cycle)

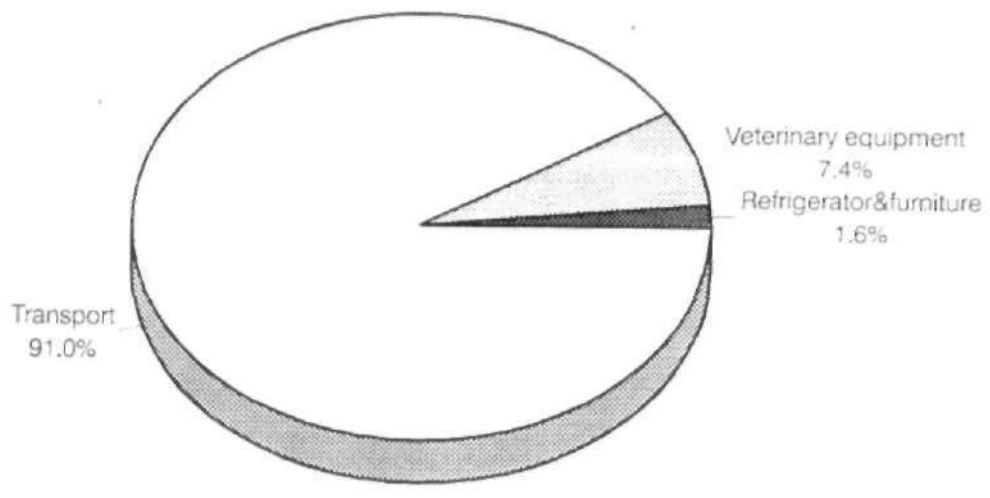


Figure 6: Components of initial investment (Vehicle)

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Table 17: Estimated annual costs and returns for a private practice

Item	Cost (Naira/yr)
Fixed costs:	
Depreciation:	
Motor cycle (Vehicle)	30,000.00 (500,000.00)
Office furniture	400.00
Refrigerator	8,000.00
vet. equipment	58,085.00
Rent - clinic	15,000.00
Utilities	8,160.00
Salaries	40,000.00
Total fixed cost	**159,645.00(629,645.00)**
Variable costs:	
Fuel and maintenance - N2.2 (N4.4)/km; 100km/trip:	
100 trips/yr	22,000.00 (44,000.00)
200 trips/yr	44,000.00 (88,000.00)
240 trips/yr	52,800.00 (105,600.00)
Drugs and supplies	55,000.00
Cost of capital (21%):	
100 trips/yr	49,695.45 (153,015.45)
200 trips/yr	54,315.45 (162,255.45)
240 trips/yr	56,163.45 (165,951.45)
Total costs:	
100 trips/yr	286,340.45 (881,660.15)
200 trips/yr	312,960.45 (934,900.45)
240 trips/yr	323,608.45 (956,196.45)
Revenue:	
Fee per VLU	150.00
25% margin on drug sales	13,750.00
50% margin on drug sales	27,500.00

Source: Computed from field data, 1996/97

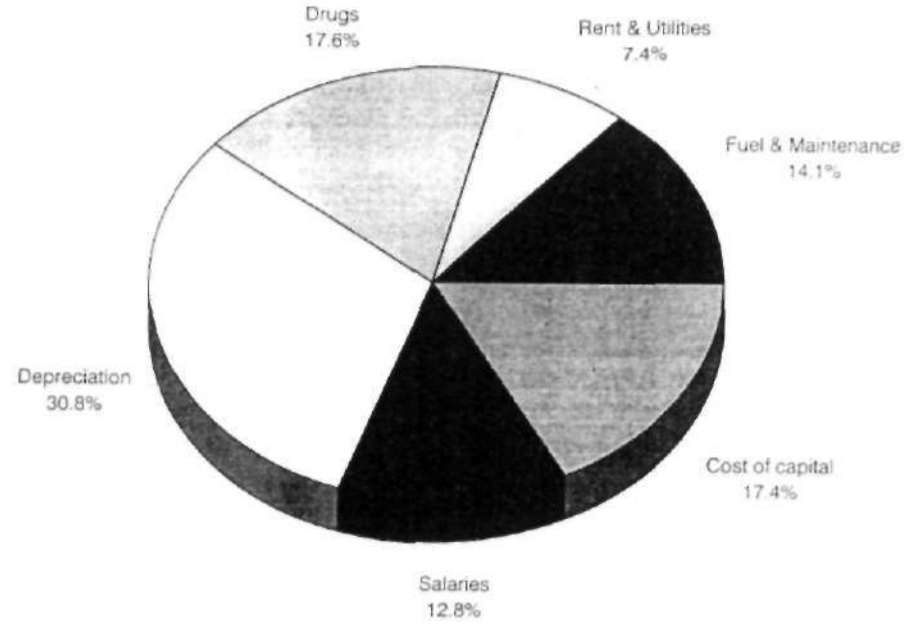


Figure 7: Components of annual cost (Motor-cycle)

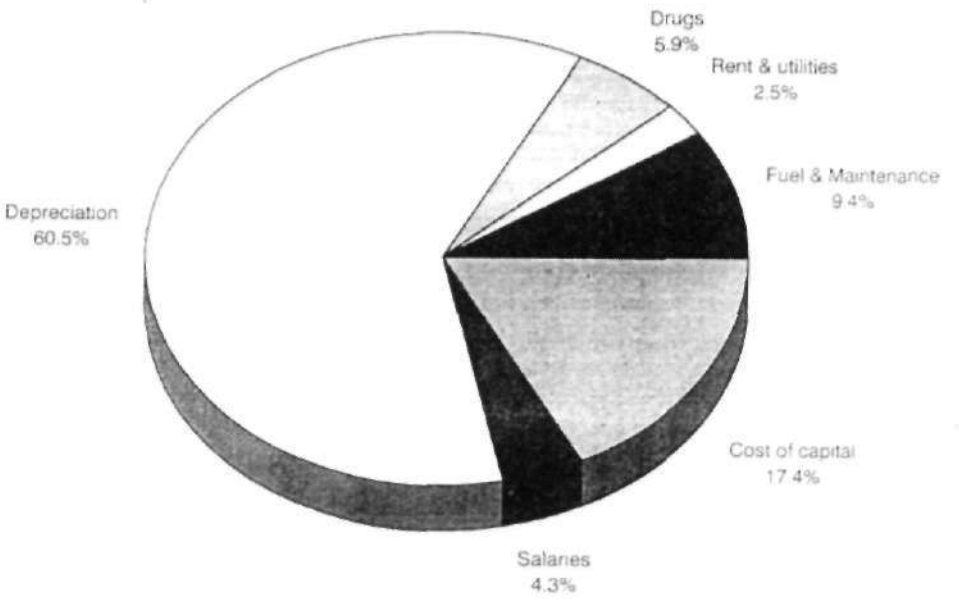


Figure 8: Components of annual cost (Vehicle)

The fee per veterinary livestock unit as presented in Table 17 was N150. This fee represents what a veterinary practice may charge as "consultation fee" for attending to one veterinary livestock unit. Later, this fee will be allowed to vary to determine its effect on the break-even veterinary livestock units. Also presented in Table 17 is information on margin on drug sales. This represents the additional revenue that a practice could make by charging some margin on drugs and expendable supplies. Two levels of margins, 25% and 50%, were assumed. With a total expenditure on drugs and supplies fixed at N55,000.00, a 25% margin will generate an additional revenue of N13,750 per year while a 50% margin will yield N27,500.00.

4.4.2 Break-Even Veterinary Livestock Units (BVLUs)

The concept of the break-even veterinary livestock units (BVLUs) indicates the number of livestock units a private practice must treat to break-even, given the prevailing costs and returns. Tables 18-20 present information on the break-even veterinary livestock units computed in this study. Each of the tables is with respect to a particular level of service fee charged per veterinary livestock unit (FPVLU). Two operational set-ups - a veterinarian working alone and a veterinarian employing a paraveterinarian -were considered in each table. In addition, the break-even veterinary livestock units were computed with respect to the type of transport facility adopted and with regard to whether the practice will concentrate purely on veterinary service or combine the service with dispensing of drugs and supplies. It was assumed for the purposes of this analysis that the practice may charge either 25% or 50% mark-up on drugs and supplies (after Umali *et al.*, 1992).

In Table 18, the service fee charged per veterinary livestock unit was assumed to be N150 which was obtained from part-time professionals in the area. There was a decrease (of between 91 and 92 VLUs) in the BVLUs as the practice moves from pure veterinary service to veterinary service with 25% mark-up. A decrease of similar magnitude was also observed in moving from 25% to 50% mark-up on drug sales. In contrast, the BVLUs increased (by about 266 units) as the operational set-up changed from a veterinarian working alone to a veterinarian employing a paraprofessional. In

addition, as should be expected, the number of BVLUs increased as the number of trips per year increased. But the most spectacular increase was in the case of a practitioner acquiring a four wheel drive vehicle instead of a motorcycle. The increase was more than 4,000 VLUs in some cases. It appears that the BVLUs could be drastically reduced in the area if the practice acquires a motorcycle instead of a vehicle, at least in the first few years of operation.

Table 18: Break-even veterinary livestock units in north-western Nigeria, 1997

(service fee =N150/VLU)

	Break-even veterinary livestock units					
	Pure vet service		Vet service +25% margin		vet service + 50% margin	
No.of trips/yr	Motorcycle	vehicle	Motorcycle	Vehicle	Motorcycle	Vehicle
Single Vet						
100	1,642	5,611	1,551	5,519	1,459	5,428
200	1,820	5,966	1,728	5,874	1,636	5,782
240	1,891	6,107	1,799	6,016	1,707	5,925
Vet + paravet						
100	1,909	5,878	1,817	5,786	1,726	5,694
200	2,086	6,233	1,995	6,141	1,903	6,049
240	2,157	6,375	2,066	6,283	1,974	6,191

Source: Computed from field data, 1996/97

Tables 19 and 20 present the results of a sensitivity analysis on BVLUs based on FPVLU. They present information on BVLUs if the fee declines to N100 (Table 19) or to N50 (Table 20). There were substantial rises in the BVLUs as the fee dropped first to N100 and then to N50. The implications of such increases would be better understood when the BVLUs are compared with the actual VLUs on ground in the study area.

