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United Nations Industrial Development Organization

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* Director, Uniproject, Vienna, Austria.

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ID/WG.[illegible] Summary
[illegible] 1975

ORIGINAL: ENGLISH

United Nations Industrial Development Organization

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Meat [illegible]

Vienna, Austria, [illegible]

PRESENT AND POTENTIAL MEAT PRODUCTS BASED ON THE RAW MATERIALS AVAILABLE IN AFRICAN COUNTRIES 1/

Summary

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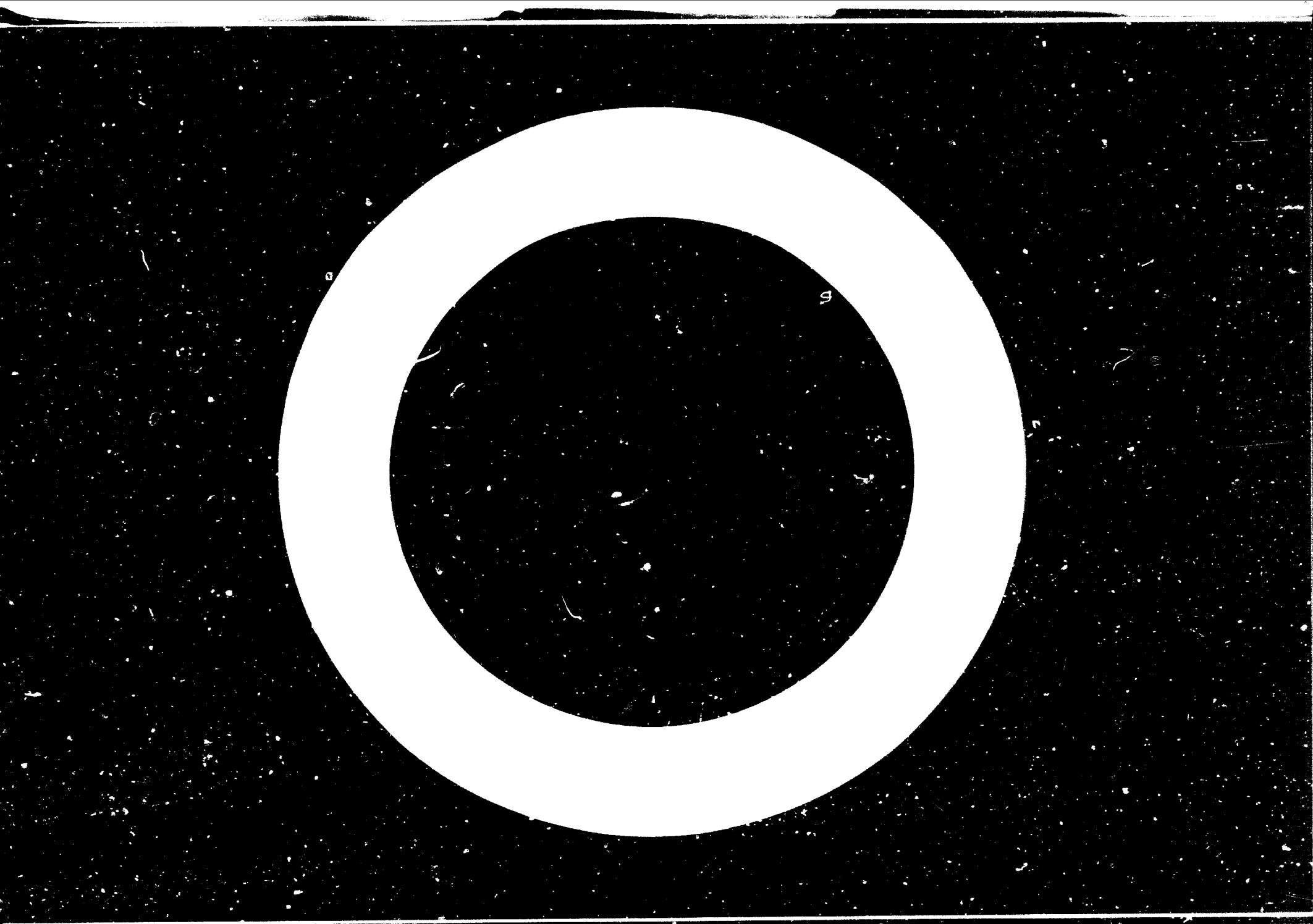

Summary

Africa's slaughter animals number about 133 million bovines and 237 million goats and sheep, and they are distributed over 5 general livestock zones: Sahara-Mediterranean (9%), Sahel-Sudanian (25%), Equatorial (14%), East African (35%), and South African (17%). Confined stock raising is increasingly being practiced, e.g. in Nigeria, in the south of the continent, nomadic grazing, however, still prevails in the northern parts, seasonal dry climates necessitating a migration of the livestock, and there the emphasis rather is on number than high production levels per animal. Tse-tse fly infested Sahel-Sudanian and Equatorial areas only permit some confined stocks of trypano-tolerant taurines. The cattle is concentrated in Nigeria and north Cameroon and the northern countries of East Africa (Ethiopia, Somalia). The bovines usually raised are zebu, Africa in general being inimical to European type cattle. Kenya has so-called "grade cattle", i.e. cross-breeds with over 50% European blood. Most of South Africa is suitable for European cattle, the majority of the livestock being found in the South African Republic, where modern breeding and finishing techniques have resulted in an optimum slaughter weight at a lower age of the animal. Yields could be significantly increased throughout Africa with more advanced methods of livestock rearing. There are also still areas where ruminant raising could be introduced if a simultaneous development of roads and water supply occurs.

It can be said that slaughtering and chilling facilities in nearly all of Africa and in particular in the north are technically and hygienically obsolete. Meat processing is not developed. The processed meat products on the market usually are imported and only consumed by a small portion of the higher income population. There is an over-supply of meat in the livestock production zones and a high deficiency in other areas. It would be highly desirable to develop modern slaughtering plants with freezing and processing facilities in the livestock zones and then transport the products chilled or frozen to densely populated areas.

Africa's potential in narrowing the increasing gap between meat supply and demand is relatively great only if advanced methods of slaughtering and preservation are developed and applied and an integration of the livestock production with a modern meat processing industry occurs.

Organisation des Nations Unies pour le développement industriel

Colloque sur les perspectives du traitement industriel de la viande dans les pays en voie de développement

Vienne (Autriche), 13-17 octobre 1975

PRODUITS DE LA VIANDE A HAUTE VALEUR AJOUTEE DISPONIBLES EN AFRIQUE : SITUATION ACTUELLE ET POTENTIEL[1/]

RESUME

par

... Sapina*

L'Afrique compte environ 133 millions de bovins et 237 millions de caprins et d'ovins répartis entre cinq grandes régions d'élevage : la zone saharo-méditerranéenne (9 %), la zone soudano-sahélienne (25 %), la zone équatoriale (14 %), l'Afrique orientale (35 %) et l'Afrique australe (17 %). L'élevage en espace clos se pratique de plus en plus, particulièrement dans le sud du continent, toutefois, l'élevage nomade prédomine encore dans le nord, l'alternance des saisons sèches et humides nécessitant les migrations du bétail. Ici, on insiste davantage sur le nombre que sur une forte production par tête. Dans les zones soudano-sahélienne et équatoriale, la mouche tsé-tsé ne permet l'élevage en espace clos que de quelques troupeaux de taurins tolérants au trypanosme. Le bétail est concentré au Nigéria et dans le nord du Cameroun, ainsi que dans les pays septentrionaux d'Afrique de l'Est (Ethiopie et Somalie). On y élève généralement des zébus, le bétail de race européenne étant en général peu adapté à l'Afrique. Au Kenya, on trouve des espèces hybrides de souche

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[illegible] entre l'offre et la demande de viande, à condition toutefois de mettre au point et d'appliquer des méthodes plus effectives d'abattage et de conservation et d'intégrer la production de l'élevage avec une industrie moderne de traitement de la viande.

