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DIPLOME D'ETUDES SUPERIEURES SPECIALISEES PRODUCTIONS ANIMALES EN REGIONS CHAUDES

SYNTHESE BIBLIOGRAPHIQUE

LIVESTOCK PRODUCTIONS AND ANIMAL
HEALTH CARE IN KENYA.

par

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Introduction

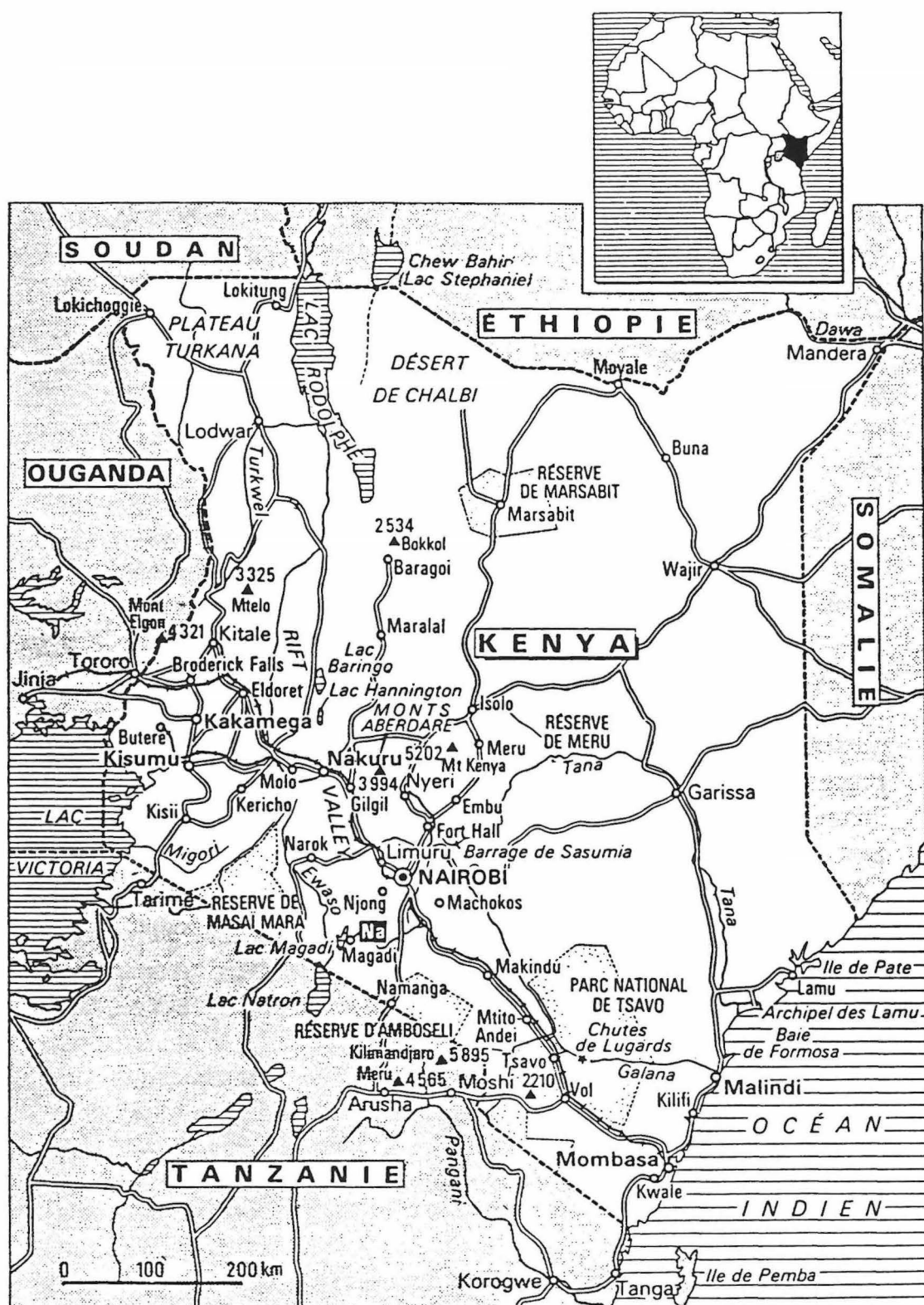
This study tries to elaborate a general approach of Kenya's stock breeding and of its main involments in the veterinary drugs market.

It is constructed around 3 major parts :

- **Part I** : main data about stock breeding, its productivity and its organisation, and its significant constraints
- **Part II** : veterinary medecine organisation and the drug market, mainly approached by its constraints
- **Part III** : additional details on one breeding system of in the pastoral Maasailand.

This study could not be a detailed one because of the vastness of the subject and because of the lack of precise information that was available, so far from the country.

However, it gives an original approach of this major economic sector which could be completed in situ if necessary.



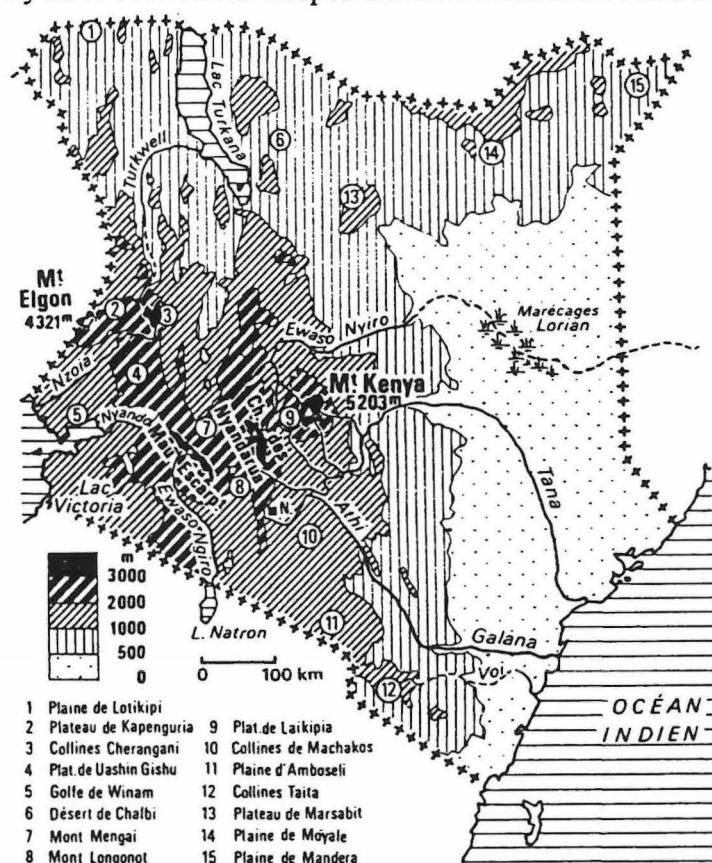
Map n°1 : Kenya (H. Bourges in « les 50 afriques, 1979, éditions seuil » in A9)

Part I : Physical, social and economical geography

I. Physical features

The total area of Kenya is 582650 km². Kenya is bisected by the equator and extends from approximately 4°N to 4°S and 34°E to 41°E (A9).

The country is mainly composed of highlands which have their base at about 1500m above sea-level and an extensive erosional plain (500-1000). The higher mountains are isolated extinct volcanos : Mt Kenya (5200m) and Mt Elgon (4321m). The Great Rift Valley bisects the country from north to south. Westwards, the plains incline beneath the water of lake Victoria and eastwards they have been down-warped beneath a sediment-filled basin.



