R2119 (S)

REPORT ON A VISIT TO TANZANIA, MALAWI AND NAMIBIA TO IDENTIFY POSSIBILITIES FOR THE APPLICATION OF THE TECHNOLOGIES OF HOT BONING, ELECTRICAL STIMULATION AND PLATE FREEZING TO LOCAL MEAT PRODUCTION

D Silverside and M Pritchard

7 - 20 November 1993

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Appendix

Abbreviations

Admarc	Agricultural Development and Marketing Corporation
ADF	African Development Fund
cdw	Cold Dressed Weight
cif	Carriage Insurance and Freight
CSC	Cold Storage Company/Commission
DSM	Dar es Salaam
EC	European Community
ERP	Economic Recovery Programme
ES	Electrical Stimulation
EU	European Union
FAO	Food and Agriculture Organisation (of the United Nations)
fob	Freight on Board
GDP	Gross Domestic Product
GNP	Gross National Product
GON	Government of Namibia
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
HSL	Happy Sausages Limited
IFAD	International Fund for Agricultural Development
KMSL	Kizinga Meat Supplies Limited
LDC	Less Developed Country
LPQP	Livestock Products; Quality and Processing
MALDC	Ministry of Agriculture, Livestock Development and Cooperatives
MDB	Marketing Development Bureau
MDC	Malawi Development Corporation
NARCO	National Ranching company
NCA	Northern Communal Area
NCCO	National Cold Chain Operation
NRI	Natural Resources Institute
ODA	Overseas Development Administration
PTA	Preferential Trade Area
PTC	Peoples Trading Centre
RAS	Republic of South Africa
RLDO	Regional Livestock Development Office/r
RNRRS	Renewable Natural Resources Research Strategy
RRA	Rapid Rural Appraisal
SADC	Southern Africa Development Community
SARDEP	Southern African Rural Development Programme
SIDA	Swedish International Development Agency
TPL	Tanganyika Packers Ltd
VCF	Veterinary Cordon Fence

Executive Summary

Purpose of Mission

1 The project entitled "Development of methods of reduction of the energy required to conserve meat without compromising its quality" in the Livestock Production Programme investigates a collection of established technologies put together in a way which will address the issues of energy savings and improved meat quality, distribution and marketing during meat processing. Essentially, the process involves the hot boning of freshly slaughtered carcases, electrical stimulation of the meat, perhaps under pressure, followed by plate freezing. The squared-off packs of meat will stack efficiently and maintain a freezing temperature over a considerable period, obviating the need for refrigerated transport.

2 For the technology to be transferred successfully to the tropics and be cost effective, the process should be sited in rural abattoirs supplied with sufficient stock of appropriate quality. The abattoir must have suitable facilities and be adequately serviced. The marketing infrastructure, including roads, transport, cold storage, wholesale markets, retail shops etc needs to be in place or established. Importantly, there must be consumer demand for the product. Initially, the experimental process described above needs to be adapted to the tropics and then to local conditions.

3 With a view to the transfer of the technology from the laboratory to the factory, the technical and marketing aspects of the project, as described above, were assessed during a visit to Tanzania, Malawi and Namibia.

4 The visit also presented an opportunity to identify other research problems associated with meat handling and which could be addressed within the resources of the Natural Resources Institute (NRI).

5 Terms of Reference for the visit are given in Appendix 1.

6 The mission was carried out by David Silverside of the Livestock Section and Mike Pritchard of the Marketing Research Systems Section of NRI between 7 and 20 November 1993.

Tanzania (paras 44 - 80)

7 The extremely low investment in the slaughter livestock and meat industries in Tanzania over the last 20 years has resulted in a base comprising the simplest of facilities at the lowest level of hygienic production. Not only are there almost no slaughter facilities in the country but also the infrastructure for the distribution of frozen products is practically non-existent. That the facilities once existed for the distribution of frozen products indicates that a market once existed. This market can no longer be exploited as consumers are now accustomed to fresh meat.

8 With the change in government policies, the livestock and meat industries of Tanzania are clearly on course for increased development. Stock are coming off the land at an increased rate and slaughter in the major cattle deficient area, Dar es Salaam, is also increasing.

9 Increased production of wholesome meat is being addressed through the African Development Fund (ADF) project which is looking to construction and rehabilitation of livestock markets and stock routes, the supply of essential veterinary inputs, the repair and restoration of railway cattle wagons, construction of a modern abattoir in Dodoma, vocational training for meat industry workers, construction of a small scale training slaughter facility and overseas training and technical assistance.

10 From an examination of the plans, the abattoir planned for Dodoma could be used to conduct research into hot boning and plate freezing and the product marketed through the channels which will be set up as part of the ADF project. However, the opportunities to conduct this research will depend on discussions with the consultants who will carry out the work (yet to be decided) and on completion of the project. This may not be until the year 1997.

11 In addition to the construction of the new abattoir in Dodoma there are two other parties interested in construction of new abattoirs. Kizinga Meat Supplies Ltd has funding and are about to start construction in Dar es Salaam (DSM) in December 1993 with a view to production in 1995. Kipunguni Enterprises is at a preparatory phase but could be ready to produce wholesome meat in Morogoro in 2 years.

12 All the appropriate private enterprises associated with the meat trade are planning to export meat in the short term. The Marketing Development Bureau of the Ministry of Agriculture, Livestock Development and Cooperatives encourages this as it sees this process as a development of the livestock industry. The chosen markets are for chilled quality meat rather than frozen.

13 Apart from the facilities at Happy Sausage in Arusha, there are currently no facilities whatsoever to conduct any meaningful scientific work in the commodity. Hopes were once raised for a rehabilitation of the Tanganyika Packers Ltd meat packing plant at Kawe, DSM, but this organisation is now considered closed.