Table 19: Break-even veterinary livestock units for a private practice in north-western Nigeria (service fee = N100/VLU)

	Break-even veterinary livestock units					
	Pure vet service		Vet service +25% margin		Vet service + 50% margin	
No. of trips/yr	Motorcycle	Vehicle	Motorcycle	Vehicle	Motorcycle	Vehicle
Single Vet						
100 trips	2,463	8,417	2,326	8,279	2,188	8,142
200 trips	2,730	8,949	2,592	8,812	2,455	8,674
240 trips	2,836	9,162	2,699	9,024	2,561	8,887
Vet + paravet						
100 trips	2,863	8,817	2,726	8,679	2,584	8,542
200 trips	3,130	9,349	2,992	9,212	2,854	9,074
240 trips	3,236	9,562	3,099	9,424	2,961	9,287

Source: Computed from field data, 1996/97

Table 21 presents the BVLUs per km^2. These were computed by dividing the BVLU figures presented in Table 18 by the estimated area of coverage of a private practice (2229.02 km^2). The area of coverage was, in turn, obtained by dividing the total study area (102,535 km^2) by the total number of professional veterinarians in the area (46). It may be argued that in the privatization process, other veterinarians could move in from other parts of the country. But if privatization is pursued simultaneously in other parts of the country, such movements may be limited because of the shortage of veterinarians nation-wide. Furthermore, since "non-indigenes" normally suffer one form of discrimination or another outside their states of origin in Nigeria, it seems reasonable to assume that veterinarians presently resident in the area may enjoy some preference, at least in the first few years of privatization, over non-residents. Even then, all those resident in the area or those that would move in could not possibly become private providers since some will still be needed for teaching and research as well as to perform other functions necessary in formulating and implementing animal health policies by government. But to the extent that this makes more VLUs available for a private provider, it increases the economic feasibility above what is reported here, rather than decrease it.

Table 20: Break-even veterinary livestock units for a private practice in north-western Nigeria (service fee =N50/VLU)

	Break-even veterinary livestock units					
	Pure vet service		Vet service +25% margin		Vet service + 50% margin	
No. of trips/yr	Motorcycle	Vehicle	Motorcycle	Vehicle	Motorcycle	Vehicle
Single vet						
100	4,927	16,833	4,652	16,588	4,377	16,283
200	5,459	17,898	5,184	17,623	4,909	17,348
240	5,672	18,324	5,397	18,049	5,122	17,774
Vet + paravet						
100	5,727	17,633	5,452	17,358	5,177	17,083
200	6,259	18,698	5,984	18,423	5,709	18,148
240	6,472	19,124	6,197	18,849	5,922	18,574

Source: Computed from field data, 1996/9

Table 21: Break-even and actual veterinary livestock units per square kilometre (service fee = N150/VLU)

	Break-even VLUs per square kilometre					
	Pure vet service		Vet service +25% margin		Vet service + 50% margin	
No. of trips/yr	Motorcycle	Vehicle	Motorcycle	Vehicle	Motorcycle	Vehicle
Single Vet						
100 trips	0.74	2.52	0.70	2.48	0.65	2.44
200 trips	0.82	2.68	0.78	2.64	0.73	2.59
240 trips	0.85	2.74	0.81	2.70	0.77	2.66
Vet + paravet						
100 trips	0.86	2.64	0.82	2.60	0.77	2.55
200 trips	0.94	2.80	0.89	2.79	0.85	2.75
240 trips	1.00	2.86	0.93	2.82	0.89	2.78
Actual VLU						
100%	23.92	23.92	23.92	23.92	23.92	23.92
60%	14.35	14.35	14.35	14.35	14.35	14.35
40%	9.57	9.57	9.57	9.57	9.57	9.57
30%	7.18	7.18	7.18	7.18	7.18	7.18
20%	4.78	4.78	4.78	4.78	4.78	4.78
10%	2.39	2.39	2.39	2.39	2.39	2.39

Source: Computed from field data, 1996/97

Table 21 shows that the BVLUs per km^2 varied from 0.65 to 2.86 with the fee per VLU fixed at N150. If it is assumed that the practice will attend to all the animals in its area of coverage, the actual VLUs on ground per km^2 (23.92), as presented also in Table 21, exceeded the BVLUs by far. If, on the other hand, it is assumed that only 60% of the actual VLU would require medical attention, the number drops to 14.35 per km^2, and to 9.57 if only 40% will require treatment, all of which still exceeded the BVLU. Table 21 shows that private practice remains economically feasible even if the number of VLUs per km^2 requiring medical attention falls to 20% of the actual VLUs. At about 10%, however, the per unit area BVLUs exceed the actual VLUs to be treated, particularly for a practice using a four wheel drive vehicle. This shows that if the proportion of VLUs requiring attention falls to 10%, private practice may not be feasible. It is, however, unlikely that the proportion of VLUs requiring medical attention would fall to this level.

Table 22 presents the BVLUs per km^2 if the service fee per VLU reduces to N100. In other words, the figures in the table were computed from the BVLUs figures presented in Table 19. The BVLUs per km^2 under this scenario ranged from 0.98 to 4.29 which exceeded the BVLUs presented in Table 21. When compared with the actual VLUs presented in Table 21, the private practice remained feasible as the proportion of livestock units to be treated decreased from 100% to 20%. When it reached 10%, however, private provision was not feasible in the case of a practice using a four wheel drive vehicle since the BVLU per km^2 exceeded the number available for treatment.

The results presented in Table 23 are the BVLUs per km^2 when the fee per VLU decreased to N50. The break-even VLU per square kilometre in this situation ranged from 1.96 - 8.58. Compared with the actual VLUs per unit area presented in Table 21, the private practice remained feasible in all cases only if at least 40% of the available livestock units per unit area are treated. For a single-vet practice using motorcycle, provision remained feasible with the units of livestock reducing to 20%. At 10%, however, provision was not feasible in some cases. For a single-vet practice using a vehicle, at least 40% of the actual VLUs must be treated to guarantee profitability in most cases. A practice employing a paraveterinarian and using a motorcycle will remain economically feasible by treating at least 20% of the actual VLUs in its area of coverage. If it used a

vehicle, it has to treat not less than 40% of the VLUs, to break-even.

Table 22: Break-even veterinary livestock units per square kilometre (service fee = N100/VLU)

	Break-even VLUs per square kilometre					
	Pure vet service		Vet service + 25% margin		Vet service + 50% margin	
No. of trips/yr	Motorcycle	Vehicle	Motorcycle	Vehicle	Motorcycle	Vehicle
Single vet						
100	1.11	3.78	1.04	3.74	0.98	3.65
200	1.22	4.01	1.16	3.95	1.10	3.89
240	1.27	4.11	1.21	4.05	1.15	3.99
Vet + paravet						
100	1.28	3.96	1.22	3.89	1.16	3.83
200	1.40	4.19	1.34	4.19	1.28	4.12
240	1.45	4.29	3.89	4.23	1 33	4 17

Source: Computed from field data, 1996/97

Table 23: Break-even veterinary livestock units per square kilometre (service fee = N50/VLU)

	Break-even VLUs per square kilometre					
	Pure vet service		Vet service + 25% margin		Vet service + 50% margin	
No. of trips/yr	Motorcycle	Vehicle	Motorcycle	Vehicle	Motorcycle	Vehicle
Single vet						
100	2.21	7.55	2.09	7.44	1.96	7.31
200	2.45	8.03	2.33	7.91	2.20	7.78
240	2.54	8.22	2.42	8.10	2.30	7.97
Vet + paravet						
100	2.57	7.91	2.45	7.79	2.32	7.66
200	2.81	8.39	2.64	8.38	2.56	8.25
240	2.90	8.58	2.78	8.46	2.66	8.33

Source: Computed from field data, 1996/97

Given the results presented above, it appears that private practice is potentially feasible in north-western Nigeria as the practices would be able to break-even. It also

appears that the choice to use a motorcycle or vehicle has a significant effect on the profitability of a practice. In fact, the choice to use a vehicle as against a motorcycle increased the BVLUs in some cases by more than 250%. Therefore, profitability can further be increased substantially if a practice uses a motorcycle rather than a vehicle.

It is also clear that profitability, as measured by the reduced BVLUs, is enhanced if the veterinary practice combines drug sales with provision of veterinary advice. This may be in contrast with human medical care where the medical doctor is normally not encouraged to undertake dispensing of drugs, such function being the preserve of the pharmacist. In the case of veterinary practice, however, it appears that the combination of the two roles, apart from increasing provider'sprofits, has another major advantage. It was noted in section 4.3 that distance, as a transaction cost, was a major factor limiting demand for veterinary services. Now if the link between provision of veterinary service and dispensing of drugs is broken, the herder is put at a further disadvantage. Not only would he have to pay for his transport to invite the veterinarian and the transport cost of the veterinarian, he also has to pay for his transport to obtain the prescribed drugs. This will certainly place a heavy financial burden on the herder. Besides, drugs obtained from a veterinarian are likely to be more authentic than if the herder had to procure them. This is because the herder, an illiterate, may find it difficult to differentiate between fake and genuine drugs. For these reasons, it would be beneficial if the private provider combines veterinary service with drug sales.