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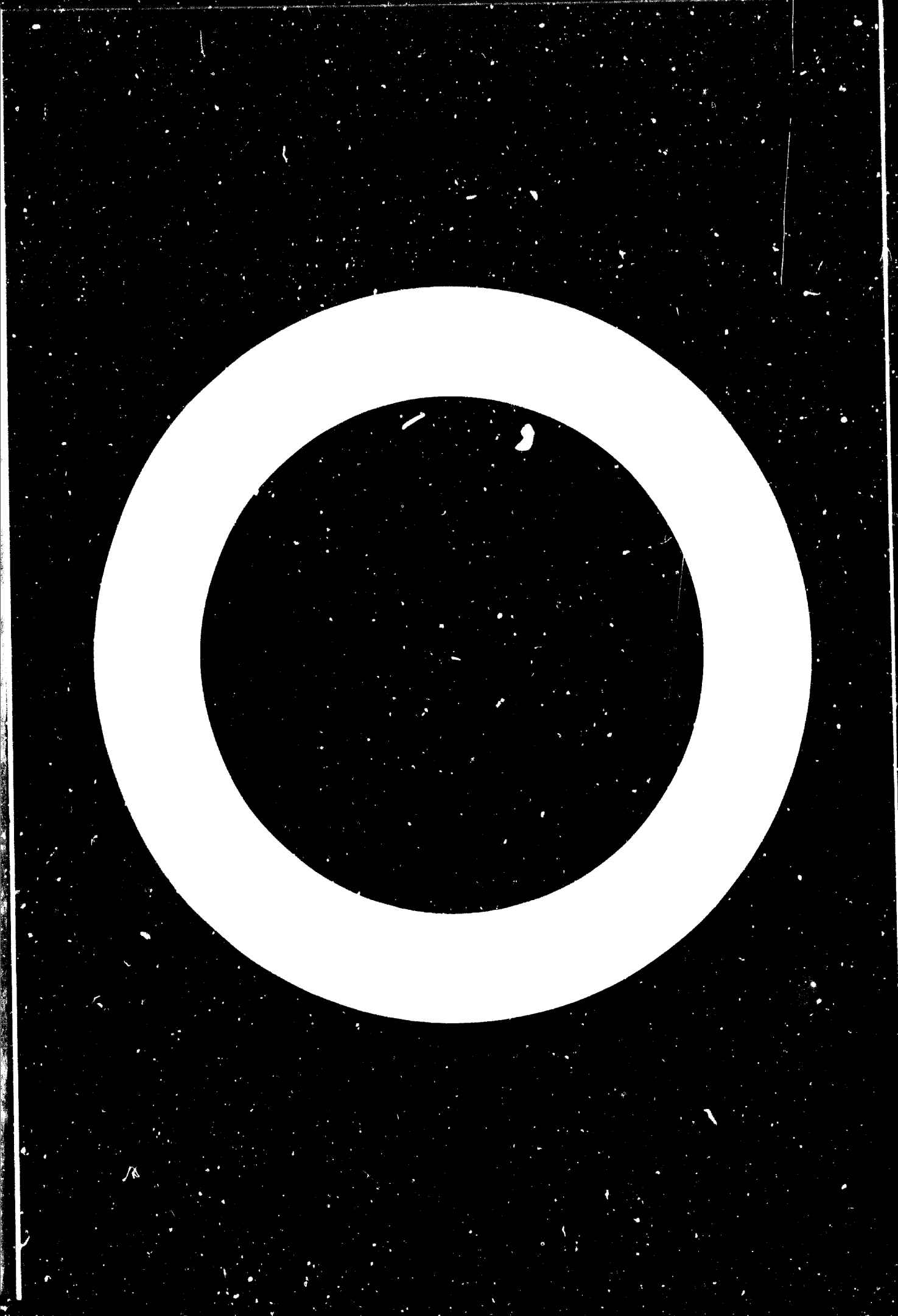

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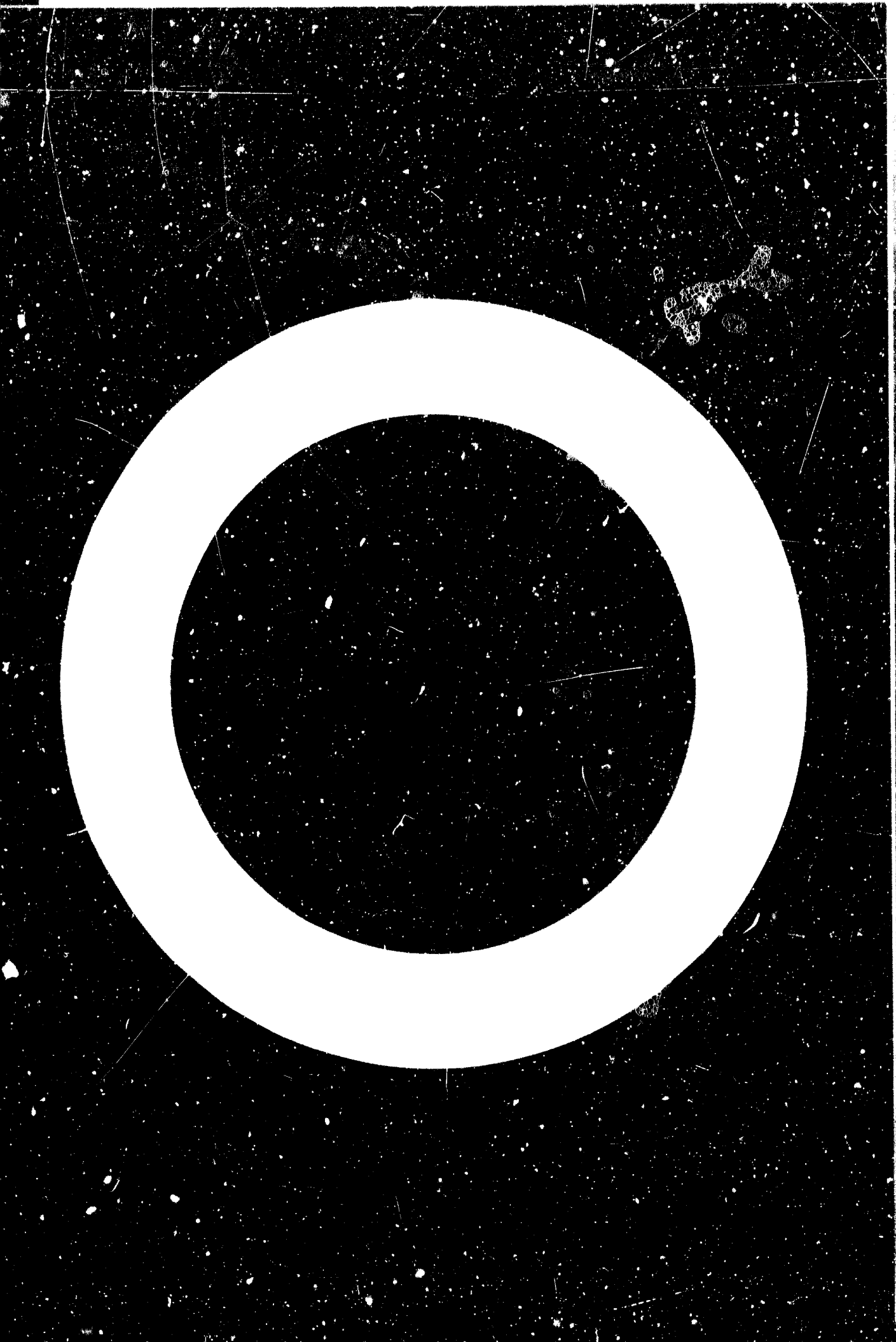

INTRODUCTION

"[illegible] per aliquid novi"
(There is always something new
in Africa, Pliny the Elder 23-79)

Africa, heart of the world, man's original home, with a surface of 30 million square kilometers, is also the continent of geographic and climatic, archeological, biological, and racial contrasts and conflicts.