14 Plans can not be made for the successful development and transfer of meat freezing technologies in Tanzania for the domestic markets for the next five years. Once the new abattoirs are up and running and an export market has been developed, it is predicted that the production of frozen blocks of meat will be required. The technology may be needed between 1995 and 2000.

> ACTION: D Silverside to review the meat production situation by writing to the Ministry of Agriculture on an annual basis.

15 Suggestions for further research in the sector include the modification of existing biogas technology to the Tanzanian situation to generate power to operate essential systems in the abattoir eg hot water. Interruptions to Tanzanian electrical supply are a severe constraint on any commercial, manufacturing and industrial development in the country. Secondly, effluent treatment is not taken into consideration in the few abattoir projects in preparation and should be given higher profile. Research into very simple effluent systems could be examined for Tanzania and other projects in the region.

ACTION: D Silverside to prepare concept notes for submission to the manager of the Forestry Products Programme about the possibility of development of biogas generators and simple effluent treatment plants for selected abattoir projects in Tanzania.

16 It will not be possible to monitor the development of the meat industry or guide its development in any meaningful way without some basic data on the structure of the industry, consumer preferences and consumption patterns and meat prices. This capability should ideally be integrated with the existing market information gathering undertaken by the existing Marketing Development Bureau.

ACTION: M Pritchard to prepare a concept note for circulation to Mr Jim Crees and the MDB for them to consider funding sources.

Malawi (paras 80 - 108)

17 The shortage of slaughter stock in Malawi has led to prices of meat which are outside the range of the vast majority of the population. There is therefore a shortage of meat which means that there is no excess for export. Informal restrictions and monosonies mean that supply shortages cannot be overcome by imports from neighbouring countries. Fish is consumed in greater quantities than meat. However, the yield of fish from the lake is diminishing and there is to be a shortfall of protein in the future. This may be made up by production of legumes such as soya and other beans.

18 Attempts to produce more slaughter stock in feedlots and by stall feeding have been marginally successful. Nevertheless, recent government policy is set to encourage increased feedlot production and some of the government ranches are being sold to private entrepreneurs. As Malawi is densely populated and much of its land under cash crops like tobacco, tea and sugar or food crops like maize, there is little land to be put to pasture or grow feed for seriously increased livestock production. Crop by-products are already in efficient use. Malawi may never be truly self-sufficient in meat.

19 Meat is produced at the Cold Storage Company (CSC) abattoirs in Lilongwe and Blantyre. These plants may soon be replaced with smaller, more efficient units. The production of frozen meat is not considered a priority.

20 Frozen meat, although not preferred, would retail if the price was realistic and the quality not impaired. All meat produced in Blantyre or Lilongwe however, could be carried throughout the length and breadth of Malawi as chilled carcases within 12 hours eliminating the need for freezing as an aid to improved distribution.

21 Simple facilities to conduct research exist at the abattoir belonging to the CSC in Lilongwe in the pork processing room. Considerable adaptation would be needed however, if they are to be used for work other than general studies. Facilities at the planned new abattoirs would perhaps offer better opportunities for research. Laboratory facilities to accompany research conducted at CSC are possible at the Central Veterinary Laboratory situated next door.

22 Suggestions for further research are based on the production of biltong as a means of using excess meat produced in the informal sector. It was agreed that Dr Phoya of Bunda College would look into the situation in the villages while NRI would consider the production technologies and marketing aspects of the product.

> ACTION: D Silverside to write to Dr Phoya of Bunda College to enquire of progress regarding meat production and its possible wastage in villages.

Namibia (paras 109 - 162)

23 The meat industry of Namibia is characterised by a well developed infrastructure for farmers south of the Veterinary Cordon Fence (VCF) and assured markets for all types of meat, although there are temporary difficulties in marketing canned meat. The infrastructure and marketing arrangements at Meatco, the monopoly organisation established by government to slaughter livestock and process meat, are well advanced and future developments determined to a high level. As a consequence, the organisation is unlikely to consider using results from the project under development at NRI regarding the production of plate frozen meat from hot boned carcases.

24 The infrastructure north of the VCF is less developed than to the south for both production and marketing of meat. This problem is being addressed through the provision of livestock markets, feedlots, abattoirs and meat processing facilities by Meatco. Meatco will also provide a extension service limited to marketing and fattening of livestock. Markets have been opened up in South Africa for meat from the area. The abattoirs at Oshakati and Katima Mulilo are undergoing refurbishment and this will include facilities and plant for plate freezing. Hot boning and electrical stimulation (ES) of carcases at these abattoirs are under active consideration by Meatco.

25 The methods of ES of beef carcases in the EU approved abattoirs are based on reactions in prime commercial stock which have been established by the Meat Research workers South Africa. Similar methods used with communal stock are said to be not so effective and are as likely to lead to problems as solve them.

26 From discussions with the management of Meatco, the chairman of the Mangetti farmers association and observation of the operation, there emerged a clear need to undertake studies into

the electrical stimulation of beef bodies to establish practical operational procedures for communal cattle

dark and dry meat. This was considered a product of poor quality and had to be sold at a discount

excessive hot boning losses, chiller shrink and other quality defects

farming systems as they relate to livestock ownership and disposal and the relationship of the livestock farmers with the national trading organisation and its procurement policies. These studies are needed to increase purchases of stock from Communal farmers north of the VCF.