The foregoing conclusion about economic feasibility was based on the fact that the provider will find sufficient livestock units on ground to break-even. But much as this is a useful criterion, it may be necessary to move a step further since the provider is not in the business just to break-even but to make profit. An important consideration should be the number of VLUs a veterinary practice would treat to make a certain level of additional income per year after breaking even. This information is presented in Table 24

Table 24: Veterinary livestock units required for a private practice to make additional income

Amount of income (naira/yr)	VLUS required 150*	100*	50*
Motorcycle			
20,000	2,199	3,299	6,597
40,000	2,332	3,499	6,997
60,000	2,466	3,699	7,397
80,000	2,599	3,899	7,797
100,000	2,732	4,099	8,197
Vehicle			
20,000	6,416	9,624	19,249
40,000	6,550	9,824	19,650
60,000	6,683	10,024	20,049
80,000	6,816	10,224	20,449
100,000	6,950	10,424	20,849

* Service fee per VLU (naira)
Source: Computed from field data, 1996/97 VLUs reqired

Table 24 presents the veterinary livestock units that a practice must treat to make income levels ranging from N20,000 - N100,000 a year. It was assumed, for illustrative purposes, that the practice will make 240 trips per year and charge 25% margin on drug sales. Furthermore, the figures are with respect to a practice consisting of a veterinarian and a paraveterinarian charging either N150, N100 or N50 as fee per VLU. It can be seen that the VLUs increased, in all cases gradually as the level of income increased but increased spectacularly as the fee decreased. For instance, if the fee is held at N150, the VLUs required increased from 2,199 to only 2,732 as the level of income increased from N20,000 per year to N100,000, in the case of a practice using a motorcycle. Similar trends can be observed for the N100 and N50 service fees.

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In contrast, when the annual income is held at N20,000, the required livestock units increased significantly from 2,199 to as much as 6,597, an increase of more than 200%, as the fee changed from N150 to N50. Similar trends can be seen for the other levels of income presented in Table 24. This suggests that fee charged per VLU is a very crucial factor determining the potential profitability of a practice in the area.

Another factor with substantial impact on the potential profitability, as mentioned earlier, is the mode of transport chosen by the practice. For example, for a fee of N150 and an income level of N20,000, the required number of VLUs increased dramatically form 2,199 to 6,416, or by 192%. It may, therefore, be concluded that the level of fee charged and the mode of transport chosen are the most important factors affecting the potential income of a private practice.

Finally, it is necessary to ascertain whether the number of VLUs required to obtain the indicated levels of income could be found in the area. The actual VLUs presented in Table 21 show the densities of livestock that could be obtained per unit area. These can be compared with the densities required as presented in Table 25. The figures in Table 25 were computed by dividing the required number of VLUs presented in Table 24 by the estimated area of coverage of a practice. The results show that for a practice using a motorcycle, the livestock densities could allow up to N100,000 income (even if the proportion of available livestock treated drops to 10%) except if the service charge also drops to N50 naira or below. If the service charge drops to N50, a profit of even N20,000 could be made only if at least 20% of the available VLUs is treated.

Table 25: Veterinary livestock units per square kilometre required to make additional income

Amount of income (naira/yr)	VLUs required per square kilometre		
	150*	100*	50*
Motorcycle			
20,000	0.99	1.48	2.96
40,000	1.05	1.57	3.14
60,000	1.11	1.66	3.32
80,000	1.17	1.75	3.50
100,000	1.23	1.84	3.68
Vehicle			
20,000	2.88	4.32	8.64
40,000	2.94	4.41	8.82
60,000	3.00	4.50	8.99
80,000	3.06	4.59	9.17
100,000	3.12	4.68	9.35

* Service fee per VLU (naira)

Source: Computed from field data, 1996/97

For a practice using a vehicle to realise a profit of N100,000, it must treat at least 20% of available VLUs within its area of coverage and the service fee must not fall below N100. If a practice charging N50 per VLU intends to make a profit of N20,000, it must treat about 40% of the VLUs in its area.

Taking an overall view of the results of this section, it could be concluded that private practice shows high potential profitability as there is sufficient livestock population in the area not only to guarantee a break-even but also to enable the practice to make reasonable profit.

4.5 Institutional Issues in the Reform of Veterinary Services

4.5.1 Restructuring Options

Given the present near-collapse state of veterinary services in north-western Nigeria, three options seem to confront governments in the area:

(1) governments may retain veterinary services but ensure better funding by increasing budgetary allocation,
(2) they may retain veterinary services but introduce cost-recovery, or
(3) they may transfer veterinary services to the private sector.

The first option implies that veterinary services would continue to be publicly provided but they would be made more effective through increased annual budgetary allocations and a more prudent financial management. Due to the present economic crisis, however, the financial resources available to government seems to be on the decline and the scope for increasing budgetary allocation for most public services is limited. It is probably this very problem that has caused the present inadequate funding.

The second option also suggests that government would continue to provide veterinary services but better funding would be achieved through financial cost-recovery. The cost-recovery could be direct or indirect. In the latter case, government may recover its cost on veterinary services by introducing a tax on the livestock sub-sector which uses

veterinary services. The draw-back here is that the method entails cross-subsidization of services received by some herders by others who may not have used the services. There is the likelihood that some herders would resist payment of such taxes particularly if they do not benefit from the services. In fact, Kela (1991) reported that a cattle head tax, the *jangali*, introduced in the 1970s in Nigeria had to be abandoned due to lack of cooperation by herders. This approach to cost-recovery may therefore be difficult to implement.

In the direct cost-recovery strategy, a herder who benefits from a veterinary service pays part or all of the cost of that service. This strategy is favoured by 35.71% of the veterinary personnel surveyed in this study (Table 26). It appears that governments in the area are also prepared to experiment with cost-recovery. To be sure, some donor-assisted projects notably ZEPA and SPLDP, are attempting this strategy in the area on a small-scale basis. But to achieve the level of funding required to revitalise the entire veterinary services, cost-recovery would have to be pursued on a much larger scale while loop-holes in the financial management system would have to be plugged. This would require an efficient organizational set-up and a monitoring mechanism that would ensure that those who handle the revenue collected make correct returns to the government treasury and that such funds are reinvested in the sub-sector. Given the level of corruption and red-tape that characterise most public hierarchies in Nigeria, generally, it is doubtful if such an organization could be put in place by government successfully.

It is probably in view of these problems associated with other reform options that calls are being made for a transfer of veterinary responsibilities to the private sector. This approach is particularly favoured by donors and some Nigerian authors (Suleiman, 1990; Kela, 1991). Some (35.71%) of the veterinary professionals and paraprofessionals interviewed also favoured privatization of veterinary services (Table 26).

4.5.2 Which Veterinary Services are Suitable for Privatization?

The whole idea of transferring public responsibilities to the private sector is rooted in the believe that the market performs most functions more efficiently than government. This, in turn, is grounded in the notion that the market transmits clear signals that provide

incentives for individuals or organizations involved in an exchange process to behave in a manner that is consistent with economic and social optimality. However, whenever the signals are not clearly transmitted and the incentives well-defined, market failure problem could arise. In a market failure situation, government intervention may become inevitable.

Table 26: Distribution of veterinary personnel according to restructuring options preferred

	Veterinarians		Paravets		Total	
Option	Freq.	%	Freq.	%	Freq.	%
More budgetary allocation	1	16.67	3	37.50	4	28.57
Cost-recovery	3	50.00	2	25.00	5	35.71
Privatization	2	33.33	3	37.50	5	35.71
Total	6	100	8	100	14	100

Source: Computed from field data, 1996/97

In principle, the decision to privatize a particular service will depend on whether or not its delivery is associated with market failure. In other words, it would depend on the economic nature of the service in question. In Chapter 2, a distinction was made between private goods, public goods and private goods with externalities. It was noted that the latter two create free-rider and market failure problems and their provision would, therefore, require some form of government intervention. Private goods, in contrast, are best provided privately since the rival and exclusion principles apply. Here, we examine the theoretical propositions explored in Chapter 2 to determine their practical application to the provision of veterinary services under privatization.

Veterinary pharmaceuticals (vaccines, drugs, sera, etc.) are purely private goods since the producer will capture all the benefits associated with producing and selling them (Umali *et al.*, 1994). Most vaccines used in the study area are produced at the National Veterinary Research Institute (NVRI) in Vom. The NVRI is a federal government agency and produces vaccines for distribution to states and other buyers. Being a private good, there appears to be no reason for NVRI to subsidise the cost of vaccines. The Institute

could charge full prices without fear of free-rider (market failure) problem. Efforts currently being made to commercialise the Institute are in the right direction, but the ultimate aim should be to introduce competition by allowing the private sector to produce vaccines. The federal government seems to have realised the desirability of introducing competition in vaccines production. Thus, in the Agricultural Policy launched in 1988, it was stated that the private sector will be encouraged to participate in vaccines production (Federal Ministry of Agriculture, 1988). However, there is no evidence to show that this policy has been implemented. In fact, the Institute still depends largely on subvention from government to finance its activities. Private entry into vaccine production will be difficult as long as government continues to subsidise vaccine production at the Institute.

Veterinary drug supply both from imported and local sources is already in the hands of the private sector. This appears to be in order. What may be needed is regulation to ensure that sub-standard products are not sold. Apart from regulation, the production and sale of sub-standard drugs and vaccines could be minimised if private veterinarians combine drug vending with the other veterinary services which, as noted in Section 4.4, makes the services even more profitable. In other words, the drugs and vaccines will now be distributed by those who have the expertise to make distinction between genuine and fake drugs. There is also an incentive for private veterinarians to ensure that drugs or vaccines bought are not sub-standard since they are subject to consumers' sanctions should something go wrong.

Vaccination, use of some veterinary drugs, vector control and diagnostic support are private goods with externalities; the individual herder who consumes them captures some of the benefits but some spill-over to others who have not paid for them. Vaccination is undertaken against infectious diseases. According to epidemiological principles of herd immunisation, disease outbreak is unlikely after a certain proportion of animals in a locality has been vaccinated (Leonard, 1993). The danger here is that most of the herders may not want to vaccinate their animals since they would assume that if others vaccinated their animals, the danger of an outbreak in their herds are minimised. Theoretically, therefore, market failure will arise in the delivery of vaccination services and government intervention becomes necessary. In practice, however, there is no evidence of herders avoiding or being unwilling to pay for vaccination in the survey area except

where vaccination has resulted in the death of animals such as in the Zamfara Grazing Reserve. Not less than 35% of all herders in this study paid for vaccination even though they were not supposed to. In fact, some of the herders paid as much as N180 per head of cattle for vaccination. From these results, it appears that private providers could charge directly for vaccination. If there is any problem with this, they could incorporate cost of vaccines into their service or drug charges. An alternative could be to build the cost of vaccinations into the membership dues, where the herders are organised into cooperatives.