Africa is characterized by an extreme range of geographical zones and climatic types. From tranquil Mediterranean and extremely varying South African coastal plains to mountainous central parts and dense equatorial rain forests of the Congo Basin and the Upper and Lower Guinea, it is a continent of many expressions: Vast savannas and grasslands, lush but still unexplored botanical spectacles and animal paradises.

There are about 350 million people in Africa but no single, trite descriptive passage can paint their life style, culture, and beliefs; they come from different societies, and their customs are as varied as the regions they live in.

The vitality and charm of Africa comes from its multi-racial population. Throughout Africa different people, distinct in culture, language and religion contribute to the unique atmosphere of this hot continent.

Living permanently in much closer association with nature than people in other continents or regions of the world, the Africans are a peace loving people, noted for their kindness, tolerance, and liberal attitude towards life and their proneness to traditions and history; they are cheerful, friendly races, very fond of music and dances full of rhythm and freedom of expressions. Africa is also rich in traditional handicraft skills: Working with wood, ivory, animal bones or metal, African artists have created images of great directness and vigor.

[illegible] Africa. The australopithecines, tool using hominids [illegible] between [illegible] and modern man, lived in eastern and southern Africa [illegible]. Homo sapiens appeared on the African continent about 100,000 [illegible].

The history of Africa is not the story of a 'dark continent', but an epic of complexity and fascination, equal to that of Europe or Asia. Africa's history has been written not in ink but in the sand of the desert, in ruins of the past civilizations, and in traditions and religions of its peoples. When the first European states were created, the African history was old. It started some million years ago and was shaped through the ages by the numerous migrations of its population.

Africa has without doubt the most glittering and most dynamic past of the world's continents. One of the earliest and greatest civilizations crystallized around 3500 B.C. when the Egypt of the Pharaohs attained immortality with its pyramids, temples, royal tombs, etc.

Initially animists and pagans, today's Africans are also Muslims and Christians. Africans christianized in the fourth century still prevail in modern Ethiopia. The Islam in Africa has come from Arabia.

Africa's fauna

Africa is an exotic, colourful part of the world with an animal life of nonparalleled richness. As might be expected, each zone of Africa is inhabited by a quite distinct assemblage of animals, in most of which we can recognize an adaptation to the environment in which they live

The fauna of Africa comprises a bewildering variety of mammals, beginning from different species of apes and monkeys right through to numerous smaller animals; the avifauna is composed of some thousand species of birds; all types of reptiles, crocodils, lizards,

snakes abound in major parts of the continent. The rich equatorial vegetation of Africa in particular is the home of a great number of varieties of tropical animals.

I. GENERAL ASPECTS OF CONSUMPTION AND MEAT INDUSTRY OF AFRICA

Africa's people [illegible] food habits and type of nutrition. Among certain people meat is [illegible] in the diet, but for a major part of the African population meat forms an appreciated article of his diet. However, meat is eaten by all groups of the population on the occasions of various festivals. The Muslim Africans are partially indebted to the Arabs for their science of gastronomy in which meat takes an important place.

It can readily be assumed that the earlier Africans ate more meat. As the population of certain regions increased and agricultural pursuits were undertaken, less meat was being eaten. The religious restrictions also contributed to the custom of abstaining from meat consumption. It is observed by the Christian Church that on fast-days man should eat no flesh meat; Muslims prohibited the eating of pork.

Methods of meat preservation have had a marked influence on Africa's history as well as on the routine of African daily life. From the beginning meat has been preserved more or less by dry[illegible] However, the problems of meat preservation have perplexed Africans and obviously contributed to a reduced meat consumption.

Although domestic animals are discussed here, it should be noted that wildlife also plays a substantial part in the African meat supply.

A. Livestock and meat production - African tradition

Africa not only is a natural paradise of animal life, but also the home of traditional animal art productions. The best proof for it are thousands of rock paintings and engravings, dating from at least 4000 B.C., found in the canyon-slashed plateau of Tassili-n-Ajjar in Central Sahara, many of these engravings and paintings depict herders and hunters who roamed here before the Sahara dried up about 2000 B.C.

From 30 B.C - when Ancient Egypt finally died with Cleopatra, but particularly when the Christianity fell in turn to Islam and the Arabs in 640 A.D. to the beginning of European colonization in the 1800's - many African people were rich in livestock. The wealth and pomp of flourishing African empires in the times of their greatest prosperity, such as Ghana - about 1000, Mali - 1500, Songhai - 1500, Luba - 1500, Congo - 1500, and Lunda - 1750, was based on their richness in livestock and wild animals.

Although some of today's African people are expert hunters and fishermen, the livestock raising is still one of the major primary industries of the African economy. Africa's slaughter animals number about 135 million heads of beef cattle and 240 million heads of sheep and goats. However, the raising of livestock is increasing, and the herding and cultivation of livestock is quickly replacing the hunting-and-gathering way of life. New, modern systems of livestock rearing, adapted to African conditions, are emerging and developing.

Although the Africa of today is still deficient in meat, it appears that the livestock industry has a very great potential ability in satisfying the local needs and the increasing export requirements. Africa can easily become tomorrow's destination in the world livestock production. It has much more to offer than other continents in its competency to produce meat for local consumption and export purposes. In order to assist in a better understanding of Africa's livestock and meat industry problems, five general African livestock and meat industry zones may be distinguished: a) Sahara-Mediterranean, b) Sahel-Sudanian, c) Equatorial, d) East African, and e) South African (Table 1).

a) Sahara-Mediterranean:

The Sahara stretches more than five thousand kilometers from the Atlantic Ocean to the Red Sea. It represents an about 1500 to 2000 kilometers wide band of windswept and stony desert, interrupted by sere highlands and expanses of shifting sand. The rather moist temperature conditions of the Mediterranean facilitates livestock breeding

Table 1. Livestock and meat producing zones in Africa

Zone	km²	Population	Beef cattle	Sheep/Goats
a) Sahara-Mediterranean	5,717,000	69,200,000	6,500,000	27,800,000
b) Sahel-Sudanian	7,273,300	36,100,000	37,400,000	53,100,000
c) Equatorial	2,119,000	86,300,000	11,000,000	32,000,000
	5,326,000	33,000,000	4,500,000	5,500,000
d) East African	3,671,000	68,000,000	42,130,000	70,800,000
	2,044,000	21,500,000	6,300,000	
	598,580	8,600,000	10,000,000	900,000
e) South African	2,661,300	21,500,000	15,000,000	46,000,000
Total	29,910,180	346,200,000	132,830,000	236,100,000

in the evergreens of the Atlas Mountains and in the narrow fertile coastal fringe eastward toward the Nile Delta.