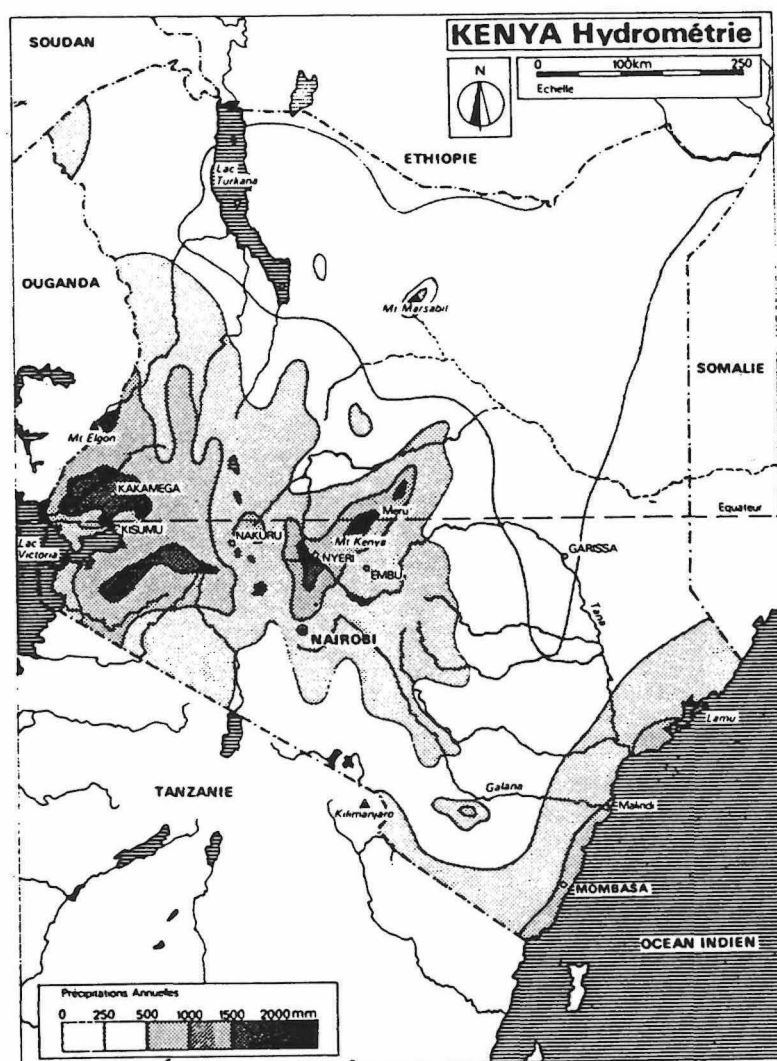
Map n°2 : Kenya's relief (D. Martin, Le Kenya, Collection « Que sais-je », 1983, in A9)

II. Climate

% of land surface area which is	
Tse-tse infested	16.9
Arid	74.7
Semi-arid	9.2
Sub-humid	2.0
Humid	0
Highland	14.1
Permanent pasture	6.6

Table n°1. Pluviometric general repartition (A6)

Kenya's range of altitude results in temperate conditions in the highlands above 1500m (temperature becomes limiting to cultivation at about 2750m). Average temperatures may be roughly calculated by taking a sea-level mean of 26°C and deducting 1.7°C for each 300m of altitude. For most of the country, rainfall is critical and only 15% of Kenya can be expected to receive a reliable rainfall adequate for cultivation (over 750mm). Rainfall is greatest at the coast and in the west of the country or in the highlands. West of the Rift Valley, rain falls in one long rainy season. East of this valley, there are two distinct seasons : the long rains (march to may) and the short rains (september to october).



Map n°3 : Kenya's rainfalls

III. Population and culture

A total population of 27 million can be estimated in 1995 from the last census in 1989. The agricultural population represents 76% of the total workers (A1). The overall density is over 40 per km² but unevenly distributed with approximately 75% of the population living in only 10% of the area. Densities approach 400 per km² on the small proportion of the land that is cultivable. The population growth rate has been declining since 1989 to 3.1% per year (1993). About 17% of the total population live in urban areas (Nairobi is over 1.5 million now) (A9). The survival rate is greater in towns than in rural areas.

Life expectancy (years) in 1979		
	Nairobi	Kenya
Men	59.4	52.6
Women	63.2	55.4

Table n°2. Life expectancy in Kenya (A8)

The structure of the population can be divided per age.

Structure of the population		
Age (years)	Nairobi	Rural areas
0-4	12.8	19.3
5-9	9.1	17.1
10-14	6.5	14.5
15-19	8.4	11.5
20-24	16.7*	7.7
25-29	14.5*	6.1
30-34	10.6	4.9
35-39	6.5	3.6
40-44	5.2	3.3
45-49	3.9	2.8
50-54	2.5	2.4
55-59	1.5	1.9
60-64	0.8	1.5
>65	1.0	3.5

Table n°3. Structure per age of the population in Kenya (A8)

* due to the importance of the rural migration : children are raised in rural areas and young adults go to town to search for a job.

Kenya has been a meeting place of major population movements in the past and the people can be divided into several ethnic groups. Swahili, Duruma, Digo and Bajun are on the coast. Major groups in the western part of the country are Luo, Nandi, Gishu, Kamasia or Tugen. Maasai and Kikuyu are in the south while Turkana, Rendille and Gabbra are mostly in the north. The center of the country is occupied by Somali, Boran and Orma.

The major group is the Kikuyu group (over 5 millions) but the official language is Swahili, although English, Kikuyu and Luo are widely understood.

IV. Agriculture and animal productions

Agriculture continues to dominate Kenya's economy although its share of GDP has declined in recent years. Agriculture represented 38% of the national GDP in 1964 and only 31% in 1982 (A10). In 1993, tourism was the principal cash crop with US \$ 295 millions whereas agricultural exportations represented a total of US \$ 530 millions (\$ 262 millions for tea, \$ 116 millions for horticultural products and \$ 113 millions for coffee) (A3).

The principal other cash crops are sugar cane, maize, wheat, sisal, pyrethrum and cotton. Kenya traditionally exports butter, cheese and skimmed milk powder. The map on the next page shows briefly the repartition of these agricultural productions.

Map n°4 : Principal agricultural productions in Kenya (CEE, june 1973, in A9)

Livestock and dairy productions are important both for domestic consumption and for export. Strictly concerning animal productions, table n°4 indicates the annual mean consumption per caput (1987).

	Annual mean consumption	
	Total (million of tons)	Per caput (kg per year)
Beef	141900	6.7
Mutton and goat meat	43100	2.0
Pig meat	4600	0.2
Poultry meat	41300	1.9
Total meat	257700	12.1
Total milk (liquid milk eq.)	1090100	51.3

Table n°4. Animal products consumption in Kenya (A6)

IV.1. Organization of animal productions

Using the Kenyan government's broad classification of agricultural producers, suppliers of livestock may be categorized as « large farms » for units greater than 8 ha that are usually in better watered areas, « smallholders » for units less than 8 ha and « range » for commercial and subsistence rangeland producers. The country can also be partitioned into areas producing more livestock than is consumed and those consuming more than is produced.

	Livestock production (%)	Livestock consumption (%)
Smallholder areas	71	65
Large farm areas	16	8
Range areas	13	7
Nairobi and Mombassa		12
Exported		8

Table n°5. Livestock productions by areas (C3) in 1975

IV.2. General productivity of livestock

Population of domestic animals

The difficulty of quantifying the national domestic herd accurately in a land with such an extensive herding organization leads to the use of different numbering systems (sometimes even by plane) (A1). A special organisation (Kenya Rangeland Ecological Monitoring Unit) has the responsibility of surveying the grazing and its occupation by animals. Two different sources of references are used below to try to confirm these numbers and to analyse their repartition.

Table n°6 indicates the annual growth rate between 1975 and 1987.

Livestock population				
	Population (hd) 1987 (A6)	Annual growth rate (%) (A6)	Population (hd) 1990 (B1)	Repartition (hd) (B1)
Cattle	9500000	-1.3	12500000	Milk 2500000 Meat 10000000
Sheep	7200000	+8.5	7635000	Meat&milk 6970000 Wool 665000
Goats	8300000	+4.1	9656000	Meat&milk 9633000 Wool 23000
Pigs	100000	+4.4	960000	
Chickens	22000000	+2.1	21478000	Broilers 2976000 Layers 1528000
Camels	780000	+3.1	810000	
Equines	2000	+0		

Table n°6. Livestock population in Kenya (A6 and B1)

The total ruminant population represented an equivalent of 8980000 heads of Tropical Ruminant Livestock Unit (TLU = 250 kg liveweight) in 1987 with an annual growth rate equal to 0.