27 These problems are often found in the formal marketing and slaughter sectors for communal cattle observed throughout southern Africa eg. Zimbabwe, Botswana, Zambia, Kenya. The new infrastructure being established by Meatco and its rôle in marketing extension presents excellent opportunities to conduct research into marketing, fattening, processing and handling of communal livestock. Establishment of a research programme to study ES, hot boning, dark dry meat and chiller shrinkage in Namibia will bring about benefits not only to the communal sector of Namibia but also to other communal farmers within the region.

28 The facilities in Windhoek and Oshakati are suitable for the work each having slaughter facilities and room to conduct experimental work. Laboratories are provided in both factories. The Agricultural laboratory in Windhoek may be used for work which is beyond the scope of the simple facilities provided at the abattoirs. This work is an adaptation of the strategic work conducted by the Livestock section of NRI in Zimbabwe.

> ACTION: D Silverside to draw up a concept note concerning studies in electrical stimulation, hot boning, dark dry meat and chiller shrink and submit to the Livestock Programme Manager for funding consideration.
>
> ACTION: M Pritchard to draw up a concept note concerning socio-economic aspects of livestock ownership and disposal and submit to the EU for consideration

Conclusions

29 Opportunities to conduct research into ES of hot boned meat followed by plate freezing in rural abattoirs for transfer to distant, urban markets are non-existent in Tanzania. The opportunities for the use of such technology will not present themselves for several years to come.

30 Opportunities to conduct research into ES of hot boned meat followed by plate freezing in any abattoir in Malawi are minimal. The scope for use of such technology in the foreseeable future is also minimal.

31 Opportunities to conduct research into ES of hot boned meat followed by plate freezing are excellent in Namibia but the technology is not considered appropriate. Electrical Stimulation of carcases followed by cold boning is the system of choice. Plate freezing is considered inappropriate for quality meat but is already practised for manufacturing beef.

32 Research into electrical stimulation, hot boning, dark, dry meat and chiller shrink of beef of communal origin is recommended to maintain meat quality since present practices are thought to put the product at a disadvantage with other meat competing in the market. Such problems with communal livestock are found throughout southern Africa and a research programme to address them could benefit farmers throughout the region..

Introduction

33 In April 1992, a programme of work started in the Livestock Programme, Livestock Products, Quality and Processing (LPQP) Problem Area, entitled "Development of methods of reduction of the energy required to conserve meat without compromising its quality". Its objectives were to assess energy and production requirements of hot meat processing and conservation procedures; to relate effects of freezing and other procedures on meat quality from lower grade animals; to assess microbiological criteria in small scale meat processing operations and to conduct a Rapid Rural Appraisal (RRA)-type survey of current meat processing practices, constraints to change and market potential in two countries. Any such research will need to have a thorough social and economic analysis to ascertain its relevance to requirements of the livestock industries concerned.

34 There are many tropical countries where large numbers of livestock are transported from their production areas to the towns and cities to be slaughtered, distributed and consumed. The transportation process is expensive not only in itself but also in terms of loss of condition of the animal, mortalities, waste or underuse of by-products and damage to the environment.

35 One possible solution to this problem is to uprate rural slaughter facilities and transport conserved meat to the main consumption areas. Such a system would not only reverse the conditions described above but also bring revenue to the area in which the animals are produced, use the waste products in the rural situation to assist in agricultural production as well as bring about environmental benefits, provide local employment and encourage farmers to produce and sell their livestock on a commercial basis.

36 While chilling is an ideal conservation method for meat, in some situations the product often suffers from circumstances beyond the control of the abattoir in the tropics. For example poor roads, difficulties in passage during the rains, reliability of transport and machinery etc all serve to extend the time taken to get the product to market, leading to failure of the cold chain. One solution is to freeze the meat and transport the material to market in insulated or refrigerated vehicles.

37 Meat is frozen conventionally in two or more stages. The chilling phase allows *rigor mortis* to be resolved and allows a period of conditioning (tenderising) to take place in some species. This is followed by a period of air freezing, blast freezing or plate freezing as blocks held in cardboard cartons. Frozen storage follows. The entire operation is expensive especially as there are several points of heat exchange which are inefficient in the use of energy and where cooled air can escape from the system. Direct freezing from hot meat is technically possible but the quality of the meat suffers. The texture is particularly affected by cold shortening which causes meat toughening. This problem may be resolved through the use of electrical stimulation of the carcases or meat shortly after slaughter. Electrical stimulation causes a change in dimensions of the muscle and may improve tenderness slightly. The restoration of stimulated poor grade muscles back to their resting length prior to freezing may offer a means of improvement in quality.

38 Research into hot butchery, electrical stimulation and direct freezing of meat was accepted by the Programme Manager and, following peer review by members of the

Programme Advisory committee, work proceeded at NRI. Once the technical work was well underway it became apparent that the RRA-type survey (which constituted part of the project) was inappropriate. It was seen as important, however, to identify possibilities for the application of the technologies being researched in the UK, gauge the potential for uptake of the technology in meat processing industries in less developed countries and identify partners with an interest in the technology, prepared and able to collaborate with NRI for transfer of the technology into an operating area. A visit was made to Tanzania, Malawi and Namibia to undertake a survey of the meat and livestock industries to address these issues.

Approach

39 The three countries visited during this assignment were chosen as representative of meat production and consumption systems at different levels of development.

40 Tanzania is characterised by an industry which has been underfunded for 20 or more years and undergoing rehabilitation. Although there is very little useful infrastructure in place, the potential for development is considerable.

41 Malawi is used as an example of a moderately well organised industry where supply and demand for domestic meat and meat products are balanced. The potential for expansion from local sources is limited but opportunities for importation of meat and its wide distribution could change with the development of its structural adjustment programme.

42 Namibia has a reputation for production and exportation of surpluses of very high quality meat. The uptake of the technology, particularly for regional distribution and scope for continued research is considered a distinct possibility.