This part of Africa is an enormous zone of extensive ruminant (sheep and goats, camels, bovines) breeding, predominantly nomadic or semi-nomadic in character, as the hot, dry climate necessitates the seasonal migration of the livestock. Confined stock raising is restricted to the Mediterranean sub-zones where the livestock rearing is complementary to the agricultural production.

From Table 2 it can easily be concluded that livestock rearing is not very developed in North Africa, and taking into account the fast growing population, it becomes obvious that the demand for meat is increasing more rapidly than the supply. Particularly Algeria, Libya, and Egypt are countries highly deficient in meat. It is clear that Mediterranean Africa will in the foreseeable future continue to import increasing amounts of meat.

The main livestock breeding people are Berbers, Bedouin Arabs, and Tuaregs. Berbers, concentrated particularly in isolated villages in the High Atlas, are mostly sheep herding. Bedouin Arab nomads, living in their goat hair tents and wandering throughout this area in search of food for themselves and their animals, subsist on rice plus the meat and milk of their sheep, camels, and goats. Tuaregs, a branch of the Berber people, with their camel caravans, are still an important economic link between oasis dwellers and merchants north and south of the Sahara desert.

In Egypt, fellahins or farmers are still tilling land in the fertile valley of the Nile by hand - as did their ancestors in the times of the pharaohs. Except the Bedouins and partially Christian Copts, they do not breed livestock for meat, but sometimes they use buffaloes or bovines as draft animals.

Municipal slaughterhouses as well as some small scale meat processing units exist in several cities of this part of Africa, but they are usually technically and hygienically obsolete. A good system of slaughterhouse and meat industry development is urgently

Table 2. Sahara-Mediterranean Zone - Population and heads of cattle

Countries	km^2	Population	Beef cattle	Sheep/Goats
Morocco	450,000	15,400,000	3,000,000	20,500,000
Algeria	2,382,000	13,000,000	500,000	2,000,000
Tunisia	125,000	7,000,000	700,000	800,000
Libya	1,760,000	1,800,000	100,000	2,500,000
Egypt	1,000,000	32,000,000	2,200,000	2,000,000
Total	5,717,000	69,200,000	6,500,000	27,800,000

needed if a better utilization of the existing livestock resources is desired. Of course, in planning the meat industry in these countries, the local conditions, traditions, and strong habits of the population should be strictly adhered to.

b) Sahel-Sudanian livestock and meat industry:

Nearly 40 million heads of bovines and over 50 million heads of sheep of Sahel-Sudanian Africa (Table 3) are kept under extremely varying ecological and management conditions, ranging from vast grassy plains to semiarid or arid areas. The meat production is varied both in quality and in quantity. The livestock areas often are more than a thousand kilometers away from the big meat consuming centres.

The bovine usually raised in this zone is zebu; however, the tse-tse fly-transmitted trypanosomiasis limits the range of zebu cattle in the south and allows only areas of small scale confined stock composed of trypano-tolerant n'dama and some other taurine breeds.

Despite the relative abundance of animals, meat production is low; the annual offtake rates are very poor - about 10 percent for bovines and not more than 30 percent for small ruminants. The average carcass weight of bovines varies from 80 to 150 kilos and of sheep and goats from 10 to 15 kilos.

Traditional transhumant and nomadic stock raising, practized by Tuaregs, Bedouin Arabs, Berbers, and Peuls, is the predominant form of livestock rearing in this zone. Ranging over the savanna in the west part of this zone, nomadic Fulani also herd beef cattle and move their camps with the season. Shilluks, Dinka, and other Nile people, but in partiaular tall and lean Nuers, inhabitants of isolated swamps and plains of the Southern Sudan, are known as skilled cattle breeders.

Mauritanians and Tuaregs are the most important camel breeders in this zone. The Bantu and some Nile tribes are hunting rhinoceros, hippopotamus, and elephants. Generally, the southern part of this zone is more or less rich in wild animals, and large mammals

Table 3. Sahel-Sudanian Zone - Population and heads of cattle

Countries	km^2	Population	Beef cattle	Sheep/Goats
Mauritania	1,031,000	1,000,000	2,700,000	8,000,000
Senegal	197,000	4,000,000	2,800,000	3,000,000
Gambia	11,300	400,000	300,000	600,000
Mali	1,204,000	5,000,000	5,000,000	11,000,000
Upper Volta	274,000	5,200,000	2,600,000	4,000,000
Niger	1,[illegible],000	4,000,000	4,400,000	9,000,000
Chad	1,284,000	3,500,000	4,600,000	4,300,000
Sudan	2,505,000	15,000,000	15,000,000	13,200,000
Total	7,773,300	38,100,000	37,400,000	53,100,000

take an important place.

A significant increase in meat production can occur in major parts of this area if more advanced methods of livestock rearing, adapted to local conditions, are applied.

Meat processing is not advanced, although some modern slaughterhouses with chilling and limited processing facilities exist in Mauritania (Kaedi), Senegal (Dakar), Mali, and Sudan. The Kaedi slaughterhouse in Mauritania and also two modern slaughtering plants in Mali, built a few years ago, are still not fully utilized. A certain number of small scale manufacturers of various local or European meat products exists in Senegal and Sudan. Canned meat production exists in Sudan; Senegal is also planning a canned meat factory.

c) Livestock of Equatorial Africa:

The major part of this zone is the area of dense equatorial rain forests in the Congo Basin and the Upper and Lower Guinea with more than 1200 mm of rain during 10 or 12 months. The animal life of this zone is predominantly adapted to the forest - numerous types of monkeys, birds, lizards, snakes. The large animals are rare, but elephants make way to antelopes, buffaloes, and okapis.

The farming system in this zone ranges from subsistence agriculture and pastoralism to large scale commercial farming and ranching limited only to some very narrow suburban areas.

Table 4 indicates that the livestock production of equatorial Africa is very backward. This region is highly deficient in meat, and the demand in meat is increasing more rapidly than the supply.

The major part of this zone is infested by the tse-tse fly which transmits trypanosomiasis. This disease renders nearly the entire zone virtually unusable for cattle rearing. The livestock raising becomes possible only where there is no tse-tse fly and where the annual

Table 4. Equatorial Zone - Population and heads of cattle

Countries	km²	Population	Beef cattle	Sheep/Goats
Guinné-Bissaut	3[illegible],000	500,000		
Guinné	24[illegible],000	4,000,000		
Sierra Leone	72,000	2,500,000		
Liberia	111,000	1,200,000		
Ivory Coast	322,000	4,500,000		
Ghana	239,000	9,000,000		
Togo	57,000	2,000,000		
Dohomey	113,000	2,600,000		
Nigeria	[illegible]	[illegible],000,000		
Total	2,119,000	86,300,000	11,000,000	**32,000,000**
Cameroon	475,000	5,500,000		
Central African Republic	623,000	2,500,000		
Gabon	**267,000**	**700,000**		
Congo	**342,000**	**1,000,000**		
Zaire	2,345,000	17,000,000		
Angola	1,246,000	6,000,000		
Equatorial Guinea	28,000	300,000		
Total	5,326,000	33,000,000	4,500,000	**5,500,000**

rains do not amount to more than 1000 mm. This is the reason why in this area only small-sized but trypano-tolerant breeds (certain taurines) can be raised.