Veterinary drugs could be categorised into two: infectious diseases drugs and non-infectious diseases drugs. The use of drugs for infectious diseases involve externalities. When a herder treats an animal, the risk to other herds is reduced. Hence, those who have not paid for treatment now benefit from the exercise which in theory may result in market failure. But it was observed, especially in the weekly rural markets that herders bought all forms of drugs, including antibiotics such as *Teremycin Q* and *Teremycin LA*, without regard to whether a neighbour who had not paid would benefit. This is not surprising considering the fact that herders paid even for vaccination whose effects cannot be physically observed. Bearing this in mind, it appears that the use of veterinary drugs of any type is a private issue.

There are two important vectors of livestock diseases, namely, tse-tse flies and ticks. The control of tse-tse flies in the open range, as is sometimes done through aerial spraying by the FDLPCS, is a public service: it benefits all herders in the community and none of them could prevent others from benefitting. Such controls will have to be undertaken by government. The control of ticks, usually done either through dips or spraying is a private good with externalities. Since the herder captures a substantial portion of its benefits, tick control could be privatized.

Similar arguments could be made for diagnostic support and clinical intervention for treatment of infectious diseases which are private goods with externalities. Individual herders would pay for them because they capture most of the benefits. To be sure, the NVRI laboratory in Sokoto charges up to N500 for some samples and herders are paying.

Veterinary epidemiological services, which involve monitoring the presence of diseases are pure public goods. The information benefits all herders and their provision is subject to market failure. They have to be provided by government or the government could pay a private provider to undertake the function. A similar conclusion had been reached by Umali *et al.* (1994). The same arguments apply to quarantine, movement control, meat inspection, slaughter of diseased animals as well as veterinary research and extension all of which are public services.

4.5.3 Who Qualifies to Establish a Private Practice?

One of the foremost problems confronting privatization is deciding who should be allowed to establish a private practice. There are two distinct groups involved here. There are the professional (graduate) veterinarians and the para-professionals (or veterinary auxiliaries). Leonard (1993) has suggested that para-professionals should be allowed to establish private practices in competition with full veterinarians. He contends that such competition would work towards improvement in the service quality. All the veterinarians and 62.50% of paraprofessionals interviewed in this study, however, took an exception to this view arguing that such an arrangement would work in the opposite direction since para-professionals are not adequately trained to be able to attend to all veterinary needs of the farmer. The position of the veterinarians is not strange given their desire to preserve the integrity of the profession. Their stand is further strengthened by the fact that only graduate veterinarians are registered by the Veterinary Council of Nigeria which has the mandate to prevent non-members from practicing.

While the two views expressed above may have their merits and demerits, it seems that the decision as to who to allow to provide what veterinary services would be influenced greatly by the peculiarities of veterinary services supply, particularly with regard to the number of veterinarians as compared to veterinary livestock units (VLUs) and the nature of training that the para-professionals have received. As stated in section 4.1.2 the ratio of veterinarians to VLUs in the area was 1: 53,315, which is too high even if it is assumed that all veterinarians in the area (including those in the state services and the university) would be willing to establish private practices. The implication of this is that if only the full veterinarians are permitted to establish private practices, they could not

effectively cover the stock population.

On the other hand, para-professionals to VLUs ratio was 1: 15,328 which is lower than that of the professionals. Bearing this in mind, it may be tempting to agree with Leonard that the paraprofessionals should be allowed to establish practices to increase the supply of veterinary services. The problem is that it is not certain what effect this would have on service quality considering the level of training of the paraprofessionals. Furthermore, studies elsewhere in Africa have shown that livestock owners do not distinguish between the services provided by a professional and those of a paraprofessional (Koma, 1997; Ly, 1997a). Akerlof (1970) has demonstrated that where buyers of a good cannot differentiate between high quality and low quality goods, the high quality good is driven out of the market. A veterinarian who would normally believe that his services are superior to that of a paraveterinarian and who would want to recover his investment in the lengthy training as quickly as possible, would likely charge higher fees than the paraveterinarian. But since herders do not make a distinction between the services provided by a veterinarian and those provided by a paraveterinarian, they would prefer to use the services of the latter which will be less costly. In this manner, the professionals may get driven out of the market which would likely affect the quality of services rendered.

To avoid a situation in which professionals may be driven out of the veterinary services market even as service quality deteriorates, it is here suggested that only full veterinarians should be allowed to establish practices, but with a pre-condition that each practice employs a number of paraprofessionals. This arrangement would also allow the practitioner to cover substantial VLUs, in the sense that the work of the full veterinarian would be reduced to instructing and supervising the paraprofessional who would do the bulk of the routine work and invite the professional only in cases that are beyond the paraprofessional's capabilities. This suggestion is in agreement with Ly (1997a) who observed in Senegal that paraprofessionals performed better when they were under the supervision of a professional. It would further have positive implications for veterinary delivery economy. According to Leonard (1993), the cost of transport tends to increase with the level of training. In other words, a full veterinarian is likely to demand more comfort in travel than an auxiliary. For instance, professional veterinarians in public

service in the area normally travel in four-wheel drive vehicles while the para-professionals are known to move around on motor-cycles, bicycles or even foot, in trying to reach herders. It was shown in section 4.4 that the use of a vehicle had substantial effect on the cost of a private practice. Therefore, having the para-professional do most of the traveling, as suggested here, will reduce service cost by reducing transportation cost. This will, in turn, increase the profitability of private practice.

4.5.4 Provider Selection

The pastoral conditions in north-western Nigeria are characterized by low livestock density. Under such conditions, animal health care delivery strategy during privatization may be more effective if each state is divided into a number of veterinary service blocks (VSBs) and the sole right of delivery in any one VSB awarded to only one veterinary practice. This proposition is grounded in a number of reasons. In the first place, given the dispersed livestock population, the level of demand in an area may not be able to profitably support more than one practice at a time. In addition, providers and herders alike will lose the economic advantage (reduced transportation costs) of geographical contiguity if there were more than one practice. This would consequently push up the cost of veterinary goods and services, probably beyond what the pastoralists would be able and willing to pay. Furthermore, a provider with sole right to an area will have an incentive to keep outsiders out, which could have positive implications for quality of veterinary services since *quacks* (that is, unqualified providers) would find it difficult to operate, thereby winning a battle which most governments have unsuccessfully fought over the years. Finally, as pointed out by Leonard (1993), in the arrangement being suggested, it will be relatively easy to pin the responsibility on a particular provider if there is a disease outbreak or contaminated product incident in an area.

Granting the sole right of practice in an area to a provider, however, has a number of disadvantages since such a provider will be in a local (or standard) monopoly position. This fact has been attested to by Gros (1993) who observed that private veterinarians in the rural areas of Cameroon enjoyed a monopoly position due to reluctance of other

veterinarians to establish practices in such areas. The problem with monopoly is the tendency for small-number opportunism. A monopoly provider is likely to charge sub-optimal prices and/or supply sub-standard veterinary goods and services in an attempt to maximise profit. We have earlier outlined in chapter two in general terms the strategies for dealing with monopoly situations including direct government regulation, short-term competitive bidding and price discrimination.

The structural reform literature is rather pessimistic about the ability of governments to effectively monitor the activities of a monopoly because of the high transaction costs involved. Direct government regulation is, therefore, not suggested in this study.

To the extent that the provider is able to determine the true ability of herders to pay and the other pre-conditions for price discrimination (that is, differences in demand elasticity and ability to separate the markets) are fulfilled, price discrimination may help in determining prices of veterinary goods and services by the monopoly provider. In fact, these conditions appear to be fulfilled in the study area. The demand functions presented in section 4.3 revealed that small-scale herders were more responsive to price than the large-scale herders. In addition, it may not be possible for a herder receiving veterinary services to resell it to another herder. Hence, the elasticity and market separation conditions appear to have been met. The problem, however, is that only one aspect of the opportunism problem - fair pricing - would have been resolved by price discrimination The question of provision of sub-standard goods and services by the provider remains unresolved. How could the monopoly veterinary provider be disciplined to provide goods and services to herders in a manner that would be consistent with social optimality?

Strategies for ensuring proper behaviour of providers could begin right at the provider selection stage. Expert opinion was sought from professional and paraprofessional veterinarians surveyed in this study on who should select private providers in order to ensure that those selected would be the best, both in terms of professional competence and commitment to professional ethics. Their responses

presented in Table 27 shows that government, veterinary associations and herders' cooperatives were identified as possible agencies for selecting providers. About 28% of the respondents felt that the selection should be done by a panel consisting of government officials and leaders of herders' cooperatives while 21% preferred a panel of leaders of veterinary associations and herders' cooperatives. A panel consisting of government officials only, herders' cooperatives only, veterinary associations only as well as government officials plus veterinary associations was advocated by 21%, 14%, 7% and 7% of the respondents, respectively.

Table 27: Opinions of veterinarians and paraveterinarians on who should select private providers

	Veterinarians		Paravets		Total	
Selecting agency	Freq.	%	Freq.	%	Freq.	%
Government	0	0.00	3	37.50	3	21.43
Vet. association	1	16.67	0	0.00	1	7.14
Herders' coop.	0	0.00	2	25.00	2	14.29
Government + vet. association	1	16.67	0	0.00	1	7.14
Government + herders' coop.	2	33.33	2	25.00	4	28.57
Vet. association + herders' coop.	2	33.33	1	12.50	3	21.43
Total	6	100	8	100	14	100

Source: Computed from field data, 1996/97

It is striking that about 78% did not support an arrangement where government officials would undertake the selection alone. Perhaps, the professional and paraprofessional veterinarians doubt the ability of government to conduct an efficient and impartial selection of providers. Given the pervasive corruption in the public sector, this doubt is probably not unfounded.

The remainder of this section attempts to demonstrate how the three agencies identified above could be involved in provider selection in such a way that would minimise opportunistic behaviour. The theoretical basis of the arguments sketched include the concept of competitive franchise bidding used in concert with price discrimination and agency theory.