43 Visits were made to very many organisations including abattoirs & butcheries and their managing organisations, entrepreneurs, veterinary and agricultural departments of the variously named Ministries of Agriculture and their Departments of Planning etc, Development Departments and Boards, Parastatals associated with the livestock and meat industries, Universities and Agricultural Colleges, British Missions and Development Divisions. A list of persons met is given in Appendix 2. The discussions started with an introduction of the technologies under investigation and a general question inviting reaction to the work. This usually led to discussion of the structure and operation of the livestock and meat industries and where the technology could be accommodated within it. Every reasonable possibility for the introduction of the technology and potential collaboration for continued research was explored. Opinions concerning the need/feasibility etc of the project varied from person to person, (sometimes from "your project is not feasible here" to "what you propose is exactly what this country needs") and country to country.

44 Reports and tabulated data were collected, read and assimilated. Finally, the team discussed the project fully and drew up the conclusions given in this report.

Tanzania

Introduction to country

45 A great deal has been written about the livestock and meat industries of Tanzania, and a suitable general reference would be the African Development Fund Livestock Marketing Project Appraisal Report of December 1991. Lionel Colby* summarised this information and the following is based on his report.

46 Tanzania lies on the coast of East Africa and has an area of 945,000 km^2. It borders Kenya, Uganda, Zaire, Rwanda, Burundi, Mozambique, Malawi and Zambia. The current population is about 28 million inhabitants with a population increase of 3.1% *per annum*. The average *per capita* income is about $120/year, one of the lowest in the world. Agriculture is very important and occupies about 80% of the population and accounts for 56% of GDP. Ancillary livestock activities engage about five per cent of the population and this includes meat retailing, processing, hides, leather etc.

47 The economy of Tanzania declined from the mid 1960s until 1986 when the Economic Recovery Programme (ERP) started. One of the main objectives of the ERP is to stimulate production and exports through a realistic and flexible exchange rate policy. This has resulted in considerable devaluation of the Tanzania Shilling from 16.5 = $1.00 in 1985 to TSh 450 in September 1993. Private sector encouragement is also a feature of the ERP. There is now a slow emergence of entrepreneurs willing to undertake procurement, processing and marketing of livestock and their products.

Livestock Marketing

48 Tanzania has the third largest ruminant population in Africa. Cattle are considered the most important class of livestock in Tanzania. Most of the cattle are indigenous breeds such as Short horn Zebu and Ankole breeds. The main cattle surplus producing and consumption deficit regions are (Marketing Development Bureau 1989);

Region	% of surplus
Arusha	27
Shinyanga	23
Singida,	13
Mara	11
Tabora	9
Mwanza	8
Dodoma	8
Mbeya	2

Region	% of deficit
Dar es Salaam	19
Mtwara	12
Kigoma	10
Ruvuma	10
Kagera	9
Lindi	9
Morogoro	9
Coast	7
Tanga	6
Kilimanjaro	5
Iringa	5

Tanzania: Livestock and Meat Export Study, L Colby, January 1994.

49 The major cattle surplus producing areas are in the north and north-west of the country whereas the main consumption and deficit areas are in the coastal and southern part of Tanzania. Consequently, for excess demand to be satisfied in production deficit areas there is a long distance marketing chain. Cattle production is largely made up of smallholders in the pastoral and agro-pastoral sector which is the sector from which the vast majority of Tanzanians make their living. A small percentage of national production, from a herd size of around 65,000 (Colby 1994), is produced by the nationalised National Ranching Company (NARCO). This enterprise accounts for nearly all the improved beef cattle in Tanzania. The livestock numbers on these state ranches have recorded successive annual declines over several years and at present the government is starting to privatise these operations.

50 Inter-regional marketing amounted to some 602,000 head of cattle on 1989 estimates (Marketing Development Bureau, Review of Ruminant Livestock Industry, 1989). This marketing is almost wholly undertaken by the private sector, with the upcountry rural trader the first link in the marketing chain between livestock producer and the urban meat consumer. In competition, traders arrange the purchase of animals, both direct from producers and through primary markets, and consign them to terminal livestock markets for sale to butchers.

51 The transport of livestock is mainly by means of long distance trekking or by rail. Both systems have existed since independence but both have suffered from underinvestment and decline over the last few years. Previously there was a functional transport system which consisted of trekking routes with dipping and boma facilities, which fed into railheads for transport to urban markets. The trekking routes are now in a state of disrepair with little or no services provided *en route*. As the rail system lacks sufficient wagons in good repair, both forms of transport often result in injuries and/or loss of condition in the animals. The unregulated and excessive use of long distance trekking through informal routes, has been estimated at leading to 10-20 per cent weight losses and 7-10 per cent mortality (ADF 1991). The transport of animals to urban markets such as Dar es Salaam, can take four weeks and the transport costs involved can form 80 per cent of total marketing costs (pers. comm Mangetti 1993). Many roads are also in a bad state of repair and the number of animals trucked by this means is minimal.

52 This decline in transport infrastructure is seen as a major constraint to the development of commercial activities. There is a proposed ADF project to rehabilitate certain stock routes and there are other donor funds being used for the upgrading of rail and road links. It is difficult to see how this will have a significant effect on the structural problems that Tanzania's livestock industry is facing as the size of the problem is so large and the funds will only cover minor rehabilitation.