Three quarters of the animal production of the first group of countries is found in Nigeria, where semi-nomadic Fulani and Mauritanians - from the northern part of the country - herd beef cattle and sheep. More than half of the beef cattle, sheep,and goats in the second group of countries are concentrated in north Cameroon. The majority of other people in Africa's equatorial zone, Ashanti in Ghana, Yaruba in Nigeria and Dahomey, Ibo in Nigeria, Luba in Congo, have only traditional land cultivating; the Pygmy people in Gabon and Congo live from hunting; the Congo's forest inhabitants, the Bambuti, live from forest products and hunting.

Some modern slaughterhouses have emerged in Ghana (Belgatanga, Tema...), Cameroon, and Nigeria. Slaughtering, and in particular chilling and freezing capacities are urgently needed and highly necessary in a major part of this zone. In Ghana and the Congo, and more or less also in all other countries of this zone, important possibilities exist for a wild animal industry development.

I) East Africa's livestock and meat industry:

The arid plateaus of the Somali Peninsula, the fertile Ethiopian Highlands, and the deserts along the verdant Nile valley bespeak Northeast Africa's variety; east of the Long lakes lies the fertile volcanic plateau supporting grasslands and evergreen forests; The coastal lowland stretches from the Limpope river to the north of the Equator.

The ecological subzones in coastal and continental East Africa range from the Afro-alpine moorlands of mountainsous parts of Ethiopia, Uganda, Tanzania and Kenya to the very arid areas in Somalia and southern semi-arid plains. Of particular importance to the livestock production in the eastern part of Africa is the modifying influence on the climate of the high mountains which cover large continental areas of East Africa. In the highland the cattle is held to altitudes of about 3500 to 3800 metres.

With the exception of Ethiopia, Kenya, Rhodesia, and, to some extent, Somalia and Uganda, this zone is not rich in meat production, but considerable improvements could be obtained by applying better, more advanced breeding and finishing techniques.

Two groups of countries can be distinguished in this zone: a) The northern group of countries, being relatively rich in cattle and sheep (Table 5), and b) the southern group of countries, being less rich in cattle and poor in sheep production (Table 6).

From Table 5 can be seen that Ethiopia produces more than half of East Africa's livestock. The main Ethiopian livestock breeders are the Christian Amhara and the mainly Moslem Danahil, who herd their beef cattle and sheep in the major part of the country. The Boran people in the south of Ethiopia and Turkana tribes in North Uganda are also known as beef cattle breeders, using their milk and blood as food.

Somalia normally gains 70 percent of its foreign exchange earnings from the sale of animals and animal products, and two thirds of Somalia's people derive their livelihood from livestock and related industry. The inhabitants of Somalia, the Afars and the Somalis, breed nearly three million camels apart from sheep and beef cattle.

Kenya's Kikuyu tribes, one of East Africa's largest group of people, mainly practise confined stock raising, the Boran tribes in Kenya, with their zebu herds are reputed as good and rich livestock producers. Inhabiting the high plains of Kenya and Tanzania, small family groups of Masai people travel with the season; skill in cattle breeding has made the Masai tribes one of Africa's wealthiest pastoralists, owning about four million heads of zebu type cattle.

In Kenya, in particular, there are areas of so-called "grade cattle" with more than 50 percent European blood. Cattle crossbred between a European dual-purpose breed and a local animal (for example, Boran-zebu) are often considered to make the best use of the environment. Over one third of Kenya's cattle are kept in the high-potential areas, while small holders and large scale farmers derive their main income from crops.

Table 5. East African Zone (northern group of countries) - Population and heads of cattle

Countries	km^2	Population	Beef cattle	Sheep/Goats
Ethiopia	1,222,000	26,000,000	26,000,000	43,000,000
Somalia	637,000	3,000,000	1,500,000	9,000,000
Kenya	583,000	10,000,000	9,000,000	4,000,000
Uganda	236,000	8,000,000	3,700,000	11,000,000
Tanzania	939,000	13,000,000	530,000	1,100,000
Rwanda	26,000	4,000,000	700,000	1,300,000
Burundi	28,000	4,000,000	700,000	1,400,000
Total	3,671,000	68,000,000	42.130,000	70,800,000

[illegible] East African zone (southern group of countries): Population and heads of cattle

Countries	Land area (km²)	Population	Beef cattle
Zambia	751,000	4,500,000	
Rhodesia	390,000	5,000,000	
Malawi	120,000	4,500,000	
Mozambique	783,000	7,500,000	
Total	2,044,000	21,500,000	6,300,000

Mixed farming systems are practized in some areas, but specialized industrial feeding and finishing systems occur only sporadically.

Some statistic data about human population and heads of cattle of the second group of East African countries is presented on Table 6.

Some areas of these countries, infested by the tse-tse fly, have reduced the number of cattle. More than half of the cattle is reared in Rhodesia, where local African cattle breeders possess two thirds of all livestock, but do not commercialize their animals. On the other hand, Rhodesian industrial feeding systems based on the full utilization of agro-industrial by-products and crop residues are practised by the white population: in the south beef cattle and in the vicinity of Salisbury dairy cattle are reared on large scale farms.

Several slaughterhouses with chilling facilities exist in Kenya, Ethiopia, and Uganda; new slaughtering and chilling units are under construction in some of these countries. Canned meat products are made in Kenya, and this country is making considerable efforts to export meat from disease-free areas.

Table 7 shows the human population and heads of livestock of Madagascar and the neighbouring islands. It can be said that Madagascar is rich in cattle, whilst this is not the case with the neighbouring islands.

To the shown number of animals about 500,000 pigs reared also by Malayan-Polynesian population of Madagascar must be added.

Madagascar has certain slaughtering and meat processing capacities, but they urgently need improvement and extension.

Table 1. East African Zone (Madagascar and neigh-boring islands) - Population and heads of cattle

Countries	km²	Population	Beef cattle	Sheep/Goats
Madagascar	592,000	7,000,000		
Comores	2,230	250,000		
Reunion	2,500	500,000		
Ile Maurice	1,850	850,000		
Total	598,580	8,600,000	10,000,000	900,000

e) Livestock and meat industry in the south of Africa :

Bleak deserts, high grasslands, fertile co· sts - the southern part of Africa is a region of contrasts and conflicts.

In the major part of this zone the climate is suitable for European cattle. Table 8 shows human population and heads of cattle of the individual countries.

The preponderant majority of the livestock is found in the South African Republic. A significant increase in meat production occurred in the past 15 years without increasing the number of cattle. Better breeding and intensive finishing have contributed to reaching an optimum slaughter weight at a lower age. Improved animal health, better husbandry, and the breeding of animals with the necessary genetic potential for good performance are the important characteristics of today's South African livestock production.

From the 46 million South African sheep about 40 million are of merino breed; the hogs amount to over 1 400 000 heads.

Contrary to the high production livestock herd belonging to white African-European settlers, the methods of stock raising practised by the indigenous people are usually primitive; some groups of African people have very limited livestock herds. Bushmen in Namibia and Botswana still live either from hunting antelopes and other wild animals, including snakes, lizards, or they are farming. Some Zulus also still tend their cattle in the coastal south African plains, but many live and work in cities and mines.

A modern meat processing industry is developing in the South African Republic.