Milk cattle are in intensive farms (75%) or in extensive ones (25%). Beef cattle or veals are raised intensively (10%) but more often are in large ranches (90%). Sheep and goats are mainly present in the Rift Valley area (57%) or in the north (10%). Pigs and poultry are raised near urban centres. Most of the chicken are local birds, raised extensively ; about 71000 turkeys, 58000 geese and 71000 ducks are also present (A7).

Productivity

The total animal production in 1991 is estimated, with an annual growth rate calculated in the 1975-1987 interval :

Output		
	Production (metric tons)	Annual growth rate (%)
Beef and veal	326000	-1.4
Mutton and lamb	26000	+4.0
Goats meat	31000	+0.3
Pig meat	5000	+3.2
Poultry meat	47000	+3.7
Other meat	29000	

Table n°7. Total animal outputs in 1991 (A6 and B1)

The growth of animal product prices has been inferior to industrial product prices because they are usually controlled by the government (A10).

The yield per animal slaughtered (total output of meat/number of animal heads in the herd) or per total herd is listed on the next page.

Yeld				
	Yeld/animal slaughtered (kg/an.)	Annual growth rate (%)	Yeld/total herd (kg/an.)	Annual growth rate (%)
Beef and veal	125	-1.2	17	-0.1
Mutton & lamb	12	+0.2	3.6	-3.2
Goats meat	11	0	2.2	0

Table n°8. Total animal yelds in 1987 (A6)

Concerning milk and eggs :

Milk output			
	Output 1987(A6) (metric tons)	Annual growth rate (%)	Output 1991 (B1) (metric tons)
Cow milk	1001000	0.1	2189000
Sheep milk	29000	+7.2	29000
Goat milk	82000	+4.7	101000

Eggs output			
Eggs	35000	+8.9	42000

Table n°9. Milk and eggs output in Kenya (A6 and B1)

The average yeld per milk cow is 450 kg/animal and the yeld per total herd is about 105 kg/animal.

It's interesting to estimate the trade (exports) of animal products:

Exports			
Live cattle (hd)	10000	Poultry meat (metric tons)	20
Live sheep and goats (hd)	12000	Fresh cow milk (metric tons)	50
Beef (metric tons)	55	Butter (metric tons)	2838
Mutton and goat meat (metric tons)	5	Dried milk (metric tons)	988

Table n°10. Animal products exported by Kenya (A6)

IV.3. A few details

Beef production (A4)

Three main beef production systems can be found which correspond with ecological areas :

- in mixed grass-arable crop rotations, beef cattle may be kept intensively with or as an alternative to dairy cattle. Diet may ne supplemented in dry season by possible silage.

- Rangelands account for 80% of Kenya's land area and is favourable to ranching. Nutrition is based on grazing and browse, with no supplementation.

- the biggest production system is pastoralism. This produces animals of poor quality depending on the avaibility of grazing and which are sold only when necessary.

The feedlots system increased in the 70s but has now been abandoned, mostly because of the high maize prices (0.97 KES/Kg in 1978 and 2.3 KES/Kg in 1980 (A10)) and the impact of foot and mouth disease.

In the intensive system of the mixed farming areas, exotic breeds and their crosses with improved zebus predominate to produce high quality beef (Hereford, Charolais, Simmental, ...). Sahiwals or borans are often used in crossing.

Zebus are the most common in ranching areas also in pastoralist areas where there are great variations in size and inherent quality.

The Kenya Meat Commission, a government parastatal organization, distributes meat at government gazetted prices to butchers. The percentage of beef handed by the KMC is however low (<20%). Most stock for slaughter are consumed on the farm or marketed through unofficial channels.

Prices have increased appreciably over the last 25 years but so have input costs and in real terms, it is likely that return from beef are only 60% of what they were 15 years ago. Fortunately for producers, they can sell to private buyers. For example, ranch animals have a 15% mortality rate and are sold on average at 3.5 years (350 kg) ; the gazetted KMC buying prices leave no margin (low prices for consumers) so the ranchers have to seek higher prices from private butchers. But these are looking for finished steers of high quality ...

Two important factors also have a great impact : drought (losses were about 40% in 1984) and diseases due to wildlife (for example, buffalos make a « disease corridor »).

More details on beef production in Kenya are exposed in part III about « Maasai herding ».

Poultry production (A7)

The private sector in poultry production is well developed (Kenya Poultry Development Company, Kenchick Ltd, ...). It has strongly increased in the recent past : the gross monetary value of eggs and poultry meat was US \$ 22 millions in 1978 and US \$ in 1987. Then chicken population was divided in approximately :

14.5 million of local or indigenous birds
770000 layers and 32000 layer parent stock
2690000 broilers and 85000 broiler parent stock

Local birds belong to many ecotypes. Hybrid are imported from Europe (Shaver, Euribrid, Hypeco, ...).

Over 80% of the layers and broilers are raised in Central Nairobi and coast provinces (near urban centres where a market for eggs and meat is available). 84% of the local birds are raised in Eastern and Western Nyanza and in the Rift Valley (where consumers prefer the local birds to either layers and broilers).

The smallholder layer and broiler producers keeps between 100 and 500 layers and less than 1000 broilers. Large producers keep more than that and the largest poultry concern (Komu Munyu Women Group) raises 200000 layers. On the other hand, the average flock size for the indigenous birds is 7-14 birds (4.4% cocks, 24.4% adult hens and 71.2% young stock <5 months).

The 32000 layer parent stock and 85000 broiler parent stock have adequate capacity to meet the market requirement for day old chicks.

Poultry feed (about 500000 tons) accounts for 73% of the total animal feed produced in Kenya. Mostly :

Maize bran, wheat bran and pollard
 Meat, bone, blood or fish meal
 Cotton, sunflower seed cake

The problems facing the feed industry are the availability of raw materials, particularly maize, their high cost and sometimes their poor quality.

Coccidiostats are included in broiler feed as well as chick starter feed.

Broilers are sold at 6-8 weeks of age with an average slaughter weight of 1.9kg (feed consumption per broiler of 4.2 kg). The mean egg production is 200 per bird.

The local birds are set on free range where they feed on greengrass, leafy vegetables and insects. Occasionally, they are supplemented with crashed maize grains or household refuse and food-left overs. No specialized housing for these birds is prepared, only simple structures to protect them from elements of weather.

The major poultry diseases are coccidiosis, newcastle, fowl typhoid and respiratory diseases. Ectoparasites (lice and red mites) are also a major problem for small poultry producers.

Most of the produce from the local birds is consumed in the rural areas. The marketing channels are :

	local birds and culled layers	broilers	eggs
selling directly to the consumer	22.6%	47.9%	26.4%
selling in an open air market	77.4%	12.0%	73.6
selling to retail shops or supermarkets	-	38.0%	-
Export	-	2.1	-

These marketing channels make the produce expensive to the consumer (marketing margin >35% in urban centres).

IV.4. Main diseases

In the absence of reliable data (both epidemiological and economic) it is impossible to quantify precisely the economic losses incurred as a result of livestock diseases in Kenya. A conservative estimate places the loss at about US \$ 43 millions each year but it is probably an underestimate. It is estimated that about 70000 cattle die of East Coast Fever annually in Kenya, which alone would account for a loss of US \$ 6 millions.