Livestock and Meat Grading

53 Livestock are graded at the Terminal markets including Pugu by the Marketing Development Bureau (MDB). The scheme was devised by the Texas A&M University and modified to suit Tanzanian experience. The cattle grading system is based on conformation and age (based on tail length). Three times/week, MDB officers select a few mobs of cattle

and run them through a race. Every fifth is selected for weighing across a scale and grading. Grades are from 0-4 as follows:

		1992
Grade 0	Tanzania Special	5%
Grade 1	Good condition	31%
Grade 2	Forward store condition	45%
Grade 3	Lean condition	17%
Grade 4	Emaciated condition	2%

54 Formal meat grading is not undertaken. It is assumed that butchers have their own system.

Production, slaughter, consumption

Table 1

Class	Number (million head)	Number Slaughtered (million)	Meat Production (tonnes)	Per capita Consumption kg/year
Cattle	13.22	1.93	199,000	7.15
Goats	9.07	1.91	23,000	0.83
Sheep	3.71	0.85	10,000	0.36
Pigs	0.31	0.23	9,000	0.32
Poultry	25.00		31,000	1.11

Source: FAO Annual Production Yearbook, 1992.

Slaughter

55 Until about 1950, slaughter of stock for domestic use normally took place in consumption areas. In 1950, Tanganyika Packers Ltd (TPL) opened the Kawe packing plant in Dar es Salaam and slaughtered cattle for local consumption as fresh beef and for export as corned beef. Cattle were carried from the production areas to Kawe. In 1974 TPL was nationalised and lost its licence to export to the UK and its marketing agreement with Brooke Bond Liebig. Its financial position deteriorated and the World Bank/SIDA (Swedish International Development Agency) provided finance to rehabilitate Kawe and construct new packing plants at Mbeya and Shinyanga. The concept was for Mbeya and Shinyanga to slaughter and freeze beef and transport the meat to Kawe for canning. Adequate stock routes, markets, and rail transport were available.

56 The Letter of Credit expired in 1976 without being fully used. With the line of foreign exchange effectively cut, civil construction work came to a halt. The temporary abattoir built to service Dar es Salaam during construction of the new abattoir continued to operate but butchers gradually took to slaughtering their stock close to their other business operations. Lack of throughput, interest and investment led to further decline. The TPL operation is now considered closed.

57 At one time livestock production, slaughtering, distribution and sales were all integrated as part of a national supply system. For example, the National Ranching Company, (NARCO) supplied TPL who distributed and sold meat through the National Cold Chain Operation (NCCO). Following the collapse of TPL, NARCO later inherited the state marketing operations from NCCO, which gave it a national cold storage distribution system. This has now all but totally collapsed, with the cold stores visited on this mission having cold rooms that were defunct and which did not look likely to be replaced.

58 Slaughter now takes place mainly at the traditional abattoirs and slaughter slabs located throughout the country. There are approximately 650 of these establishments each requiring total rehabilitation.

59 The only abattoir of high specification slaughtering for a specialist market is situated in Arusha. A description of Happy Sausages Limited (HSL) can be found in Appendix 4.

Meat Sales

60 There is very little wholesaling and individual butchers control most of the retail trade. The products are generally limited to hot cuts of either steak or meat with bones, with very little differentiation into other products. There is a small number of higher income retail outlets that serve expensive restaurants, hotels and the expatriate market segments in Dar es Salaam. There is a small quantity of frozen meat sold in some of these outlets but this is carried out by means of domestic chest freezers, which are used to store any meat not sold on the day of slaughtering. Consumer preference however, is for fresh hot meat and most outlets sell the beef cut direct from the hot carcase and limit their daily turnover so that all their stocks (ie one carcase) are sold.

61 Until the late 1970's the government applied retail price controls but nowadays these are only nominally in force. The fixed retail prices are used as a minimum by the butchers with actual prices some 50 per cent higher than the regulated level in 1991. In general however, it has been observed that meat prices as well as livestock prices have moved in line with inflation and therefore are rising steeply. The existence of a highly nucleated small butcher sector limits price manipulation by any larger retailers, with only a few larger retail outlets able to charge a price premium based on targeting higher income consumers. Generally it was felt that the meat sector was profitable especially if one integrated retailing operations with slaughtering.

62 A survey of butchers and officials connected with the meat retail trade was carried out. A summary of their views regarding operation of their trade is given in Appendix 5.

Direction/prospects of the livestock sector

63 There are a few prospects for development of the slaughter sector. These are based on the African Development Fund Project, Kipungi Enterprises Ltd and Kizinga Meat Supplies Ltd

African Development Fund

64 This project is valued at FUA11.31 million

65 The overall objective is to increase the volume of wholesome meat available for local consumption and for the export market. This will be achieved through revitalisation of livestock marketing, by organisation of an efficient marketing chain for livestock, meat and meat products, through the rehabilitation or construction of essential marketing infrastructure, establishment of a marketing intelligence service and provision of necessary veterinary back-up services.

66 Effectively this will involve

construction and rehabilitation of livestock markets and stock routes,

the supply of essential veterinary inputs

the repair and restoration of railway cattle wagons

construction of a modern abattoir in Dodoma (to be used as a model for other abattoirs in Tanzania)

vocational training for meat industry workers

construction of a small scale training slaughter facility

overseas training and technical assistance

67 The project report indicates that there are several potential markets for Tanzanian chilled and frozen meat. These included bordering countries eg Burundi, Rwanda, Malawi, Mozambique, Zaire and, in the long run, Kenya. The Middle East, Seychelles, Comoros, Reunion, South Africa and Egypt might also provide opportunities for increased meat marketing. Meat for these markets might well be slaughtered in the new Dodoma abattoir and in new abattoirs of which the Dodoma structure would provide a model. The planned initial output of 60 head/day could be increased to meet export demand by double shifts or relatively cheap extension. The appropriate freezing facilities would need to be installed.