The choice of competitive franchise bidding here as a mechanism for dealing with a monopoly situation does not imply that it is a panacea. To be sure, Williamson (1984) has identified *asset specificity* as a possible threat to competitive bidding (see section 2.3.6). Leonard (1993) has, however, countered this, contending that most assets used in a veterinary practice are not transaction-specific since they have ready second-hand market. Yet, he concedes that the use of competitive bidding for selecting veterinary providers could be hampered if, as is the case with most parts of Africa, the government agency organising the bidding could not be trusted to always act in the best interest of the herders. This fear is pathetically real in the Nigerian setting where corruption and affective ties are known to influence the award of contracts. Under such circumstances, it is not very likely that the providers declared winner in a bidding exercise would be the best, both in terms of technical competence, prices quoted and commitment to societal goals. A similar fear has been expressed by Gros (1993) in the case of Cameroon.

To circumvent the above-stated problem, it has been suggested (Leonard, 1993) that herder involvement in the selection process is required. In other words, the interest of the herders would be better protected if they are involved in the selection process. The major barrier to herders' participation in selecting providers is posed by information asymmetry between the providers and the herders. The providers are veterinarians who have specialised training in disease prevention, control and treatment; herders having no such training could not evaluate the technical competence of providers even if they could select those quoting lowest prices. The effect of information asymmetry could, however, be attenuated if selection was done in phases. Figure 9 presents a possible model which could be adopted in the phased selection process.

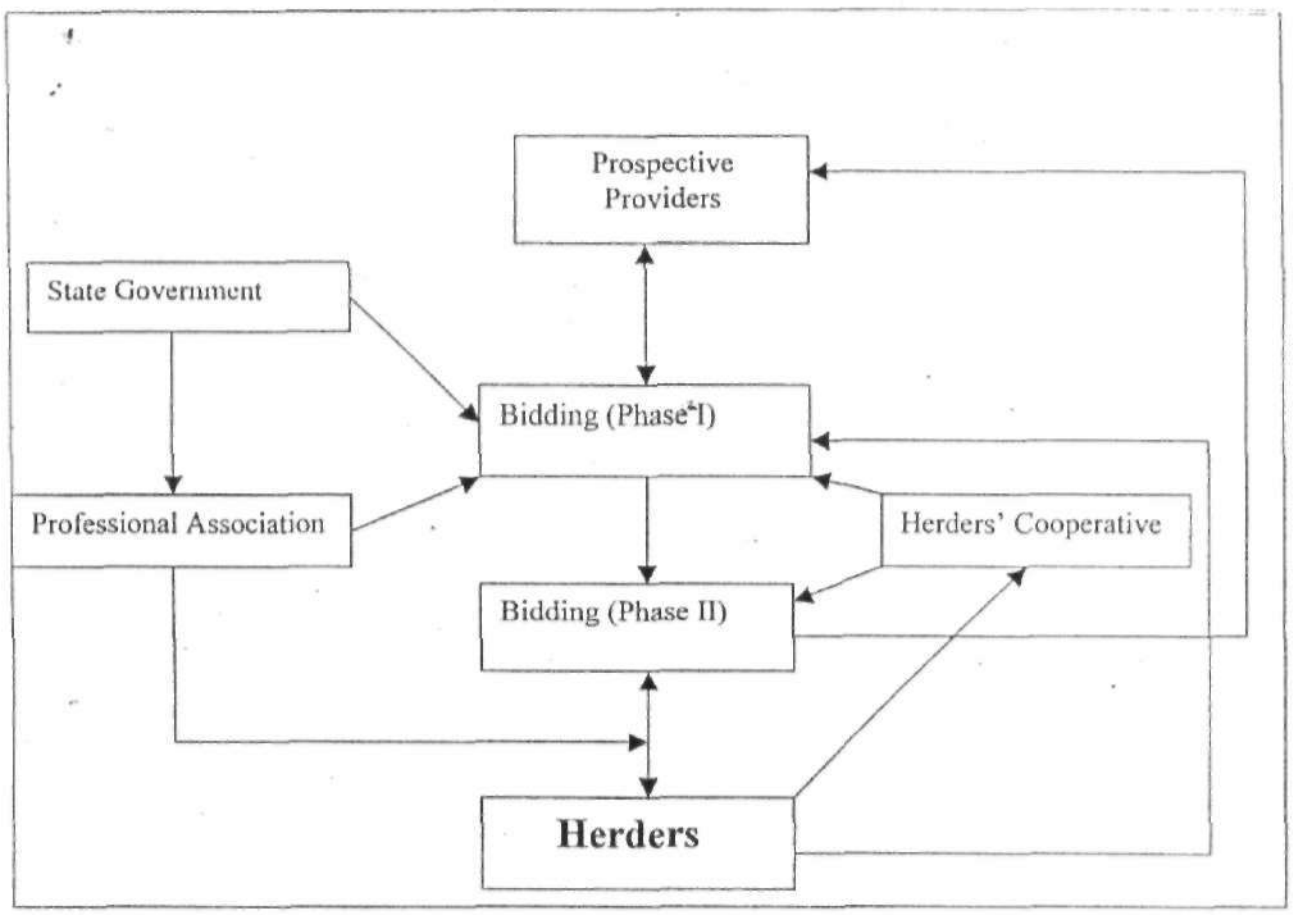


Figure 9: A model for the selection and regulation of private providers

In the first phase, providers wishing to supply veterinary services to a veterinary service block (VSB) are subjected to competitive bidding and those who meet the necessary requirements are selected for the next phase. The first phase would require evaluation of the technical competence of providers which suggests that it has to be done not by the herders but by those who are qualified to do so. Herders or their representatives (such as leaders of a herders' cooperative society) could, however, be present to assure that providers selected are those who have quoted the lowest prices. The other members of the selection team in the first phase could be government officials or, preferably, their licensed non-governmental organization such as the Nigerian Veterinary Medical Association which has the expertise to evaluate the technical capabilities of potential providers. The criteria to be used in selection would include professional qualification, possession of requisite equipment and materials necessary for a practice, prices quoted and level of commitment to professional ethics (for instance readiness to undertake certain functions such as slaughter of diseased animals and report of disease out-break which may not necessarily bring in income). The providers who are unsuccessful in the first bidding phase would return to the pool of prospective providers, hence the double arrow in Figure 9.

The above-stated arrangement is not entirely free from the effects of corruption or opportunistic behaviour. Nonetheless, since it only guarantees inclusion of a provider in the list of those to contest in another phase, and not actual selection, the effect of corruption may be minimised. Moreover, if a veterinary association is licensed to undertake the first selection, the desire to respect professional ethics and maintain the integrity of the profession as a group is likely to work toward selection of the best providers.

The providers who scale through the first phase would again undergo competitive bidding in the second phase and the best would be selected to provide the services at the quoted prices or range of prices. Herders would be the only selectors in this phase. They could be involved in the selection process in one of two ways: either they vote directly and choose the provider or join a cooperative society and allow the leadership of the

cooperative to do the selection. Given the peculiarities of the Fulani herders in the area, the second option appears more appealing for a number of reasons. First, majority of the Fulani pastoralists are itinerant illiterate small-holders and the transaction costs of bringing all of them together for frequent competitive biddings might be too high. This is to be contrasted with a situation where a single leadership of cooperative society speaks for the majority thereby reducing the need to assemble farmers frequently.

Second, it is not certain whether the illiterate small-holders acting on their own would not suffer manipulation in the hands of elite veterinarians during the selection process. So, it may be better to allow the leadership of the cooperative, which is likely to be more enlightened, to deal directly with the prospective providers.

Third, there already exists a culture of cooperative movement involving the pastoralists. For instance, Table 28 shows that 79% of the herders belong to cooperative societies. By far the largest proportion (75%) belong to the Miyetti Allah Cattle Rearers' Association, which is national in outlook, while a few others belong to Farmers' Club (3%) and Pasture Association (1%). This is in spite of the fact that a major proportion (45.57% of members) believed that they obtained no benefit from their associations (Table 29). Members of the Miyetti Allah Association pay annual membership fees of N100 as at the time of the study.

The major functions of the associations as presented in Table 29 appear to have been in settling farmer-pastoralist conflicts (16.88% of members) and promoting unity among the Fulani cattle herders (16.46%). The involvement of the associations in helping herders in disease control appears to be minimal as it was reported by only 5.06% of the respondents. But with the present moves toward privatization of veterinary services, it appears that the associations could play crucial roles in veterinary services provision, the least of which is certainly not their involvement in provider selection.

Table 28: Distribution of herders according to membership of cooperative societies.

	Zone 1		Zone 2		Total	
Type of Society	Freq	% (n=150)	Freq.	% (n=150)	Freq.	% (n=300)
Miyetti Allah	101	67.33	124	82.67	225	75.00
Farmers' Club	9	6.00	0	0.00	9	3.00
Pasture Assoc.	3	2.00	0	0.00	3	1.00
Total members	113	75.33	124	82.67	237	79.00
Non-members	37	24.67	26	17.33	63	21.00

Source: Computed from field data, 1996/97

Table 29: Distribution of herders according to benefits derived from cooperative societies

	Zone 1		Zone 2		Total	
Benefits	Freq.	%	Freq.	%	Freq.	%
Unity	17	15.04	22	17.74	39	16.46
Settle conflict	30	26.55	10	8.06	40	16.88
Control of diseases	12	10.62	0	0	12	5.06
Financial assistance	9	7.96	4	3.23	13	5.49
Provide information	7	6.19	3	2.42	10	4.22
Others	13	11.50	2	1.61	15	6.33
No benefit	25	22.12	83	66.94	108	45.57
Total	113	100	124	100	237	100

Source: Computed from field data, 1996/97

It could be argued that by allowing the leadership of cooperatives to negotiate and select veterinary providers, we would end up with another monopoly and opportunistic situation. That is to say, given such mandate, the cooperative will be the only source of veterinary services to the herders which put them in a monopoly position. But this need not be the case if the leadership is elected by the herders on one-man-one-vote basis. An

exploitative leadership would risk being voted out.