Table 8: South African Zone - Population and heads of cattle

Countries	km²	Population	Beef cattle	Sheep/Goats
South African Republic	1,220,000	19,000,000		
Namibia	824,000	500,000		
Botswana	570,000	650,000		
Lesotho	30,000	850,000		
N'Gwana	17,300	400,000		
Total	2,661,300	21,500,000	15,000,000	46,000,000

II. DEVELOPMENT OF THE ANIMAL AND MEAT INDUSTRY

There are two ways of improving the meat supply in Africa: A. By increasing the total number and improving the output of animals, and B. By better utilization of the existing livestock.

A. Increasing the total number and improving the output of animals

Although this is possible, it may be difficult to realize it in practice. Some important prerequisites require to be fulfilled, like improved animal health, better husbandry, and better breeding of animals with the necessary genetic potential, or an improvement of the local conditions.

Animal health: Although losses from animal diseases have been drastically reduced during the last few decades by means of intensive animal health measures, even now disease losses are still estimated to account for about 15 percent of the cost of production. In addition, the tse-tse fly which transmits trypanosomiasis, renders immense areas of Africa virtually unusable for cattle raising, although important feeding possibilities exist there; the eradication of this disease would almost result in a doubling of the present heads of cattle (Jasiorowski, 1972). The presence of foot-and-mouth disease and rinderpest in parts of Africa precludes or seriously limits the export of meat from this continent. Incalculable losses are also caused by parasitism and infertility.

Husbandry system: All systems of slaughter animal production exist in Africa, but extensive systems are absolutely predominant. The objectives of African cattle husbandry vary gradually from the traditional emphasis on number (Mauritania, Chad, Sudan, Ethiopia...) to higher production levels per animal (Kenya, South Africa...).

Pastoral, transhuman, semi-nomadic or nomadic animal husbandry systems are a dominating form of livestock breeding in major parts of the African continent, particularly in its vast arid and semi-arid areas.

[illegible] Africa, often in [illegible] and Eastern Africa, [illegible] to the main to the southern part of the continent, where only [illegible] stock raising is increasingly being practised.

Modern [illegible] and finishing of cattle is prevalent, is restricted primarily to [illegible] areas, the Guinean and equatorial areas (Brazzaville, [illegible], and the limited areas in Kenya, Rhodesia, and South Africa. However, completely confined stock raising, with the finishing taken care of by the owners themselves, is still [illegible] an exceptional way of livestock breeding in Africa. A significant specialized growing and finishing livestock industry does not exist.

The pattern [illegible] system of livestock breeding, combined with confined stock raising, will be dominant in Africa for a long time to come. Of course, with improving management and feeding conditions the production may be expected to increase.

Once land becomes short, and when better technical knowledge has been accumulated, more intensive production systems and better breeds will be introduced on a broad scale.

In Africa there are still areas where ruminant production does not exist but could be introduced, provided that the expansion and development of the infrastructure in the form of a network of roads, provision of water, etc., simultaneously occurs. On the contrary, in many regions the traditional pasture lands are poor and already overexploited, and an increase of the beef production with the present systems is no longer possible.

Genetic improvement. In spite of the many efforts to introduce better slaughter animal breeds in various African countries, the genetic improvement of the African livestock has generally not been very successful, although there have been notable exceptions. It can be assumed, however, that genetic progress plays a comparatively minor role in the overall improvement of the African livestock industry.

The major part of the African continent is inimical to cattle originating from temperate zones, while the native cattle do not yield much milk and meat. However, some types of the indigenous African zebu, like the Peul zebu or the Gebra in West Africa, or Boran zebu in North Kenya and South Ethiopia, may show relatively good meat production performances, if they are fed better in more convenient circumstances. The Renitele breed from Madagascar, the Ankole cattle of Central Africa, as well as the n'dama from Casamance, are well adapted to local conditions and may easily increase their yields, if more respect was paid to their feeding requirements.

In principle, zebu cattle may be preferred for pure breeding in arid areas and for crossbreeding with European breeds in semiarid areas. Trypanotolerant taurine breeds are the only solution for tse-tse infested areas. Dual-purpose beef/dairy zebu, and in particular the improved zebu breeds, can be recommended for many low-potential areas in Kenya, Ethiopia, Zambia.... Finally, commercial crossbreeds with European cattle may be advantageous in high-potential and climatically more moderate areas.

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The development of the sheep industry in Africa depends on the methodical improvement of the whole ecological and husbandry systems, based on the rational migratory use of grazing lands and on balancing the animal nutritional requirements with supplementary feeding.

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The future African ruminant production is unlikely to meet the expected demand because ruminants have strong biological restraints for a rapid increase, and a large portion of the meat supply will therefore have to come from poultry and pigs (for non-Muslims). The poultry and pigs grow quickly, are economical food converters and have a high production rate.

[illegible] and improved particularly as an important part of the [illegible] important ways of improving poultry production in Africa [illegible] reduction in the form of small or large [illegible] production with improved stock and good [illegible] poultry producers and combined poultry and egg producers.

b. Better utilization of the present livestock (development of the meat processing industry)

A highly efficient meat production can be achieved not only through the implementation of intensive livestock growing and fattening schemes, but also through simultaneous development and improvement of the meat processing industry. In other words, the livestock production in Africa has relatively great potential in narrowing the increasing gap between meat supply and demand only if the appropriate methods of meat handling, preservation and processing are developed and applied. Economic circumstances are now much more favourable for their development, taking into account the growing world shortage in meat and the progressive increase in market prices.

In Africa, where under present livestock producing systems meat output is low from carcass weight achieved when cattle are 3 years or older and the meat itself often a by-product, the full and economically justifiable utilization of animals and their carcasses is of primary importance. In pastoral, transhumant, and (semi-)nomadic systems of livestock breeding, production costs are generally low, but the animals stay in optimum conditions only 3 to 4 months of the year, following the end of the rain season. This fact postulates the presence of good meat preserving and processing techniques in order to ensure regular meat supply around the year. Due to the strong interdependency between the livestock production and meat consumption, it is also of great importance to establish adequate marketing channels for meat and by-products.

However, today it can be said that the slaughtering and dressing techniques in municipal slaughterhouses not only in rural committees and small towns but also in the big cities throughout Africa are still carried out under very poor conditions. Inadequate water sup-

ply and sewage disposal systems [illegible] lack of refrigeration, as well as the careless and faulty handling [illegible] in the often humid and always hot tropical milieu results in a heavy contamination of the meat, reducing its keeping and eating qualities considerably. The low standard of the meat markets, meat retailers and processors, contribute to the gravity of the problem.

More modern industrial or semi-industrial slaughtering plants, sometimes with by-products rendering and meat processing facilities, have been constructed besides the municipal slaughterhouses in many African countries during the last 1 or 2 decades. Some of these industrial plants are in full operation and their production continues to be prosperous and increasing; however, some of these newly constructed, modern slaughterhouses are still insufficiently used and some others are completely unutilized. The common problem with all these industrial units is the lack of qualified staff at all levels.

A series of activities is necessary to develop or improve the preserving, processing, and marketing of meat in Africa. The basic prerequisite is the creation of an adequate slaughtering system, corresponding to the types and the quality of livestock produced.

It is obvious that the new African slaughtering systems should be composed of at least two types of slaughterhouses: a) Small public or private slaughterhouses, and b) industrial large scale slaughtering and by-products rendering plants with or without meat processing facilities.

In order to move the surplus meat production from isolated areas to highly populated cities, the slaughtering plants would also have to be developed in major cattle producing districts and the meat then transported chilled or frozen. Where applicable, the boning and chilling of meat allows much more flexibility in the use of the carcass, particularly from the viewpoint of transport costs, handling facilities, etc. The prepacking of the selected cuts of chilled or frozen meat is a good example of this type of development.