Many different diseases affect Kenya's herds and only the major ones are quoted below which are often described in literature (A5, A7, B1, B2, B3, C1) :

Bovine diseases

Anaplasmosis	East coast fever	Heart-water
Babesiasis	Carbuncle	Foot and mouth disease
Blackleg	Mastitis	Trypanosomiasis
Brucellosis	Leptospirosis	Colibacteriosis
Coccidiosis	Milk fever	Ruminal tympany

Ovine diseases

Blue tong	Colibacteriosis	Foot rot
Fascioliasis	Pasteurellosis	Nairobi sheep disease
Enterotoxemia		

Caprine diseases

Mastitis	Trypanosomiasis	Caprine peripneumoniae
Colibacteriosis	Abscess	Parasitic infestation

Porcine diseases

African swine fever	Colibacteriosis	Foot and mouth disease
Swine erysipelas	Porcine atrophic rhinitis	Sarcoptic mange
Metritis-mastitis-agalactia syndrome of sows		

Poultry diseases

Newcastle disease	Gumboro disease	Chronic respiratory disease
Marek's disease	Coccidiosis	Heterakidiasis
Fowl cholera	Ascaridiosis	Avian infectious laryngotracheitis
Avian infectious bronchitis		

Equine diseases

Babesiasis	Tetanus	African horse sickness
Colibacteriosis		

For example, the main reasons for death cattle in Meru District (1986) are (A5) :

East Coast Fever	22%	Diarrhoea	5%
Anaplasmosis	3%	Other diseases	1%
Trypanosomiasis	8%	Accident	17%
Lumpy skin d.	2%	Drought	13%
Unknown	29%		

Predators are very important in smallstock causes of death (about 30%).

Part II : Veterinary medicine market in Kenya

The veterinary market is a good approach to the herding system in Kenya, showing both strongnesses and weaknesses of the animal health care organisation. This market is usually quite limited in Africa as indicated below :

Country	% of the market	Country	% of the market
N. America	35.8	S. Africa α Japan	7.3
W. Europe	19.8	Australia	2.7
E. Europe	13.4	Middle East	2.3
S. America	9.9	Africa (- Maghreb)	1.9

Table n°11. % of the veterinary market in the world (third international technical consultations, Veterinary Drug Registration, Paris 1986, in B3)

This market represents less than Ksh 350 million in Kenya (about FF 25 million). However, many major epidemic diseases threaten Kenya's livestock as it has been discussed before and should justify the development of the health care system in the following years. For example, the estimated lost due to Trypanosomiasis in Kenya is about Ksh 5000 millions (FF 500 million in 1993) (Lettre d'Afrique Orientale, n°23, 1994, in B1).

I. Organisation of the veterinary medicine market

Two main sorts of products can be found :

- O.T.C. : Over The Counter products, which are freely sold, without prescription in many cooperatives or general stores. The producer name is their only reference and generally there is no proof of their efficiency.
- Ethical products : only sold on prescription. They are mainly produced by international firms and are often more expensive. Some are made locally or imported from India or China and are less expensive. These products are exclusively sold in stores authorized by the state.

I.1. Principal products and producers

Ethical products represent more than Ksh 300 million per year and can be divided in :

Acaricides : Ksh 200 million

Steladone (Ciba Geigy, leader with 35% of the market), Triatix, Supadip (Cooper), Asuntol (Bayer), Sevin (Rhône-Poulenc) and Supona (Shell Chemical).

Anthelmintics : Ksh 30 million

Imported (Cooper, Bayer, ...) or locally produced (Cosmos Ltd, Dawa Pharmaceuticals, ...) products.

Antiprotozoals and Trypanocides : Ksh 40 million

Rhône-Poulenc is leader of this market with about 60% of the market share.

Antibiotics : Ksh 10 million

The main antibiotics used are tetracyclins, penicillins, streptomycin or cloxacillin. This part of the market is probably under-estimated (?).

Vaccines : Ksh 25 million

I. 2. Animal health organisation

A strong distinction exists between the public or the private system.

I.2.1. Public sector

Organisation

It is regulated by the Veterinary Department of the Ministry of Livestock Development in Nairobi. Its organisation is the following.

National	Director of Veterinary Services Assistant Directors (5)
Provincial	Provincial Director of Veterinary Services
District	Veterinary Officer Director Veterinary Officers
Local	Animal Health Assistants and Dip Attendants

Role

The actual State's importance in animal health care is decreasing. The services are usually designed to detect, control or prevent major epidemic diseases rather than to provide a curative service for individual herds. They still have the vaccine market control although more and more vaccines are bought abroad. Thus, the Kenya Veterinary Vaccine Production Institute has only a KES 75 millions budget. It still produces for example Foot and Mouth disease, Rinderpest, Lumpy skin, Blue tong, Brucellosis, Newcastle, Rabic disease, Bovine peripneumonia vaccines, ...

In short, the actual State's roles can be listed as following :

- providing health care and medecine locally, where and when it's possible
- producing and importing drugs (almost vaccines). The actual budget of KES 100 millions is rather insufficient (1993) and many foreign firms hesitate to sell to the government who pays with important delays.
- evolving to an epidemiological survey of the territory, with a total market liberalization and the development of the private sector.

The Health Services should in short terms supply in areas where there is no vet installed.

1.2.2. Private sector

Veterinary drug origins

The private medicine market is divided in 2 unequal parts :

→ local production : only 5% of the total market, because of the foreign competition and the consumer tastes for foreign products.

Main producers are :

Cooper (K) Ltd (acaricids + anthelmintics + vaccines)

Dawa Pharmaceuticals (antibiotics)

Cosmos Ltd (anthelmintics + feed supplementation)

and furthermore Meditec Pharmaceuticals Ltd, Skaj Ltd, ...

→ imported production : 95% of the market. Drugs are imported by international firm representations, local importers or sometimes by important ranchers directly for their own herd.

The main international importers are :

Cooper (35% of the acaricids market)

Bayer (20% of the acaricids market)

Kenya Swiss Chemical (Ciba-Geigy) (15% of the acaricids market)

Shell (15% of the acaricids market)

Rhône-Poulenc (60% of the antiprotozoals market)

and furthermore Hoechst, Pfizer, Unga Feed, Hackmey, MSD, Laprovect, Intervet, Virbac ...

The main local importers are :

Twiga Chemical Industries (raw materials)

E.T. Moncks

Sigma Laboratories

Assia Pharmaceutical

Drugs are mainly imported from Great Britain (31%), Germany (14%), Italy (12%) and Switzerland (9%).

Products from India are also increasingly bought because they are less expensive.

Legislation

Products must be registred at the Pharmacy and Poison Board. The classification is based on British pharmacopeia. The licence is delivered for 5 years and the delay for registration is about 1 year.

Imported products are toll free but usually can not be re-exported.

1.2.3. Distribution

Different levels exist :

□ Ethical products

- public sector which is based on the pyramidal system described above but which drastically lacks means to import or to distribute

- private sector : pharmacy or veterinary offices (margin about 30%) and grossists such as the Nairobi Veterinary Center which sells products to retailers, ranchers, the government...

- OTC products
- Cooperatives (Kenya Grain Growers, ...)
- Markets and supermarkets ...

II. Main market disfunctions and perspectives

The major constraints to the control of diseases are a lack of knowledge of many farmers in addition to a limited availability of drugs.

Vaccination campaigns are carried out by veterinary staff against a number of diseases (mostly Foot and Mouth disease) but vaccinations against sporadically occurring diseases are usually undertaken only in response to a fresh outbreak, which often is too late. Full coverage of all susceptible animals is rarely achieved due to operational difficulties and to the unavailability of vaccines (A5).

Kenyan veterinary services

Veterinary services operate both at the national level to deal with potential disease outbreaks and at the level of individual farmer. They are under the responsibility of the Department of Veterinary Services. However, the department is constrained by a lack of funds and transport facilities and an inconsistent supply of drugs. Staffing levels are also low varying from a ratio of 1/1000 TLU in high-potential areas to 1/13000 TLU in the pastoral districts (A5). There is a particular need for auxiliary animal health services in these districts of the country.

Thus, in general, the veterinary service is inadequate to meet the needs of the livestock sector.

Private sector

In contrast to the developed world, the private practitioner service in Kenya is very rudimentary. Most of the veterinary offices are in town as it is indicated below (census from 1990) (B1).