The provider selected in the second phase would then supply veterinary services to all members of the cooperative society in the VSB while the unsuccessful would return to the pool of prospective providers and re-apply at a future date. The provider could use price discrimination based on the ability to pay of the herders but within the framework of the approved range of prices. Herd size could be used as a measure of ability to pay, especially as the results of the study have revealed that large-scale herders are less responsive to cost of veterinary care than small-scale herders. In any case, the provider needs to get fairly close to his clients after some time. This would allow him to determine not only their herd sizes, but also other income-generating activities which would give him a good picture of ability to pay. If any reluctance is noticed on herders' part in paying for collective goods such as vaccinations, the cost of vaccines could be included either in the service charges or cost of drugs. Alternatively, it could be built into the annual dues charged by the cooperative society and remitted to the provider.

4.5.5 Provider Regulation

After awarding a contract of provision to a particular provider, the next task is how to ensure that he complies with the terms of the agreement and does not provide sub-standard services or charge sub-optimal prices. In other words, the next task is a regulatory one. A discussion on regulation of private providers can be motivated by referring to the New Institutional Economics doctrine of *opportunism* and *bounded rationality*. The former implies that human economic agents have a tendency to seek self-interest with guile while the latter suggests that complete information about a contract is not usually available, leading to information asymmetry between the contracting parties. Consequently, there is usually the need to monitor the activities of the parties involved, especially where there is ground for small-number opportunism such as in the case of a monopoly provider.

Several ways of dealing with this situation have been suggested. The *ex ante* and

ex post competitive franchise bidding mechanism suggested in this write-up is itself a strategy for dealing with a monopoly. The argument is that the monopoly position is bid away during the competitive bidding exercises.

Bounded rationality and information asymmetry rules out regulation of provider by herders. Similarly, high transaction costs of inefficiency makes direct regulation by government unattractive. There are, however, theoretical precepts in agency theory that seem to possess good potentials for designing incentive mechanisms to discourage providers from bad behaviour. Application of agency theory here is predicated on the fact that an agency relationship exists between the herder and the veterinary provider. The provider is agent to the herder, the principal. The theoretical presentation made in Chapter 2 with respect to veterinarian-herder relationship suggests that

(1) A large stock of value that could be lost, such as assets subject to suit or loss of reputation, as a result of bad behaviour would enlist proper conduct by the provider,

(2) Long-term repeated transactions develop the stock of value needed for "enforcement", and

(3) Professional associations are in a better position than herders or government to regulate the activities of their colleagues.

What the first of the above-stated propositions implies is that if the provider possesses assets that could be lost in a legal suit or he has built-up reputation (or what is sometimes called brand-name capital) which could be lost through bad behaviour, he is likely to adhere strictly to the ethics of the profession. With reference to the peculiarities of the Nigerian situation, emphasis will be more on loss of reputation from bad behaviour as against legal suits. This is so for various reasons. First, it is not certain if a poor Fulani herder could win a legal case against a member of the Nigerian elite class, the veterinarian. Furthermore, the litigation processes in Nigeria are usually slow and it could take several months or even years (with frequent adjournments) before a legal case is disposed off. The cost in terms of man-hours lost in trying to appear in court repeatedly for a long period

of time is likely to be too high for the herder. Even where the court is unbiased, adjudication in matters such as this by courts may present difficulties, given that the outcome of the animal's health is only partly a function of the efforts exerted by the veterinarian (Arrow, 1985; Leonard, 1993). In other words, veterinary service delivery involves hidden action or moral hazard problems which may make favourable ruling for herders, even in situations where their cases are genuine, uncertain.

Rather than lean so heavily on the courts, arguments for self-discipline of providers are better couched on reputation. During the field survey, herders complained about a number of local government veterinary assistants who they considered to be of bad ethical behaviour and quietly pleaded for the removal of the assistants. If such personnel were not impositions by government, but private providers, herders would have terminated business activities with them. Reputation matters a great deal in veterinary service delivery and a bad-behaving provider could easily find himself out of business. This provides an incentive for good behaviour of private providers.

The second proposition of the agency theory is still linked to the significance of reputation. That is to say, where providers expect repeated transactions with the same herders on a long-term basis, they are likely to act in accordance with professional ethics since sub-standard service will be detected with time and reputation will be lost. After serving properly for a number of years, and built a reputation, the provider will avoid actions that could tarnish such reputation. The desire for long-term repeated transactions, as will most likely be the case with veterinary provision, enables the provider to build reputation, the loss of which would be costly to him.

The third agency proposition is to have professional associations, such as the Nigerian Veterinary Medical Association to undertake whatever regulation that is still required. This is predicated on the believe that such associations with similar expertise as the provider and who stand to lose from bad behaviour of colleagues are better placed to regulate the activities of providers than government or any other party (Touhy and Wolfson, 1978; Pratt and Zeckhauser, 1985; Gros, 1993; Leonard, 1993;). But how

could professional associations lose from bad behaviour of colleagues? In the first place, bad behaviour could lead herders to a generalization that veterinary intervention is not effective or it may drive herders to self-medication and/or *quacks*. Furthermore, professional veterinarians who constitute the association are under oath to adhere strictly to professional ethics. If it is assumed that the association is dominated by good veterinarians, it would not approve of unethical behaviour by colleagues.

Currently, the only organization which performs functions close to regulation is the Veterinary Council of Nigeria whose functions, as stipulated in the Veterinary Surgeons Decree of 1969, include:

(1) determining what standards of knowledge and skill are to be attained by persons seeking to be registered as veterinary surgeons and raising those standards from time to time as circumstances may permit,

(2) securing the establishment and maintenance of a register of persons registered as veterinary surgeons, and the publication from time to time of lists of those persons,

(3) performing other functions conferred on the Council by the Decree.

(Veterinary Council of Nigeria, 1990).

The Council draws its membership from NVRI, state ministries of agriculture, Federal Ministry of Agriculture and universities, in addition to other elected members. But it is doubtful if the Council has an effective machinery to monitor the activities of providers apart from keeping and updating lists of registered persons. Perhaps, since the services have been dominated by government veterinary personnel who provide services free of charge, the country could condone the weak regulation provided by the Council since the personnel in government would not have strong incentives for sub-standard behaviour. The situation will radically change, however, as we move towards privatization, with profit as the driving force, private providers would have incentive to provide low quality services and/or charge sub-optimal prices. Effective regulation is, therefore, essential under such circumstances.

If the Veterinary Council of Nigeria has to retain the regulatory function during privatization, it may be necessary to decentralise it so that each state has its branch of the Council with full mandate to regulate and punish providers and sellers of veterinary drugs and supplies without having to refer to the national body, in order to make it more efficient. A likely draw-back of this approach lies in the fact that the Council is essentially a government establishment and is accordingly dominated by government officials. The high transaction costs (for example, red-tape and corruption) which characterise government establishments resurface.

A better alternative may be for government to delegate regulation to the Nigerian Veterinary Medical Association as earlier suggested. Effective regulation could be achieved if the government delegates licensing of providers to the association. The Association would have a branch in each state to monitor providers. Under such an arrangement, providers for competitive bidding first have to obtain license from the Association before entering for the first phase of the bidding. The Association in each state would also have the power to take disciplinary measures, including withdrawal of license, against providers found guilty of professional misconduct. Such monitoring could be financed from annual dues of members, application fees of prospective providers and/or subvention from government.

4.5.6 Provision of Infrastructure

About 57% of the veterinary personnel interviewed in this study identified inadequate veterinary infrastructure as a likely obstacle to privatization of veterinary services in the area (Table 30). It would be necessary for government to provide certain veterinary infrastructure to facilitate the privatization process. Such facilities would include veterinary clinic buildings, livestock routes, watering points, vaccination centres, and dip/spray centres.

Table 30: Perspectives of professional and paraprofessional veterinarians on likely obstacles to privatization

	Veterinarians		Paravets		Total	
Likely obstacle	Freq	% (n=6)	Freq	% (n=8)	Freq	% (n=14)
Lack of take-off capital	6	100	7	87.50	13	92.86
Private provision not viable	1	16.67	3	37.50	7	50.00
Inadequate infrastructure	3	50	5	62.50	8	57.17
Herders not settled	3	50	2	25.00	5	35.71
Total*	13	216.67	17	212.50	33	235.74

* Figures may be higher than "n" or 100% due to multiple responses

Source: Computed from field data, 1996/97

There are two reasons for government to construct clinic buildings. First, the cost of putting up a building may be too high to be borne by a prospective provider. Second, if the provider constructs the building, the problem of asset specificity would arise. This is because the building will most likely be located in a rural or peri-urban area where the second hand value may be low. Consequently, the incumbent provider who has constructed a clinic building will have more advantage over other potential providers during the competitive bidding exercise.

Luckily, local governments already have clinics in each district in the area while the states have zonal veterinary posts all of which are hardly in use. Such facilities could be rented out to private providers. Where there are no properly positioned clinics, the state governments would put up the structure for renting out to providers.

The delivery would be more cost-effective if livestock or veterinary service routes are established by government. Herders could then move their animals to designated points along this route through which the provider will move and attend to the animals. Such routes could be equipped with watering points where herders could water their

animals while the provider attends to them at the same time. This will ensure economy in delivery since the provider would not have to travel to the remote location of each herder. The same argument applies to the establishment of vaccination and dip or spray centres where animals in the area could assemble for the purposes of vaccination and dipping or spraying of animals. All the herders need to know is the provider's traveling schedule which could be made known through an effective information dissemination system.

There already exist a few cattle routes in the area, but there have been reports of encroachment into these routes by arable crop farmers leading to incessant clashes between the farmers and the herders. The existing routes would have to be re-demarcated and additional ones established. The herders should then be given sufficient property rights to the use of the routes and facilities established in the same way that arable farmers have title to the land they cultivate.