[illegible] the building of slaughterhouses and meat packing plants it is necessary to contribute to the organization of the meat processing [illegible]. At least parts where the meat production is still predominantly seasonal. Therefore it could prove advantageous to have livestock producers financially involved in the meat processing industry. The better utilization of [illegible] will the [illegible] their own direct advantage. The integration of the meat processing industry with the livestock production is a new worldwide common pattern. The liaison of livestock producing and the meat processing industry should be supported by international organizations, governments, etc. Some kind of grouping of the small meat producers and processors may bring important advantages, especially to ensure cheaper meat supplies, better veterinary services, and the like.

Meat preserving methods: The preservation of meat in Africa involves some specific problems which differ to a large extent from those encountered in the temperate zones. Meat in Africa, being less rich in fat, contains larger amounts of water and may therefore have a lower keeping quality. The prevalent methods of pre-slaughter treatment of animals, slaughtering and dressing techniques, as well as post-abattoir handling of meat in Africa, give rise to abundant contamination and rapid growth of bacteria in meat and reduces its shelflife.

No generalization can be made which could serve as a reliable guide in the selection of methods of meat preservation. The chosen method must be based on local needs and conditions, after careful weighing of the many variables involved.

In Africa, the traditional preference is for freshly slaughtered meat, but the introduction of chilling should present no difficulties if it is accompanied by a series of measures facilitating its application.

Freezing is a common and convenient method of meat preservation which gives satisfactory storage stability and can be used in Africa.

In principle, meat refrigeration facilities should be associated with slaughterhouses situated in livestock production zones. Today, the refrigerated transport of carcasses and meat rather than the transport of cattle on foot to the main marketing centres is on the increase.

Dried meats already form an important part of the diet in many African regions. Although the conventional meat drying methods used in Africa do not quite fit into modern meat industry programmes, they will continue to be of great economical and nutritional importance. For example, Ethiopian dried beef or quanta, biltong dried meat popular in South Africa, and sun-dried meats from some other regions, are known as very good products accepted also in areas other than those of its origin.

Meat curing and smoking techniques, although still not sufficiently used, are also increasingly applied in Africa.

Canned meat production already exists in many African countries.

Meat products in Africa: Industrial meat processing is not developed in Africa. There are many reasons for this: Consumer preference for warm-fresh meat, the predilection of Moslems for beef, backyard livestock production, etc.

Generally, the majority of local African attempts in modern meat processing have not proved very successful. For example, the production of corned beef in Ghana, or the manufacturing of canned beef in Senegal, and the processing of meat in some other African countries, had to be abandoned. The production of various sausages (all beef or not), dried, cured or smoked meats, is also very limited due to various factors. Only rather exceptional meat processing, particularly canned meat production, exists, for instance, in Kenya, Sudan, South Africa.

On the other hand there are many varieties of imported processed meats on nearly all African markets, but these products - usually very high-priced and not of a high quality -

are reserved mostly for consumption by foreigners and higher income African groups.

There are, however, numerous and popular meat products made and locally commercialized in all African countries. These products include first of all various types of grilled meats. The most popular West African cooked meat product is "dibi" - a kind of local meat specialty in Mauritania, Senegal, Gambia, Mali..., produced by numerous, usually street dibi confectioners in cities or villages; the meat for dibi-making is cut into 2 - 3 cm pieces, heavily spiced, and cooked according to individual preferences and skilfulness of the producer, and sometimes on a skewer. Another product, "banta" (= stick spiced meat, dipped in a special flower sauce and grilled on wooden sticks over a charcoal fire, is known not only in West Africa but also in major parts of Central and Equatorial Africa (Niger, Nigeria, Chad, Cameron, Gabon, Congo, etc.). Different types of grilled and fried meats, initially made only by the nomadic Mauri, are today widely accepted in North, West, Central, and Equatorial Africa. Similar much consumed products are found in Somalia, Sudan, and other East African countries.

Special types of meat products made throughout Africa are various soups, stews, and sauces, sometimes containing some vegetables. The soups are particularly popular in Ghana, Upper Volta, the Ivory Coast, Nigeria, and also in other equatorial countries. The sauces and stews (for example, sauce-mafé, a finely spiced peanut sauce extremely popular in Senegal, Mauritania, Mali, Gambia, Guiné-Bissau, etc.) exist in all possible varieties and are principal home and restaurant dishes in many African countries; it should be noted that the African cuisine is extremely rich in this type of meals, and there is little doubt that the extreme skill of the African housewives in their preparations resulting in attractive flavours and aspects is the main reason why many Africans reject more economical but less tasty modern meat products.

Game meat (in some African English speaking countries known as "bush-meat") contributes substantially to the meat supply in major parts of Africa.

While in some countries the meat from almost any wild animal may be eaten, including antelopes, grass cutters, monkeys, monitor lizards, giant rats, porcupines, squirrels, crocodiles, snakes, etc., in other countries only meat derived from selected animal species are used for human consumption. In each region, of course, some kind of preferred meat exists, but customs vary extremely with the people. For example, in Ghana, Upper Volta, Dahomey, the meat of the grass cutter (belonging to the porcupine group of rodents and weighing up to 16 pounds) is usually considered as superb; the meat of the giant rat and the snail is also found to be very good by some people; often the monkey meat is preferred for making soups, and the meat of the antelopes is not only a stew meat but is also sometimes roasted or fried. Only in exceptional cases some meats from wild animals are dried.

Some aspects of the use of modern meat processing methods: It is wellknown that meat quality, being determined by a large number of interdependent intrinsic and extrinsic factors such as breed, conditions and nutrition, age, exercise, pre-slaughter treatment, slaughtering conditions and milieu, and, finally, methods of handling, preserving and processing, may be quite different in various regions. The diversity of livestock in Africa and the particular conditions of rearing it, are without doubt reflected in the quality of the meat produced. Generally it is assumed that the beef in the tropics contains higher amounts of protein, water and other non-fat constituents and therefore appears to have higher water-binding and emulsifying capacities and a more "meaty" taste; such meat loses more juice if boiled or fried. Also the structure, firmness, and colour of the lean meat and the distribution of both lean meat and fat cannot be identical in beef derived from animals reared in the tropics and from those grown in temperate regions.

The major problem with the efficient utilization of meat in Africa is the lack of understanding as to how to utilize such properties and how to adopt and develop suitable methods for cooking and processing. Adequate techniques of cooking and processing the African beef would reduce the effect of unfavourable factors related to its toughness and would bring out its full "meaty" flavour and attractive colour. It means that the development of the African meat processing industry also needs investigation and research efforts.

The existing European processing techniques should be verified and adapted to local African conditions. Sometimes wellknown and generally accepted meat products formulations are uneconomic or even absurd in African conditions. For example, it is known that producers of canned beef in Kenya or some other African country very often do not have enough fat to meet the minimum requirements of their canning lines, thus the manufacturing of products from African beef carcasses according to European standards requires completely new formulations and consequently new processing techniques, based on other economic principles.

In the production of different sausages and cured meats the technological problems may be more complex. The use of beef fat in meat processing, the industrial production of locally popular products, the labour problems, and the problem of production costs are often very specific and need continuous research and investigation.

III. AFRICA's MEAT PRODUCTION AND CONSUMPTION OF TOMORROW

The Africa of today continues its dynamic development. Although in old African towns and villages children still play in littered streets, Africa as a whole is experiencing a new modern cities building boom in which the traditional African dynamism is the life-blood of modern progress and development.