Repartition of veterinary practitioner offices					
Nairobi	13	Nyeri	1	Kericho	1
Ngong Hills	1	Othaya	1	Kisii	1
Mombassa	3	Njoro	1	Meru	1
Nakuru	2	Subukia	1		

Table n°12. Veterinary offices in Kenya (B1)

In addition to the scarcity of this staff at a national level, the vastness of the area, the scattering of people and their herds, the poor roads and communication facilities all hinder the efficient supervision of farmers (A5).

The lack of good distribution associated to strong prices of veterinary drugs are also a major problem in pastoral areas. The effectiveness of traditional methods of prevention has reduced and the need for curative services has increased (B2). Although theoretically controlled and available only on prescription, expensive and often unreliable modern medicines are available through itinerant traders and from the veterinary offices. Pastoralists are becoming increasingly

aware of the value of these medicines and becoming dependent on them. However, they really need better access to reasonably priced modern medicines and information on how to use them properly.

An actual approach to solve these problems is based on the training of individuals in order for them to provide veterinary services to their communities (B2). These « paravets » are selected by their communities, receive a short training in the recognition and treatment of the common, simple diseases and return equipped with a loan of medicines which they then use to treat their neighbours' animals as well as their own. They leave a small profit as an incentive to continue the work. The problem of inadequate drug supply is addressed in 2 ways : existing drug shops are expanded to include a larger quantity of unscheduled drugs and communities are being encouraged to set up their own drug stores which can either be a permanent store or a mobile store that is carried to dry season grazing areas.

This approach gives pastoralists control over the health of their livestock and may be a good but a long-term solution.

General problems

Many problems are related to the poor roads and to the bad communication systems. But the national economic situation is also quite worrying : the GDP has been reduced by 4.1% in 1993 and is only US \$ 310 at the same time (A3). The long drought, the arrival of the Somali refugees, and the international decrease of coffee or tea prices have led to this situation. The unstable political situation has also contributed to aggravate the problems and led to ethnic conflicts.

In these circumstances, many international companies remain careful about the economic evolution : infrastructure degradations, every day violence, corruption, and ethnic conflicts affect their activity,. Only 30% of these companies would accept to increase their investment in the short term.

III. Traditional medicine

In pastoralist areas of Kenya, lots of traditional methods of treatment exist and take a great importance in animal health care. As modern medicines are not available everywhere and all year long, these practices will probably go on for quite a long time.

Examples of these treatments are given below, without consideration of their real activity.

Bovine pleuropneumoniae : to vaccinate, make a sick lung fragment ferment during 48 hours in millet bran, fresh milk and some pod of *Acacia nilotica* powder. Introduce this fragment in a cutaneous incision of the bridge of the nose for 3 days. Then take it off and cauterize the sore.

Bloat : if free gas bloat, administer orally a sugared water solution.

Snakes biting : apply on the tumefaction a maceration in fresh milk of *Securidaca longipedunculata*'s root. Maceration of *Balanites aegyptiaca* bud is also effective.

Oestrus : *Cissus quadrangularis* used by fumigation in the herd in the evening provoke oestrus. *Ficus glumosa* dried fruits have a similar effect, per os.

Horses constipation : a maceration of *Adansonia digitata* leaf powder can be used.

Spasmodic colics : dried leaf in warm water is effective used on horse or cattle orally.

Bovine anthelmintic : leaves of *Chenopodium ambrosioides* in boiled salt water are used orally as anthelmintic.

Sores : *Cissus quadrangularis* and *Phyllanthus pentandrus* (dried leaf) can be applied on sore to help scaring.

Others : *Datura inoxia* is antispasmodic. *Ranwolfia vomitoria* makes hypotension and sedation. *Aloes barteri* is used against Guinea worm. *Terminalia avicennoides* is used against Trypanosomiasis and babesiasis.

Part III : Maasai herding

The Maasai are the second biggest group of pastoralists in Kenya, after the Somalis, numbering some 360000 out of a total pastoralist population of some 1,4. Maasailand extends over 40000 km² (7% of Kenya's total land area) along the Tanzania border. Ecoclimatically, the region can be roughly divided into dissimilar halves which approximatively match the administrative units of Narok District on the more humid western side, and the Kajiado District to the more arid east. Maasailand has a heterogeneous resource base which overall holds great productive potential.

Two thirds of the beef consumed in Nairobi as well as most of the capital's mutton and goat meat comes from Maasailand (FAO 1980 in C2). But pressures on land, leading to environmental degradation and diminishing levels of welfare, are undermining the Maasai pastoral mode of production which historically is a sustaining, if underproductive, economy. The rangelands offer great scope for increasing livestock production once the transition is made to market oriented production systems. But in pastoral society such as that of the Maasai, resources are communally held and ecological constraints are little modified. The selling of an animal is often due to necessity rather than by plan. Livestock are repositories of value and the spur to livestock accumulation is underproduction for market.

« In pastoral societies, a succesful career is built upon the acquisition of animals which are to serve as the basic source of subsistence, as measure of personal status, as the basis upon which influence in the community is established and as the mean of projecting social status and influence into the future through the acquisition of wives and hence sons, and also through the establishment of personal obligations that assure protection against the vicissitudes of old age » (Goldschmidt in C2).

The stock associate is of particular importance in Maasailand. It is an important medium for maintaining relationships, the person with few animals is poor not only in subsistence terms but also socially. This point will be largely discussed below.

I. Maasai society organisation

I.1. Historical context

When the europeans arrived, the Maasai occupied an area of 155000 km². In 1904, the British formed 2 Maasai reserves. The northern reserve was eliminated in 1911 and the southern one was expanded to a total of 40000 km² (Narok and Kajiado districts) (C1).

Other tribes also lost land to european settlers and many Kikuyu moved into Maasailand and started cropping in higher potential areas. National parks and natural reserves were also created, restricting the use of land by the Maasai.

Finally, the drought of 1948 increased conflicts between the Maasai pastoralists and farmers. A stste of emergency was declared in 1952 and thousands of Kikuyus were repatriated to their own reserve.

Following independance in 1963, the government promoted transfer of land from Europeans to Africans. But the range areas were mostly given to African farmers and were not returned to the groups which occupied them traditionally. In late 1965, the government proposed for pastoral areas to change the orientation of production from subsistence to commercial orientation, primarily through group ranching. Major changes in land tenure and organisation were required. Security of tenure was so evocated as a key instrument in promoting the

development of the pastoral rangelands. The Land Act of 1968 stated that lands and stock would have to be shared in ranches and this share would be decided by a group ranch committee.

The group ranch concept was a first attempt to radically transform a nomadic system into a sedentary, commercially oriented system. But the average Maasai had little understanding of this concept which implicated adjudication of trust land into ranches, registration of permanent members of each ranch, allocation of grazing quotas to each member, development of shared ranch infrastructure such as water points, dips or firebreaks, management by an elected committee ...

The administration determined boundaries of the the group ranches. Several individually owned ranches were also adjudicated. But even today, boundary disputes remain a problem. The mean size of these ranches is about 16500 ha and counts about 125 registered members.

Major social changes have occurred in Maasailand since the group ranches were created. Maasai continue to manage their cattle for maximum milk production and still suffer large losses of stock during droughts. However, they move their animals over shorter distances and make wider use of veterinary preparations. They also make more use of improved breeds.

The livestock population has not been reduced, although the principle of grazing quotas and the degradation of the rangelands may increase.

Maasai are now increasingly cultivating their land despite strong cultural proscriptions. Territorial organisation has strongly evolved but has not provided a workable substitute to traditional leadership. The mean size of the boma has fallen from 6.2 households in the 50s to 2.7 in the 70s.

Lastly, dietary changes are real and Maasai do not eat agricultural food stuffs only during droughts. Many children go to school in the hope they will find an employment. Unfortunately, many will remain in the ranches as pastoralists or traders ...