4.5.7 Information Dissemination

Although the new institutional economics literature rejects the neo-classical proposition that all information relevant to a transaction are known or could be obtained costlessly, it still recognizes the significance of information to an exchange process. Regarding provision of veterinary services, information is very important to all parties in the veterinary matrix of the area. Thus, the herder requires information on disease outbreak, date and location of vaccination, traveling route and schedule of the provider, and so on. In this study, herders were asked about the existing channels of information. Their responses are presented in Table 31 which shows that, regarding information on disease outbreak, majority (64%) of all herders indicated fellow herders as their most important information source. This information is usually exchanged especially in the periodic markets where herders usually converge in large numbers. It should be noted that due to the pastoral production pattern in which herders are itinerant in nature, information spread among herders is rather fast. Other sources of information on disease outbreak include district head (12.67%), veterinary personnel (7%), cooperative society (7%), and radio (2%).

Table 31: Distribution of respondents according to sources of information

Source of Information*		Zone I		Zone 2		Total	
		Freq.	%	Freq.	%	Freq	%
Fellow herder	1	81	54.00	111	74.00	192	64.00
	2	18	12.00	0	0	18	6.00
District head	1	28	18.67	10	6.67	38	12.67
	2	81	54.00	70	46.67	151	50.33
Vet. personnel	1	18	12.00	3	2.00	21	7.00
	2	32	21.33	64	42.67	96	32.00
Radio	1	6	4.00	0	0	6	2.00
	2	9	6.00	0	0	9	3.00
Cooperative	1	21	14.00	0	0	21	7.00
	2	14	9.33	3	2.00	17	5.67

* 1 = information on disease out break; 2 = information on date and venue of vaccination

Source: Computed from field data, 1996/97

Table 31 further shows that majority (50.33%) of the respondents obtained information about date and location of vaccinations from their district heads. Such information, further investigation shows, is usually passed from the local governments through the district heads to the local leaders (the *Ardo*). The *Ardo* then delivers the information to the herders. Sometimes, the district head sends a messenger to deliver the information to the herders on market days. Another major source of information is from the veterinary personnel directly to herders, as reported by 32% of the respondents.

It seems that private providers could use these channels of information dissemination, particularly the district heads, local leaders and the weekly markets to pass information to herders. The herders, in turn, could reach the provider when his services are needed outside normal schedule through their leaders (*Ardo*) and the district head, or through the leaders of their cooperative societies. The herder could also make personal visit to the provider although this may be costly sometimes.

The agencies responsible for disease surveillance and diagnostic support may also find it necessary to reach out to herders in emergency situations, such as during outbreak or threat of outbreak of an infectious disease. Such agencies may require to use mass media, especially radio to reach the herders. Of all the mass media, radio appears to be the most effective for illiterate herders scattered in remote locations without electric power supply. In fact, while none of the respondents indicated ownership of television sets, majority (56%) reported owning radio. Radio, therefore, could be used as a good mass communication channel to herders. Livestock extension services could also use this medium for broadcasting information on livestock improvement to herders. In addition, the veterinary Medical Association which is expected to regulate the activities of providers could announce its visits, both to herders and providers, through the radio. The use of radio for these purposes could be combined with passing the information through the district heads and making announcements in the weekly rural markets. Herders' cooperative societies could also serve similar purposes.

4.5.8 Take-Off Capital

Information presented in Table 30 shows that majority (92.86%) of veterinary personnel interviewed considered lack of take-off capital as a major obstacle to private provision of veterinary services. This is probably because veterinary services involve high initial investment in veterinary equipment and transport facilities. Further analysis of the cost figures presented in Tables 15 and 16 shows that a private practice would require at least N397,375 for initial investment alone. Given the present economic situation in Nigeria generally, it is inconceivable that a prospective provider, acting on his own would be able to mobilise such amount of capital without assistance. Therefore, a special low-interest credit scheme should be established to enable providers to establish practices. Provision of low-interest credit to the agricultural sector is not new in Nigeria. Therefore, there are existing institutions such as the Nigerian Agricultural and Cooperative Bank and the Agricultural Credit Guarantee Scheme which could be used to lend to private providers.

The importance of take-off loan in private provision of veterinary services appears to have been recognised by the Second Pilot Livestock Development Project in Sokoto State. Hence, the Project has established a credit scheme for intending private veterinary providers. This should be adopted by all agencies in the area seeking to promote privatization of veterinary services.

A major problem that lenders to the agricultural sector have encountered in Nigeria, is that of loans default. Loans given out to private providers could be insured as a remedy to the problem of loans default. In this regard, the Nigerian Agricultural Insurance Company could play a major role.

CHAPTER FIVE

SUMMARY, POLICY IMPLICATIONS AND CONCLUSION

5.1 Summary

Since independence, governments in Nigeria have assumed almost exclusive responsibility for the provision of veterinary services. The present economic crisis has, however, resulted in the poor funding of veterinary services leading to their ineffectiveness and the reappearance of livestock diseases that were formally under effective control. This, in turn, has caused high livestock morbidity and mortality and the consequent low productivity in the livestock sub-sector. The economic losses resulting from the low productivity are substantial.

In view of the present near-collapse state of government veterinary services, some donor-assisted projects, particularly those in north-western Nigeria, are now experimenting with structural reform (by introducing cost-recovery and inviting private veterinarians to establish practices) with the ultimate aim of transferring veterinary responsibilities to the private sector. While governments are making these unmistakable moves toward structural reform, however, there is no evidence to show that an appropriate environment has been created for its success. The problem is that a structural reform which is not properly planned and for which appropriate institutional environment has not been created is likely to be a failure.

As an attempt to contribute to the debate on the necessary institutional build-up for the success of structural reform (particularly privatization), this study examined the response of Fulani pastoralist herders to cost of veterinary service and the overall feasibility of private provision of veterinary services, with particular reference to north-western Nigeria. The specific objectives of the study were:

(1) to describe the present state of veterinary services in north-western Nigeria,

(2) to compare the effectiveness of veterinary services in an area where cost-recovery has been attempted with an area where no reform has been attempted,

(3) to determine the herders' ability and willingness to pay for veterinary services and their degree of responsiveness to cost of veterinary care,

(4) to ascertain the economic feasibility of private provision of veterinary services in the area,

(5) to identify veterinary services suitable for privatization and those that have to be publicly provided, and

(6) to determine the appropriate institutional framework necessary for the success of privatization,

To achieve the objectives of the study, a field survey was conducted in north-western Nigeria (comprising Sokoto, Kebbi and Zamfara States) between January 1996 to June 1997. Two categories of respondents were identified. These were the Fulani pastoralists (herders) and veterinary personnel. Cluster sampling, based on the major provider of veterinary services, was used in selecting the herders. The first cluster consisted of herders served mainly by the state government while the second cluster included those served mainly by a donor-assisted Project (that is, Zamfara Environmental Protection Agency). The first cluster consisted of Wurno, Rabah and Goronyo Local Government Areas (LGAs) in the present Sokoto State, while the second covered kaura Namoda, Birnin Magaji and Zurmi LGAs in Zamfara State. One hundred and fifty herders were randomly selected from each cluster, giving a total sample size of 300 herders. The veterinary personnel sampled consisted of six professional veterinarians and nine paraprofessionals working with state government, Usmanu Danfodiyo University (UDUS) and Zamfara Environmental Protection Agency (ZEPA), all of whom were randomly selected

The first, second and sixth objectives were achieved using descriptive statistics in concert with relevant statistical tests of significance, while the third objective was achieved using a number of multiple regression models. The fourth objective was achieved using a farm budgeting (break-even) model. The fifth objective was achieved through verbal

description informed by the arguments of economic theories in the light of the empirical findings of the study.

With respect to the first objective, the results of the study revealed that the provision of veterinary services in the area was dominated by the three state governments working through their respective ministries of agriculture and sometimes through donor-assisted projects such as Zamfara Environmental Protection Agency (ZEPA) in Zamfara State and Second Pilot Livestock Development Project (SPLDP) in Sokoto State. To a limited extent, virtually all the local governments, in principle, also provide veterinary services. In practice, however, the veterinary services of most of the LGAs is limited to assisting the state governments in mounting their annual vaccination campaigns against rinderpest and CBPP. Even the services of the state governments is presently limited to this annual vaccination campaigns with the exception of zonal veterinary clinics located in Sokoto town, Gusau and Birnin Kebbi (that is, the state capitals) which also provide curative services.

The other agencies connected with veterinary services in the area include the National Veterinary Research Institute (NVRI) laboratory located in Sokoto, the Federal Department of Livestock and Pest Control Services (FDLPCS), Faculty of Veterinary Medicine of Usmanu Danfodiyo University Sokoto (UDUS), importers, veterinary and human medicine stores and the ubiquitous weekly rural market drug retailers. There are complex interrelationships and linkages among the various agencies.

The staff profile of the veterinary services consists of professional and paraprofessional veterinarians, with the latter being higher in number. There was one professional veterinarian to 53,315 veterinary livestock units (VLUs) and one paraprofessional to 15,328 VLUs. Both ratios were higher than the recommended ratios suggesting under supply of veterinary personnel.

The comparison of two providers (objective two) shows that veterinary services by ZEPA were more effective than those provided by the states ministries. Herders served

by ZEPA were within 0-15 km radius of a functional service post as against 20-60 km for those served by the ministries. The number of livestock affected by diseases as well as the calf mortality rates were also lower in the ZEPA area, while the calving rates were higher The mean calf mortality in the ZEPA area was 9.26% as against 12.47% in state government area. Calving rate in the ZEPA area was 81.11% as compared to 72.27% in the government zone.

In achieving the third objective, it was found that herders were generally willing to pay, with 75% agreeing that paying for veterinary services was proper. Some (34%) even paid for vaccinations which officially should be free. The demand functions estimated revealed that demand was relatively inelastic, suggesting low response to cost of services. The demand elasticities were 0.566, 0.407 and 0.766 for all herders combined, large-scale and small-scale herders, respectively. This difference in elasticities between large- and small-scale herders suggests that price discrimination may be possible. The important demand determinants in the area include cost of service, distance from veterinary post or clinic, herd size and number of sick animals recorded.