Urban growth and industrialization is transforming Africa again as it had been transformed so many times in its history ! Africa and Africans are changing in their own way, profoundly and dynamically, but not opposing their religions and traditions. A rapid evolution in their nutrition and food habits, accompanied by an increased consumption of meat, has become clearly evident in the past few decades.

The rapid increase of the population and rising income expectations in the majority of African countries call for a further expansion of the livestock and the meat industry.

Africa remains a dynamic, ever-changing continent ! Ex Africa semper aliquid novi ! In the time of Pliny the Elder and today !

I. THE SAUSAGE BUSINESS IN GENERAL

The sausage manufacture is usually the largest part of the meat industry. As a rule, a country with a developed meat industry always has an important sausage production. Sausage and other small goods industries contribute markedly to better nutrition and may increase profits both of butchers and animal producers.

Sausage manufacturing can be operated as an independent business or as part of an industrial slaughterhouse or a meat processing plant. The equipment required for sausage production depends upon the volume and the variety of the products. However, a standard minimum layout always includes a mincer, a cutter and a stuffer, with additional equipment such as tables, cooking tanks, smokehouses, ice crushers, meat and fat slicers, trucks, scales, and other accessories.

The choice of efficient and inexpensive equipment is an objective of primary importance for the good functioning of a sausage manufacturing plant. From UNIPROJECT's many years of experience we can confirm that an expensive and technically very sophisticated machine will not necessarily contribute to high-quality and economically justified production.

A. Perspectives of the sausage industry in Africa

In all regions of Africa there are more or less numerous small meat traders engaged in some kind of smallgoods preparation who usually are not conversant with the methods which should be employed in order to have a safe, economical, and complete sausage production. It is a fact that the sausage trade in Africa has suffered from an inferiority complex, but the African public is not increasingly recognizing sausages as an important item of the diet which can provide an appetizing, calorie and protein rich food.

If the consumer preference, marketing conditions, and relative costs of sausage ingredients have a direct influence on quality and quantity of the sausage production, then it seems that the major part of the African continent may become an important potential area of the sausage industry. Of course, racial and religious groups may wield a direct and significant influence in this regard. A high degree of local variations in both manner of spicing and the types of sausages should be broadly tolerated. For example, some areas of the African continent, particularly West Africa, will favour highly spiced, "hot" products. Similarly, important sections of the continent will demand grilled sausages, while the consumers in other regions may generally prefer the kinds of meats for sausages typical of the region from which they sprang. In general, Africa may provide a sound market for all types of smallgoods.

B. African meats for sausage production

In principle, sausages can be made from the flesh of all mammals, birds, water animals, etc. But a multiplicity of sausage products may be developed only if a comprehensive understanding of the properties of the meat used in their preparation is available. Therefore, the first essential of a well founded knowledge of the sausage business is an adequate understanding of meat quality. The self-evident need for the determination of meat quality applies also to wild animals in which Africa is especially rich. Consequently, the scarcity of knowledge of the real quality of African meats may for a long time act as an obstacle for the development of a competent sausage industry.

There is no doubt that humid and/or dry tropical and subtropical climate influences the quality of meat derived from animals reared in such regions. In general, meat in the tropics, being less rich in fat, contains relatively higher amounts of protein and water. Reduced intramuscular fat is more saturated; a large proportion of stearic acid, although palmitic acid content is still high, probably contributes to the particular "grainy" consistence and "tallowy" flavour of African ruminant fat. However, the general quality of African zebu beef as well as other African meats is good and as nutritional as all other meats in Europe or America and with some additional favourable properties.

... next problem is the lack of understanding as to how to utilize such properties and ... modern cutting methods for cooking and processing. It is obvious that adequate ... preparation and suitable processing of African meats would reduce the effect of un... factors related to their toughness and to the quality and quantity of their ... and would bring to the fore their full "meaty" flavour, attractive colour and usu... very good technological properties. The most promising techniques in this respect ... obviously those used in the sausage production.

Sausage products should be developed according to some quality yardsticks and value criteria, taking into consideration discrepancies in Africa's very diverse domestic and wild animal populations as well as the changing requirements and interests of developing a meat industry, animal rearers and consumers. Particularly the latter have their special requirements in meat consumption, which differ in rural, urban and coastal areas according to the climatic zones, customs and religions, social groups, cooking techniques used, etc.

Generally it can be stated that the development of sausage and meat processing industries in Africa needs urgent investigation and adequate research efforts in order to develop the necessary methods and techniques.

C. Which types of sausages may be produced in Africa?

Sausages which can be produced and consumed in Africa may be considered under three main groups, though there may, of course, be some overlapping between these groups.

Although the percentage of the different kinds of meat used in individual sausage formulations may vary from time to time because of fluctuations in supplies and relative costs, all sausage products should be clearly characterized by fundamentals of manufacture and essential properties of the finished products.

a) Fresh sausages:

These are very perishable products, and speed in manufacturing and distribution is essential. This kind of sausage must always be kept under refrigeration and should be heat-treated before eating.

Meat of all young animals or selected cuts of meat of medium-aged animals may serve as main ingredients in manufacturing this type of sausages. In the case of pure beef sausages the use of zebu hump fat could be highly advisable.

In North-West Africa merguez - a pure beef or mutton sausage for frying or barbecuing - enjoys considerable popularity. Similar sausage products prevail in some other regions.

Some of the varieties of fresh sausages which could be industrially produced, particularly in big cities and in urban areas in general, include primarily finely comminuted fresh sausages of "Bratwurst" or "Bockwurst" types, made from the meat of various domestic and wild animals.

b) Cooked sausages:

Cooked sausages are made from fresh meats and then cooked (and/or smoked). Examples of cooked sausages imported but also already produced in Africa are some types of frankfurters, sometimes also termed "Wieners".

The production of all beef and other meat frankfurters may have good prospects in Africa. The excellent processing quality of African beef with its high water binding and emulsifying properties and the availability of fresh-warm meat are important advantages for the development of locally accepted formulations and techniques in the production of these types of sausages. The problem arising with the use of beef and other non-pork fats in cooked sausage production can be successfully overcome, as it has been shown by the experience of the Institute de Technologie Alimentaire, Dakar, Senegal, and by the Food Research and Technology Development Centre, Serdang, Malaysia.

Other cooked sausages (smoked or not) which can be produced on a large scale in Africa are those of mortadella or bologna type, then liver sausages, blood sausages, various ready-to-serve specialties, meat cheeses, luncheon meats, meat loaves, mince rolls, jellied meats, etc.

c) Dry sausages

Dry sausages are made mainly from cured meats and processed by smoking and air drying or only by air drying. Dry sausages are ready-to-eat and will keep indefinitely if stored under certain conditions.

Although dry sausages are usually considered as pork products, they can be successfully manufactured from beef, mutton, or wild animal meats.

The types of dry sausages which can hopefully be produced in many African countries include many varieties of small-diameter salami, then fermented cervelats, and dry chorizo-type products. Similar highly seasoned dry meat products already enjoy great popularity in some areas of Africa.

Africa can easily become a continent of dry sausages ! A variety of meats, including game and particularly firm-structured meats of large and small African ruminants, as well as a real abundance of fresh and inexpensive flavouring and spicing matters, allow the production of a large number of products able to suit virtually every taste. The only prerequisite is the necessary skill in a highly technical and carefully controlled process.

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