68 The Consultants for the project have yet to be chosen. Meat production is planned to start in 1997.

Kipunguni Enterprises Ltd

69 The Director of this company, Capt Mvungi, wishes to build an abattoir at Morogoro to supply the Dar es Salaam market with hot, chilled and eventually frozen carcases. It is planned to slaughter 40 beef animals/day and increase to 125. It is also planned to export not only meat, which will be in cryovac and chilled rather than frozen, but also enter the

European corned beef market. The Director already exports a little beef through using the remaining cargo space on his monthly airline flight to the Gulf. There are difficulties however, as the maximum export weight is three tons/flight and it is difficult to forecast the cargo space likely to be available on the passenger aeroplane.

70 Capt Mvungi was sincere but clearly only at the concept stage of his project. He believed (wrongly) that an abattoir built to European Union (EU) standard was the only major requirement for export to Europe. He said he was to use the Food and Agriculture Organisation (FAO) modular abattoir which he thought would be sufficient to satisfy the EU. He thought a local man could build the abattoir from the plans given in the FAO book. He had not worked out the costings of corned beef manufacture or estimated the likely competition.

71 Capt Mvungi was not over-enthusiastic about providing facilities to conduct research into frozen meat however, as he felt that the present market was for the fresh product.

Kizinga Meat Supplies Ltd

72 Mr Hassan, Director of Kizinga Meat Supplies Ltd, plans to build an abattoir in Dar es Salaam using Tanzania Development Fund funding. The capacity is to slaughter 250 head of cattle for the Dar es Salaam market each day. The plant is to produce hot meat and cryovac chilled for export to the Middle East and neighbouring countries. He has no real interest in frozen meat and thinks there is no market for it except in export markets in Seychelles and the Comoros. Notes regarding his views on the direction of the meat industry in Tanzania and a summary of the Feasibility study which he commissioned for his company is to be found in Appendix 3.

Potential for adaptive research into the application of hot boning, electrical stimulation and plate freezing technologies

73 Tanzania has a very large national herd and considerable potential for development of the livestock and meat industries. Regrettably, the country lacks the necessary infrastructure for processing and marketing of this valuable resource effectively. These issues are being addressed but it will take some time before they are at a level which could be used for adaptation of the technology under development at NRI.

74 At present only the facilities at Happy Sausages Ltd would be of interest to the project although new factories are being planned to produce meat for supply to the large conurbations and export markets. The services to these factories suffer from frequent interruptions and fuel is short. In practice therefore, there are limited opportunities to apply the NRI technologies effectively.

75 A market survey conducted by HSL shows that there is a preference for chilled meat and that the prospects for frozen material are not good. Nevertheless, given the appropriate circumstances, perhaps a market could be developed but this is outside the scope of the present project.

76 Plans can not be made for the successful development and transfer of meat freezing technologies in Tanzania for the domestic markets for the next five years. Once the new

abattoirs are up and running and an export market has been developed, it is predicted that the production of frozen blocks of meat will be required. The technology may be needed between 1995 and 2000.

> ACTION: D Silverside to review the meat production situation by writing to the Ministry of Agriculture on an annual basis.

Further studies and observations

77 It was felt by various members of the industry that many more market research data were needed to encourage the private investment that government wants. Data are required on the size of meat markets, the profits and margins earned by various participants in the sector and the demand for different products and services that at present do not exist. These data should ideally be integrated with the existing market information gathering undertaken by the existing Marketing Development Bureau. Private commercial investors and government policy makers involved in meat sector investment planning admitted to having poor market information. It was thought that market research data could help stimulate investment especially if it could be shown that there was undersupply in the market and attractive profit margins for processors.

> ACTION: M Pritchard to prepare a concept note for circulation to Mr Jim Crees and the MDB for them to consider funding sources.

78 Other suggestions for further research in the sector include the modification of existing biogas technology to the Tanzanian situation to generate power to operate essential systems in the abattoir eg hot water. Interruptions to Tanzanian electrical supply are a severe constraint on any commercial, manufacturing and industrial development in the country. Secondly, effluent treatment is not taken into consideration in many abattoir projects and should be given higher profile. Research into very simple effluent systems could be examined for use in Tanzania and other projects in the region.

> ACTION: D Silverside to prepare concept notes for submission to the manager of the Forestry Products Programme about the possibility of development of biogas generators and simple effluent treatment plants for selected abattoir projects in Tanzania.

Conclusions of the visit to Tanzania

79 Tanzania has many of the assumed criteria relevant to the plate freezing research programme of NRI, ie the long distance transport of live animals involving large weight losses, injuries and mortalities. Slaughter in the production areas and carriage of meat to the consumer would appear to address the problems of livestock losses. However, the lack of any viable institution to take up the proposed technologies, the lack of ancillary services and infrastructure, the supply side problems of the livestock sector and the low income elasticity of the major markets makes the proposed NRI technologies inappropriate to the current situation.

80 Future developments in the meat processing industry might make the proposed technologies more suitable. New abattoir investment is being planned by a number of institutions and plate freezing may be of interest to them, as might be transport in insulated trucks. Most of these plants however, are to be built near urban markets and it is likely, due to consumer preference and the absence of cold rooms, that these will be served by hot carcase meat. Only if long distance trade opens up, either from surplus production areas to the coast or exports to neighbouring countries or further afield would there be any incentive for upgrading to production of plate frozen cuts. None of this is likely in the short or, perhaps medium term.

81 The cost of these technologies must also be considered and the weak domestic demand, especially for prime cuts and quality products, will make plate freezing and electrical stimulation in particular, an unacceptable investment for processors. The possibility of exploiting higher income segments in overseas markets is unlikely until the veterinary and disease problems are overcome. Only the Middle East has any kind of potential and the ability of Tanzanian meat to access this market is indeterminate.