1.2. Maasai population growth

The desire of every Maasai pastoralist for children is economically rational, considering the labour demand and the reliance upon one's offspring for old-age security. « In spite of the importance which Maasai attach to their cattle, they regard the possession of children, especially sons, as a more significant social value. Hence, a wealthy man is one who has both many cattle and many children ; a man with many cattle but few or no children is accorded no special status at all, being equated with a poor man who has neither many cattle nor children » (Jacobs in C4).

However, population growth rates of pastoral people have been found to be generally lower than those of cultivators. Traditionally, a man cannot marry until he has attained senior warriorhood. The trend nowadays is toward younger and larger families as both Maasai men and women marry at an earlier age. A decline in many pastoralists' welfare induces fathers to have daughters marry at a young age so that the brideprice may be received sooner.

When improved health care which is now available is considered in addition to these social changes, it is not surprising to find an accelerating population growth rate among the Maasai. This indicates that subsistence needs will be more important than the capacity of the resource base as utilized in the pastoral mode of production.

1.3. Food consumption

The staple diet of the Maasai consists of cow milk, butter, maize meal and meat. Milk is drunk fresh or in tea sweetened with sugar. Maize meal is cooked to make a porridge. Meat is eaten only irregularly. Blood is rarely drunk, only during drought or on ceremonial occasions. This diet, dominated by milk, is relatively rich in fat and proteins but low in energy. For example,

pregnant women have energy intakes under 60% of that recommended by FAO but do not appear to deliver underweight babies (C1).

1.4. Maasai social structure

♦ Socio-spatial integration (C1)

Maasai socio-spatial organisation is composed of five basic units, classified from smallest to largest :

- household : locus of cattle ownership ; autonomous decision-making unit, highly mobile and flexible (may split seasonally) ; based on viability = people/animal balance.
- boma : joint unit for herding/watering and other livestock management ; strong prescription for good sharing.
- neighbourhood : broader cooperation/information, exchange, sociability ; share and control of local grazing and water resources.
- section : large to allow for resource fluctuations ; largest unit of traditional administration/apex of age-set system.
- Maasai society : ideological unit ; shared language and culture.

Until recently, Maasai households, primary unit of production, lived together in bomas of 6 to 12 households. But the average size of the boma has declined markedly as they moved towards individualisation of production. Bomas were grouped into larger units, or neighborhood, usually centered around a permanent water point and had a core of people who resided there permanently. Each Maasai producer belonged to a neighbourhood, which he considered his home area and had a right to leave (whereas permission of residents was required for him to join another locality). Each section had a fixed territory that belonged to section members collectively and was large enough to provide adequate grazing in normal and dry times.

The Maasai as a whole form a distinctive social unit sharing a culture, language and social structure.

♥ Cross-linkages

The Maasai have linkages which unite people within and even across sections. These cross-linkages are of two types : group-wide and individual. Group-wide ties of age-sets and clans form the most important framework for socio-political organisation. Through them, every person has well-defined roles and responsibilities.

Traditionally the Maasai political organisation was based on a serie of age-sets. Each boy was circumcised and incorporated into a generational category. Then, he passed through the stage of warrior, junior elder, senior elder and retired elder, each stage lasting about 15 years. The senior elder age-set had the responsibility for the traditional administration in Maasailand. But this organisation is increasingly offset by the actual level of education.

Maasai clans are patrilineal : a child belongs to the clan of his father and remains a member for life. Non Maasai can be ritually incorporated into a clan. Clan-mates have very strong mutual aid obligations. They provide help in marriage and are a locus of settlement of disputes.

Every producer has his own egocentric network composed of blood relatives, especially patrilineal kin, affines, especially his wife's kin and stock associates ; relationships established by the exchange of animals.

Marriage is polygamous ; a man's first marriage is usually arranged by his father who provide the bride-wealth cattle. It occurs between people from the same section but from different clans.

♠ Division of responsibility and labour in livestock production

The Maasai have strong prescribed norms for the division of responsibilities and labour between age groups and sexes.

Δ Men : adult married men are primarily managers and supervisors : they gather the necessary information on range conditions, water availability and marketing. They decide on herd movement and on who will do the herding. They organise the functioning of dips. They also inspect animals each evening to make sure none are lost, to determine whether animals have grazed enough, whether any are about to give birth or are sick. They buy and administer veterinary drugs and perform castrations and other minor veterinary procedures. They decide when and which animals should be slaughtered or sold.

Δ Women : women make all major domestic decisions, including those relating to childcare, food preparation, collection of water and fuelwood and house-building and maintenance. They take care of the cattle and smallstock allocated to their sub-household. They do the milking and have the right to the milk of their animals. They also own the skins of stock allocated to them.

Δ Children : much of the Maasai household is carried out by children, who do almost all of the herding and much of the work around the boma. At 6 years old, a child becomes a full-time herder, beginning with smallstock and starts herding calves at 8 or 9. Children who attend school are expected to herd on weekends ; that's why poorer households educate as many children as labour needs and finances will allow. Girls tend to do more calf herding and help with young-stock management, preparation for milking and domestic tasks.

Table n°13 shows the actual division of labour in households as a percentage of each livestock management task.

Task	Children		Adults	
	M	F	M	F
Watering supervision	15	5	74	6
Herding	48	44	3	5
Dipping/spraying		5	74	21
Other livestock work	17	23	33	27
Milking	1	18		81

Table n°13. Division of labour by sex and age in Olkarkar (as a percentage of each task) (C1)

Adult and immature cattle, as well as smallstock require full-time herders, while young animals remain around the boma under the care of small children with supervision from women.

Milking occurs mainly early in the morning before cattle leave for grazing, or after 18.30 when they return. Women prefer to milk by daylight but often milk in the dark in the dry season.

II. Livestock management practices

Maasai grazing and watering management practices are aimed at :

- minimising distances between the night boma, the water point and grazing locations,
- avoiding predator attacks,
- ensuring animals arrive at the appointed times
- providing the best possible grazing for each stock class.

II.1. Watering management

The further a producer lives from water, the more likely it is that he practices alternate day watering. It is also more common in dry period. In wet periods, ephemeral ponds or pools in riverbeds provide additional water points.

II.2. Herd management

Cattle are usually divided into two groups for herding : adult cattle, comprising lactating and dry cows and all young stock from the age of 4 to 24 months. When the animals are taken to distant pastures, some lactating cows and their calves are kept at home to provide milk. The mean size of herding units ranges from 85 to 120, sometimes up to 700 adult cattle in the largest groups.

Herding is mostly done by a child who acts mainly as observer and rarely influences animal behaviour directly. Herd activity pattern is largely determined by the lead cows or old steers. The grazing orbit is determined by the herd owner's decision on when the herd should depart and whether, when and where it is to be watered.

Adult cattle leave the boma between 06.30 and 07.30 and return after 18.30. About half an hour is spent on watering. The time available for grazing is about 8 hours a day (actual grazing, walking in search of forage and walking between periods of harvesting). The total distance covered is about 12 to 15 km.

Sheep and goats are herded together. Flocks include both adults and the young that are mature enough to cover the daily orbit. The mean size of herding units ranges from 80 to 105 heads of smallstock. Their activity profiles is fairly similar to those of cattle. The herding day is shorter (< 10 hours) and animals stay around the boma, their grazing orbit being much shorter than those of cattle (C1).

II.3. Calf management

Milk offtake is carefully controlled to maintain a safe balance between the needs of the calf and human consumption. During the first 3-4 days after birth, the calf is allowed almost all its dam's milk. Calves are allowed to suckle during and immediately after milking and then are separated from their mother. The women milk the 2 left teats, leaving the 2 right ones for the calf.

Calves are penned in enclosures until they are 1 month old then tethered in the shade until 3 months old. Sometimes women cut grass and carry it home for them. At 3 months, calves are taken to reserved grazing areas. In general, they are not weaned forcibly but continue to have access to their dams at milking. Natural weaning occurs when the dam is in calf again.

II.4. Management of young smallstock

It requires particular care. Young lambs and kids are kept in small enclosures or sometimes in the house. A recalcitrant dam is held so the young can suckle. Extra attention is given to twins. Weaning is gradual and at 3 months, they join the smallstock flock.