In terms of feasibility of private provision (objective four), it was found that private provision was potentially feasible since the actual veterinary livestock units (VLUs) per unit area exceeded break-even VLUs per unit area. For instance, break-even livestock units per square kilometer for a practice using a motorcycle and charging consulting fee of N100 per VLU, ranged from 0.98 to 1.45 which were clearly below the actual VLUs per square kilometre in the area. In fact, further analysis revealed that a private practice could earn reasonable profit per year, particularly if it used a motor-cycle instead of a four-wheel drive vehicle as means of transport.

The selection of veterinary services to privatize (objective five) would, in principle, be determined by the economic nature of the services in question. Since most veterinary services display collective good characteristics, it would have been thought that their provision would involve market failure. But empirical evidence from the study revealed that herders paid for a wide range of services including some collective ones. Therefore,

it seems that most veterinary services including production and sale of veterinary drugs, vaccines and supplies, clinical intervention (diagnosis and treatment) against infectious and non-infectious diseases, dipping and vaccinations could be privatized. Where reluctance is noticed, which the results of the study show is unlikely, regarding paying for vaccination, the cost of such service could be built into the service charges for curative treatment or the annual membership fees of herders' cooperative societies. However, other services such as movement control, quarantine, disease surveillance, veterinary research and extension as well as control of tse-tse flies in the open range, which are pure public goods, should either be retained or paid for by government.

Some of the necessary institutional mechanisms examined (objective 6) were with respect to the determination of who should be allowed to establish private practices, provider selection procedure, provider regulation, provision of basic infrastructural facilities, information dissemination mechanisms, and provision of take-off capital. After weighing the possible negative quality implications of allowing both veterinarians and paraprofessionals to establish practices in competition, against the increased supply of veterinary services that such a strategy would entail, it was felt that an arrangement in which a veterinarian works with at least one paraprofessional would be better.

Regarding selection of private providers, the possibility of using competitive franchise bidding was explored. The model ultimately suggested was one in which providers will be selected in a two-tiered bidding where herders (or their cooperatives) and professional associations will be actively involved in the selection process. To minimise moral hazard problem, government involvement in the selection process was to be minimal. If government would be involved at all, it should only be in the first phase of the bidding. Preferably, such responsibility could be delegated to the Nigerian Veterinary Medical Association. The regulation of the providers who ultimately emerge as winners to ensure that they adhere to the terms of the contract should be delegated to the Association suggested above.

Provision of infrastructural facilities such as clinic buildings, cattle routes, watering points, and dips was part of the institutional issues examined. The existing channels for information dissemination were examined. Fellow herders, district heads, local leaders (*Ardos*) and weekly markets were the major sources of information to herders. These traditional channels in concert with radio could be employed by private providers and other agencies to communicate with the herders.

The study found that establishing a private practice could be fairly capital-intensive. A prospective provider may require at least about N397,375 (roughly N0.4 million) as initial investment capital.

5.2 Policy Implications of the Study

Some of the policy implications of the study involve the appropriate institutional framework necessary for the success of privatization (as earlier discussed) and are outlined more specifically as follows.

(1) The decision to privatize and how the privatization should proceed should be made at the state level. This is in contrast to the present moves where the FDLPCS prescribes for all the states (through the SPLDPs) the reform strategies to employ. Efficiency during reform can be enhanced if decision-making is decentralised;

(2) To succeed, the privatization has to be pursued as a deliberate (guided) policy of the state government instead of allowing interested individuals to randomly establish practices. Following the latter procedure would present monitoring and regulation problems which would then give room for opportunistic behaviour on the part of providers;

(3) Each state should be divided into a number of veterinary service blocks (VSBs), the size of which would be determined by the livestock density *vis-a-vis* the

number of available qualified potential providers. The present Livestock Services Zones in each of the states in the area may require further subdivision for effective coverage. The state government should equip each block with such facilities as clinic building (which could be rented out to providers), livestock route, watering points and dipping centres (which should be run and maintained by the provider);

(4) A provider should be assigned to one VSB. Such a provider should be selected through a two-phased competitive bidding as earlier discussed and the rights of the provider to the block should be clearly spelt out in the contract. Illegal providers who encroach on these rights should be appropriately punished;

(5) Each state should begin privatization initially on a pilot scale (e.g. in just one VSB). Other areas would be involved based on the experiences learnt from the first block;

(6) Herders in each VSB should be organised into a cooperative society which should play an active role in the provision of veterinary services, particularly in the selection of providers (during the suggested competitive bidding) and in information dissemination. If it is agreeable to herders, what may be needed could be a restructuring of the familiar Miyetti Allah Cattle Rearers' Association for the new roles. After the initial organization, the association should be allowed to run on democratic principles without interference from government;

(7) Each state government should involve the Nigerian Veterinary Medical Association in the privatisation process. In particular, the Association, which should become active at the state level, should be given well-defined rights including the right to select providers (at least in the first phase). It should also be given the right to regulate the activities of providers and the right to punish those found guilty of professional misconduct. To effectively perform these roles, the Association has to be given necessary legal backing. Furthermore, government interference in the running of such associations should be minimal;

(8) Each state government should work in collaboration with the Nigerian Agricultural and Cooperative Bank to provide low-interest credit to prospective private practitioners. If this is not done, only the wealthy veterinarians would be able to establish practices and this would, in most cases, put them in such a monopoly position that even the competitive franchise bidding could not resolve. Such loans could be insured by the Nigerian Agricultural Insurance Company, to side-tract the usual collateral problem;

(9) It should be made compulsory for each private veterinarian to work with at least one paraprofessional. The arrangement could be one of two forms: either the veterinarian forms partnership with the paraprofessionals or he employs them;

(10) The problem of providing veterinary services is made more difficult because of the pastoral pattern of production which is characterised by constant movement of the herds and wide spatial dispersion of livestock. Provision of veterinary services would be easier, both for the herder and the provider, if the herders were sedentarised. Under such circumstances, herders should be given well-defined title to land such as is the case with arable crop farmers. The fact that such attempts have failed in the past is no reason to stop further efforts. As the expansion of crop cultivation increases, the available grazing area has continued to decrease. Therefore, sooner or later the government will have to take sedentarisation very seriously.

5.3 Conclusion

This study examined one important aspect of livestock production - animal health - which has suffered a relative neglect in north-western Nigeria. This neglect is manifested in poor funding of veterinary services which has resulted in their ineffectiveness and the consequent low productivity in the livestock sub-sector. The main focus of the study was to determine the feasibility of privatization of veterinary services as a possible alternative to the current ineffective government provision.

After examining the willingness of herders to pay for veterinary services, the potential profitability of private provision of veterinary services and the economic nature of veterinary services, it can be concluded that a gradual, selective, case-by-case privatization of veterinary services is quite feasible in the study area. Such an exercise, it is hoped, would improve the effectiveness of veterinary services by allowing the injection of private capital in to the sub-sector. An effective veterinary service, by lowering livestock morbidity and mortality, would increase livestock productivity and, *ipso facto*, the supply of livestock and livestock products.

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APPENDIX A

Demand Function for all Herders Using the Linear Model

Variable	Parameter Estimate	t-value
Intercept	1679.744	3.872***
Service cost (price)	-7.832	-3.759***
Herd size	3.499	6.315***
distance	-5.792	-0.721ns
No. of sick animals	-4.415	-0.588ns

R^2 = 42.76; F-value = 20.62*** ; *** = significant at P<0.01; ns = not significant
Source: Computed from field data, 1996/97.

APPENDIX B

Demand Function for all Herders Using the Quadratic Model

Variable	Parameter Estimate	t-value
Intercept	5365.791	6.942***
Service cost (price)	-48.385	-7.311***
Herd size	0.601	0.490ns
Distance	-7.677	-0.241ns
No. of sick animals	-10.809	-0.476ns
Cost of service squared	0.099	6.346***
Herd size squared	0.001	2.092**
Distance squared	0.042	0.088ns
No. of sick animals squared	0.114	0.485ns

R^2 = 58.15; F-value = 18.48***; **, *** = significant at P<0.05 and P<0.01, respectively; ns = not significant

Source: Computed from field data, 1996/97

APPENDIX C

Demand Function for Large-Scale Herders Using the Linear Model

Variable	Parameter Estimate	t-value
Intercept	3.021	14.201***
Service cost (price)	-0.002	-2.291**
Distance	-0.008	-1.648ns
No. of sick animals	0.014	3.380***

R^2 = 39.82; F-value = 5.822*** ; **, *** = significant at P<0.05 and P<0.01; ns = not significant.

Source: Computed from field data, 1996/97

APPENDIX D

Demand Function for Large-Scale Herders Using the Quadratic Model

Variable	Parameter Estimate	t-value
Intercept	6273.413	3.047***
Service cost (price)	-58.839	-4.408***
Distance	77.313	0.790ns
No. of sick animals	10.064	0.202ns
Service cost squared	0.110	3.917***
Distance squared	-1.197	-0.839ns
No. of animals squared	0.164	-0.287ns

R^2 = 60.61 ; F-value = 6.00*** ; *** = significant at P<0.01; ns = not significant.
Source: Computed from field data, 1996/97

APPENDIX E

Demand Function for Small-Scale Herders Using the Linear Model

Variable	Parameter Estimate	t-value
Intercept	456.815	3.437***
Service cost (price)	1.310	2.910***
Distance	-4.875	-1.884*
No. of sick animals	15.107	1.704*

R^2 = 34.37; F-value = 4.608*** ; *, *** = significant at P<0.10 and P<0.01, respectively.
Source: Computed from field data, 1996/97

APPENDIX F

Demand Function for Small-Scale Herders Using the Quadratic Model

Variable	Parameter Estimate	t-value
Intercept	510.045	1.696*
Service cost (price)	-1.935	-0.834ns
Distance	-20.257	-2.210**
No. of sick animals	64.897	3.357***
Service cost squared	0.001	1.150ns
Distance squared	-0.198	-1.368ns
No. of animals squared	-2.691	2.851***

R^2 = 52.17 ; F-value = 4.254*** ; *, **, *** = significant at P<0.10, P<0.05, and P<0.01, respectively; ns = not significant.

Source: Computed from field data, 1996/97