Malawi

Introduction to country

82 Malawi lies in Central Africa and has an area of 11,800km^2. It borders Tanzania, Mozambique and Zambia. The current population is about 10.3 million inhabitants with a population increase of 3.4% *per annum*. The average *per capita* income is about $200/year, one of the lowest in the world. Agriculture is very important and occupies about 73% of the population and accounts for 33% of GDP.

83 In 1988 Malawi found itself in economic difficulties and, on the advice of the IMF, was obliged to reschedule its debts. In January 1988 the kwacha was devalued by 15% and import restrictions reduced. In March of the same year the government published a statement of development policies for the period to 1996, emphasising liberalisation of the domestic economy and trade policy in an attempt to stimulate investment and exports. Targets for import volumes, export earnings, real GDP and budget deficits were exceeded in 1988 and have continued well on target since then. There is now an emergence of entrepreneurs willing to undertake agricultural production and marketing.

84 Malawi is essentially poor in protein. Fish constitutes the major intake but as the lake is becoming overfished and sediments build up, smaller fish are harvested. Protein availability is becoming a real problem for the future. Land based resources for the production of more livestock are limited and it is planned to increase the production of vegetable proteins, mainly as soya. Soya is generally disliked by the population so, although resisted by government, pressures for the importation of protein in the form of meat and poultry are now applied.

Production, slaughter, consumption

Table 2

Class	Number (million head)	Number Slaughtered (million)	Meat Production (tonnes)	Per capita Consumption kg/year
Cattle	0.96	0.09	17,000	1.65
Goats	0.89	0.27	3,000	0.29
Sheep	0.20	0.05	1,000	0.10
Pigs	0.24	0.19	10,000	0.97
Poultry	9.00		9,000	0.87

Source: FAO Annual Production Yearbook, 1992.

Livestock and meat marketing

85 The proportion of households keeping cattle in Malawi stands at around 13% but this figure, like the size of the national cattle herd has been declining since 1986 (Mangisoni 1993)*.

86 Approximately half of the cattle produced in Malawi is from the Central regions with the remainder being shared equally with the Northern and Southern Regions. In the Northern Region production is carried out almost wholly by smallholder agro-pastoralists whereas the Central and Southern Regions have some large scale ranches.

87 The Southern Region also has a small feedlot and stall feeding sector which supplies fattened beef to the Cold Storage Company Ltd (CSC), the meat processing parastal. These feedlots supply 90% of the top grade beef for the CSC and the large scale retail sector. These are transported live by truck to the two CSC abattoirs in Lilongwe and Blantyre which are not any great distance from the production areas and accessible by good roads.

88 The output from the small holders' sector however, is decreasing and this is reflected in rising livestock prices and the difficulty CSC has in the procurement of animals for slaughter. This is put down to previous disease and drought problems reducing the national herd size, population pressure leading to an inability to increase herd sizes and the liberalisation of livestock prices having a negative impact on supply response due to low price elasticities of supply.

89 The Malawian economy has often been characterised as "dualistic" and this is reflected in the system of meat marketing. At least 80 per cent of the national offtake is slaughtered either at the roadside or at small slaughter slabs in market towns. This supplies the vast majority of Malawians with beef. The feedlot sector is integrated with the CSC and the commercial retail sector, represented by two major retailing groups, Kandodo and the People's Trading Centre (PTC). All these operations, although nominally run as independent commercial concerns, are interlinked through complicated institutional group holding structures and are under the influence of major political and commercial figures in Malawi. These retail chains cater to high income consumers and supply a range of differentiated products throughout the country. They dominate this segment of the market and take the bulk of CSC production.

90 The CSC is the monopoly processor of these products. Currently the organisation is undergoing a major review of operations by the Crown Agents with a view to new investment and a new equity structure. The CSC suffers from underinvestment which has been partly caused by a pricing systems under which it operated. Livestock prices were freed in 1988 but wholesale and retail prices of the meat remained controlled by the Government. This cut profits and funds for investment in the industry.

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* JH Mangisoni. A review of the effectiveness of livestock and livestock product production and marketing policies in Malawi. Paper presented at the regional workshop on livestock production and marketing, Zambia, 9 July 1993

91 Nowadays, the retail prices for the large retailers are regulated to a much lesser degree. The margins are substantial, especially for PTC which has guaranteed supply through its connection to the feedlot operations. Imports are heavily discouraged by the government and therefore retail meat prices are comparatively high compared to import parity. CSC is also burdened with being the livestock buyer of last resort and a duty to process all animals offered to it for a regulated fee. It is unable to procure sufficient cattle for processing on its own behalf due to supply constraints. The main constraint is price based as smallholder producers can make more money by selling their cattle for roadside slaughter than by selling to CSC. This is due to lower transactions costs ie slaughter and need to weigh and grade into cuts which penalises their low grade animals.

92 The large retailers sell the full range of standard cuts with the high profit margins on the primal cuts being used to subsidise the price on the cheaper cuts. There is very little price competition between PTC and Kandodo with Kandodo using parity pricing with PTC as its benchmark.

93 The retail prices as of 28.11.93 were:

Meat cut	Price in Malawi Kwacha/kg
Fillet	36.00
Rump	33.00
Silverside	26.00
Stewing steak	17.00
Economy Stew	13.00

NB Communal beef is retailed on the informal market at K6.00 to 9.00/kg and goat meat at about K5.50

94 The distribution of the carcasses is by refrigerated trucks for PTC and Kandodo and by unrefrigerated transport for other consumers. The road system in Malawi is such that no part of the country is more than a few hours away from the main centres of livestock slaughter. Freezing is not used and the carcasses are butchered at point of sale or consumption.