Maasai usually castrate their smallstock around weaning time.

II.5. Animal health care

Cattle are supposed to be vaccinated twice a year against foot and mouth and any other diseases specified by government order by the veterinary services. Ticks are controlled by

hand-spraying or dipping livestock with acaricide, although some remove ticks by hand. Cattle are dipped an average of 13 to 16 times a year. Many producers change to hand-spraying their cattle in enclosures, although it is less effective than dipping because it's cheaper and easier to organise.

Most livestock owners are familiar with the common veterinary drugs and buy them wherever they're available, including veterinary officers. Injectable tetracycline and trypanocidals are the most commonly used. The Maasai have also traditional practices and plants they use to care for their cattle.

III. Productivity of cattle and smallstock

III.1. Cattle productivity

The structure of 41 herds regrouping over 5000 cattle in Kajiado District (Maasailand) was analyzed between 1981 and 83 (C1). Results are presented below.

♣ Herd composition

Table n°14 shows the herd structure in the study area.

Per cent of animals					
Males	Age (years)	Mean	Females	Age (years)	Mean
Calves	0-1	7.8	Calves	0-1	9.8
Young steers	1-2	10.4	Heifers	1-4	20.5
Imm. steers	2-4	8.2	Cows	>4	36.1
Mature steers	>4	2.0			
Bulls	>4	5.2			
Total males		33.6	Total females		66.4

Table n°14. Cattle herd structure (mean) in eastern Kajiado District (King et al, 1984, in C1)

Each producer prefers to have his own breeding bulls and replacements. The number of cows per bull increases from 11 to 14 with increasing herd size. The calf/cow ratio is generally lower in small (1-40 head) herds because producers are forced to sell or exchange young female stock for cash or marketable steers from the rich producers.

♦ Breeds and weights

95% of the 5000 cattle were classified as Small East African Zebu. Others are mixed-breeds (Zebu with Sahiwal or Boran). Animal weights shows differences between herding areas, and increase with producers' wealth. Mean weights for the main management classes are given in table n°15 (all animals are SEAZ except adult bulls which are SEAZ and crossbred with Boran or Sahiwal).

Mean weight (kg +/- SE)		
Sex	Weaners	Adults
Female	174 +/- 7	251 +/- 4
Steers	171 +/- 7	262 +/- 13
Bulls	164 +/- 10	322 +/- 34

Table n°15. MeanWeight of weaner and adult cattle (King et al, 1984, in C1)

♥ Reproductive performance

Calving should be evenly distributed throughout the year to give a continuous milk supply. In practice, the Maasai do not control the breeding of their cattle and hence their reproduction is primarily influenced by the bimodal rainfall regime and the resultant seasonality in feed supply. There are 2 major peaks in conception that coincide with the 2 rainy seasons (oct. to dec., short rains and march to june, long rains). This conception pattern results in a calving peak from the end of the long dry season in september through november (31% of all births) and a larger peak from february through may (51%).

The average calving rate is 58% but it may be as high as 75% in years with 2 consecutive good rainy seasons. Cows that calve during rainy periods give birth about 17 months later and those that calve during the dry season give birth some 21 months later. Calving interval is, however, highly variable among the cows but the duration of milking has little effect on calving intervals.

♠ Mortality and disease incidence

Calf survival is high up to 4 months of age due to the efficient management system that Maasai have adopted for young calves which are kept in and around the boma and rely exclusively on their dam's milk. Mortality increases when calves are sent out to graze. Then, from 7 to 18 months, survival is again high (mortality rate of 2-4% over 11 months). For example the survival rates of calves to 4, 7 and 18 months in Kajiado District, measured on 678 calves (1981-83) are :

Age (months)	Rate*	(* neonatal deaths are not included)
4	0.97	
7	0.94	
18	0.91	

The main cause of calf death is disease and malnutrition, and predation in older classes of stock. The mortality rate of cows is fluctuating (2 to 10% a year) in the different study areas. Brucellosis and Leptospirosis seem to be the most common diseases. Theileriosis occurs mostly in the south of the District where *Rhipicephalus appendiculatus* (brown ear tick) is present. Incidence of major diseases in cattle in the study area (1983, C1) is (in % of animals tested) :

Brucellosis	15	Anaplasmosis	3
Leptospirosis	18	Theileriosis	4
Paratuberculosis	2	Bovine otitis	3

However, diseases incidence is low ; that suggests mainly subclinical infections and/or enzootic stability and tolerance. The inherent genetic resistance of the indigenous breeds is believed to play an important role.

♣ Growth of young stock

The overall mean birth weight of calves is 19.2 kg but calves born 2 kg heavier if the last trimester of gestation coincided with a rainy season. But the effect of season of birth on subsequent growth is significant only up to the second month. Calves born in april-june have the lowest gains due to their being exposed to poor grazing longer than calves born in other seasons. Table n°16 shows the daily weight gain of these calves (382 calves tested).

Age (months intervals)	Weight gain (g/day)	Age (months)	Calf weight (kg)
1-4	212	4	46
4-7	187	7	64
7-18	204	18	132

Table n°16. Daily weight gain and 4, 7 and 18 months weight of calves (C1)

♦ Milk offtake

Actual milk supply depends on the milking strategy of the producer. This determines how much milk the calf is allowed to suckle and how much is taken off for human consumption. Herd size and its proportion of lactating cows, the milk-production potential of each cow and milking frequency are the main components of this milking strategy.

Maasai tend to prolong milking for as long as possible ; that increases the efficiency of milk production, as shown in table n°17 (estimations in C1). Short lactations, when they occur, are due to the death of the calf and problems with milk let-down.

Milking period (months)	Calving interval (months)	Efficiency* (%)
6	20.1	30
8	20.3	39
10	20.5	49
12	20.7	58
14	20.9	67

Table n°17. Efficiency of milk production (C1)

* Efficiency = milking period/calving interval

The average daily milk offtake from cows that are milked twice a day is 0.94 litre. It varies from 0.65 litre/day in dry months to 1.20 litres/day in wet months. There is a competition between calves and the family for the milk of the same cow. If a calf seems weak, its dam will be milked less frequently. After calf survival, the most important criterion in determining how much milk to extract is the need of the family. Women seem to aim for a daily milk offtake of about 1 litre per person in dry season and 1.5 litres per person in wet season. The availability of other foodstuffs also influences family needs for milk, mostly in poor households.

Milk sales account for only 5% of milk offtake and do not have a marked effect on the production.

Women do not always milk all their lactating cows. Some cows are not milked at all. And usually milked cows are not necessarily milked every day or at every milking. An average of 70% of lactating cows are actually milked, of which 85% are milked twice a day. Lastly, women prefer taking a lot of milk from a few cows rather than taking a little from all their cows, as it takes less work.

♥ Lactation yield

It has been estimated in early lactation only (using calf growth rates). The total lactation yield between 30 and 90 days after calving is about 250 litres with a daily production of 2.8 litres of which 40% is taken off for human consumption.

III.2. Smallstock productivity

The same 41 households as for cattle have been analysed in Kajiado District with a total of 2700 sheep and 2300 goats.

♠ Flock composition

The average composition of sheep flocks is given in table n°17.

Percentage of flock by class			
Age (months)	Males	Castrates	Females
Young (0-15)	8	10	21
Mature (15-30)	2	5	20
Old (>30)	1	6	26
Total	11	21	67

Table n°17. Average sheep flock structure (King et al, 1984, in C1)

The average composition of goat flocks is given in table n°18.

Percentage of flock by class			
Age (months)	Males	Castrates	Females
Young (0-15)	7	9	18
Mature (15-30)	1	7	22
Old (>30)	1	8	27
Total	9	24	67

Table n°18. Average goat flock structure (King et al, 1984, in C1)

It's interesting to notice the high proportion of males and castrates in both flocks, so that the sale of small ruminants can be increased without impairing the reproductive capacity of the breeding flock.

♣ Breeds

The major sheep breeds are Red Maasai, Black-headed Somali and different crosses. Almost all the goats are of the Small East African breed.

Reproductive performance

The Maasai try to control breeding of their smallstock using breeding aprons and this results in a distinct peak of conception early in the long dry season, when the breeding apron is normally removed. Natural lambing or kidding occur throughout the year (80% between October and April).

Smallstock have generally poor reproductive performance (> 30% of those that conceive have a parturition interval of over 2 years and more than 30% do not conceive at all in an interval of over 3 years).

♦ Mortality and disease incidence

The mortality rate up to weaning is lower for sheep (18%) than for goats (34%) but the difference is smaller at 18 months (57% vs 66%). About 15% of the goats produce twins, which are twice as likely to die before weaning as are single born kids (1% of twins in sheep).

On the other hand, lambs born in the dry season have an higher death rate than those born in other seasons, which is not the case for goats less sensible to the food deficiency. Table n°19 shows the causes of sheep (n=634) and goats (n=537) deaths in Kajiado District (1981-83).

	Percentage of deaths			
	Sheep		Goats	
	Young	Adult	Young	Adult
Disease	52	63	76	54
Injury	3	6	1	8
Malnutrition	3	2	4	4
Predators	30	20	11	19
Lost	12	9	9	15

Table n°19. Causes of sheep and goat deaths in Kajiado (Peacock, 1984, in C1)

Diseases and predators seem to be the principal causes of mortality in smallstock. Lambs and kids suffer from scouring, leading to deshydration (coccidiosis, enterotoxaemia or colibacillosis associated). Helminthiasis and salmonellosis are frequently diagnosed. Adults suffer mostly from theileriosis, babesiosis, Nairobi Sheep Disease, heart-water and anaplasmosis. Acute haemonchosis is also common in goats.

♥ Growth performance

Kids grow much more slowly than lambs up to 5 months, in part because of the higher twinning rate of goats.

	Liveweight (kg) at age (months)				
	0	3	5	12	18
Lambs	3.5	10.0	13.8	20.9	28.8
Kids	3.1	7.9	10.3	18.0	24.1

Table n°20. Mean weights of lambs and kids in Kajiado (Peacock, 1984, in C1)

Lambs and kids born in the first rains are also heavier up to 5 months than those born in other seasons.

Adult males have an average annual growth rate of about 18 g/day (6-7 kg a year). Similar trends are found in females (i.e. the weight remains constant during the long dry season and raises sharply during the rain) with an annual weight gain of 5-6 kg in both species.

III. 3. Functions of livestock

Livestock have both short and long-term functions.

♠ In the short-term, the primary functions of the cattle are to supply milk throughout the year and to generate cash income. Goats may be milked by poorer households but sheep are almost never milked. The most important functions of smallstock are for use in developing and maintaining social ties and for slaughter. Giving animals as gifts is an important social mechanism in Maasailand : for a ceremony, for a birth, for friendship... Cattle are given only for major needs and gifts of smallstock are far more common.

Most animals slaughtered by choice are smallstock, during droughts, when it substitutes for milk. Although the Maasai eat sheep meat, they prefer fatty goat meat for its flavour. Cattle are generally slaughtered only *in extremis*.

♣ In the long term, livestock accumulation represent the wealth of the Maasai. Cattle are the most important mean of this wealth increase. Smallstock play an important role, particularly for young men, and can be sold or exchanged for cattle. Lastly, livestock is the only source of long-term security against periodic disasters such as droughts. Smallstock have higher survival rates and provide milk much sooner after a drought than cattle. Multiple species production makes fuller use of the environment, while spreading production is a risk because factors which negatively affect one species may affect others less.

III.4. Household pattern of expenditure

Pastoral households incur consumption expenditure : food and non food items and services, of which level is determined by the size of the Boma, its relative wealth and the attitude of its adult members. The mean annual cash expenditure of the households in Kajiado District was, in 1981-83, Ksh 9400. Two thirds went to household consumption (about 30% food and 30% non food). The percentage of annual expenditure per person on food and beverages is indicated below :

Maize	35	Wheat	3	Sugar	22*
Tea	9	Fat/oil	5	Potatoes	2
Meat	1	Other foods	3	Hotel food	8
Hotel drinks	9	Tobacco	3		

(*Maasai women use sugar also for brewing the local beer)

The last third of expenditure was used for livestock production.

III.5. Costs and returns to livestock production

About 28% of the gross annual output of the Maasai livestock production system can be considered commercial (26% cattle, 1% smallstock and 1% milk sold). About 27% is subsistence production (2% cattle, 3% smallstock and 22% milk consumed). The remaining 45% is in the form of herd and flock accumulation (40% cattle and 5% smallstock).

On the other hand, Maasai producers spend little cash on their production since they do not pay directly for the major inputs of the system, family labour or land. Cash expenditure on production relates in fact to the purchase and maintenance of livestock, including the purchase of drugs.

	Mean (Ksh/household/year)	Percentage
Dipping	710	22
Acaricide (spraying)	255	8
Drugs	540	17
Salt	70	2
<i>Subtotal health care</i>	1575	49
Hired labour	20	0
Livestock purchase	1480	47
Others	120	4
Total expenditure	3195	100

Table n°21. Mean annual expenditure on livestock production, 1981-83 (C1).

The mean annual cash expenditure on livestock maintenance was about Ksh 12 per TLU in 83. After deducting the direct production expenses, the net output of the system was about Ksh 30300 per household, Ksh 3100 per person per year, which compares favourably with the average gross product of Ksh 3117 per person for the Kenyan economy as a whole during 1981-82.

III.6. Cattle marketing

The following data have been collected at the Emali Market, in eastern Kajiado, between 1981 and 1984 (over 7500 cattle transactions). 62% of the cattle traded at Emali were destined for slaughter and the remaining were mainly bought by producers. 97% of the total animals were SEAZ. Sahiwal and Boran-crosses represented less than 3% of the total, and were mainly castrate animals. 42% of the animals sold were castrates (mean price Ksh 1403), 39% were male (mean price Ksh 1067) and only 19% were female (mean price Ksh 966). The supply of cattle generally varies markedly between seasons and increases as long dry season progresses, although their body condition decreases and their price goes down. But the marketing system in Maasailand suffers from different problems which are a lack of good market outlets for smallstock, the absence of infrastructures along trek routes and livestock markets, a lack of information and the low cattle prices.

Conclusion

Kenya has certainly the foundation for a vigorous and technologically advanced industry. Its central position in East Africa, its relative ethnical peace and the actual process of price liberalization are positive chances. But lack of infrastructures, increase in city violence and corruption, political and economical instability hinder production development.

Major economic objectives have been negotiated with the World Bank in 1993 : increase of 5% of the GDP, an inflation rate under 10% a year with a total liberalization of prices and a major program of privatisations (A3). About 50% of the international firms involved in Kenya's economic market think this evolution will be favourable in the short term even if middle term consequences remain quite unforseeable..

In 1993, France's exports to Kenya were about FF 472 millions (mostly in construction and in food sectors). Nevertheless, the Kenya's veterinary drug market is still actually difficult to anticipate.

Some important firms have well established activities and will be hard to compete with. The level of the monetary system is very low and products from Europe do not always have an adequate presentation or way of use. International competition is strong and the importance of Indian importats should not be neglected.

The drug supply improvement has to be explored and appropriate solutions must be found rapidly. There is also a particular need for auxiliary animal health services in Kenya. All this indicates that the drug market should develop in the near future. It is not only a question of choice but a necessity.

Indeed, one of the major constraints to the development of the Kenyan economy will be the growth of human population, which has more than doubled in the past 25 years. And as the population increases, more domestic animals are required to sustain them. Thus, animal health will take more importance in the future not only as an economic factor but also as a strategic challenge. As the Maasailand example shows, livestock production should become an intensive production and take a growing importance in the country's economy, leading both the upper and downstream channel.

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