Slaughter and grading

95 Butchers throughout the country slaughter and sell hot meat with the bone in towns and villages throughout the country. The carcases are not necessarily inspected, weighed or graded. The number of informal markets, slaughter sites and shops is unknown as records are not kept. Assistance to this sector is difficult, particularly without effective and enforceable legislation. The route to improvement of the industry is to provide incentives to market livestock through the likes of the Cold Storage Company Ltd of Malawi.

96 CSC has about 350 staff situated at two plants, one each in Blantyre (HQ) and Lilongwe. It is owned by Admarc (Agricultural Development and Marketing Corporation) a parastatal body although it is rumoured that MDC (Malawi Development Corporation) is soon to take over. The organisation is not profitable and has serious cash flow problems. Cattle slaughter has dropped from 24,000 in 1983 to about 16,000/year in 1992. Equal

numbers are slaughtered at Lilongwe and Blantyre with an average carcase weight of 150kg. Although the Company works on a 37% gross margin this is below inflation and unable to maintain profitability. The official pressures which prevent the CSC from making economical charges are mentioned above.

97 The factory at Blantyre was built in 1955 or thereabouts and said to have been originally fitted with second hand equipment. The factory has suffered from a lack of investment and is now totally inadequate and beyond refurbishment. Although better, the plant at Lilongwe, built by the Danes in 1971, is probably in a similar situation. MDC has asked for a consultancy to assess the future of the assets and has employed Crown Agents to undertake a survey. It seems that as these two plants are the only substantial assets of the company, the consultants have the task of engineering a total reorganisation of the infrastructure of the CSC as they have condemned the two buildings.

98 CSC slaughters private stock for a fee of K90/head of cattle and buys the hide from the owner which it onsells to Italy or Greece after air drying. About 60% of the stock is slaughtered for PTC and other private owners and 40% of the slaughter is of CSC stock purchased from auction markets and privately from butchers. Cattle are purchased for cash and based on liveweight at auctions. Cattle bought privately are paid on cold dressed weight (cdw). There are official ceiling prices, set by committee, but these are slow to react to market forces. Presently these are K3.50 to 3.80/kg liveweight and K8.00 cdw. There are seasonal variations also, the period of school fees and purchase of fertiliser occur simultaneously and this brings more cattle on to the market. A shortage occurs at harvest time. There is a concept that the glut should be purchased and put on to a feedlot to act as a buffer store. There are plans to increase throughput by acquiring a ranching operation. There are several ranches and feedlots in the country and the management has observed similar practices elsewhere in Africa, eg Botswana, Zimbabwe and Zambia. The CSC is unable, therefore to forecast its throughput with any accuracy. Although CSC is a "last resort" buyer, this option is now rarely taken up.

99 The cattle slaughtered at CSC can be given one of five grades based on an age/weight conformation/finishing index:

Choice	<3 years, >170kg and well finished
Prime	<3.5 years, >150kg, not well finished
Standard	<3.5 years, <150kg, not well finished
Commercial	5 years
Inferior	The remainder, usually emaciated

Malawi Zebu tend to be found in the Commercial and Inferior grades

100 Offtake of the national herd of 960,000 is thought to be about 90,000. Slaughter of, say, 20,000/year by CSC would indicate that CSC process about 22% of the stock leaving 78% to the informal sector. Informal slaughter cannot be stopped outside the few main towns and cities in Malawi and there is very little which can be done to prevent it from happening in urban markets either. The pricing structure of the animal, lack of market response and considerable overheads which it has to carry leaves CSC to handle only the meat destined for the high-grade/price market.

101 The CSC opinion is that there is an unsaturated demand for meat yet there is no export and very little importation of meat. It must be assumed that the prices of meat are so high as to put meat beyond the reach of most people as the *per capita* consumption is given at about 4kg/head/year. Although importation is not practised, the CSC feels that it may be necessary in the future. In this case, the meat will arrive in chilled form and not frozen.

Direction/prospects of the livestock sector

102 The prospects for increased production of livestock are limited by the available land for grazing or production of feed. Much of the agricultural land is under production of food crops like maize and vegetables or cash crops eg tobacco, tea and sugar. Malawi is densely populated and there is little available land for the production of extra animal feed. Malawi is short of foreign exchange and is reluctant to import animal feed or livestock for slaughter. The CSC is undergoing reorganisation of its infrastructure and management. This will almost certainly result in a smaller and more efficient organisation to address the contraction of the industry. Although there are projects to increase production and expand marketing, this is likely to be slow.

Potential for adaptive research into the application of hot boning, electrical stimulation and plate freezing technologies

103 Although *per capita* consumption of meat is very low at 4kg/head/year, the supply and demand for meat balance so that there is no perceived need for its importation and no excess for export. Fish is consumed in greater quantities than meat.

104 Attempts to produce more slaughter stock in feedlots and by stall feeding have been marginally successful. Nevertheless, recent government policy is set to encourage increased feedlot production and some of the government ranches are being sold to private entrepreneurs in the hopes of improved productivity and output. Growth in output and productivity of livestock from these feedlots is likely to be slow, however, indicating little change in meat eating habits.

105 With regard to research, the only possible location for work on the freezing project is at CSC, Lilongwe. The pig processing room, which is adjacent to the slaughterhouse, could possibly be converted to undertake hot boning and a plate freezer. Strict control on staff entry and product security generally would be required. Any equipment would need to be imported, there is nothing available at the plant except spare 3ph capacity and water. Since beef carcases are in relatively short supply, operation would be difficult. Both CSC plants may soon be replaced with smaller, more efficient units but the production of frozen meat is not considered a priority.

106 The Veterinary laboratories in Blantyre and Lilongwe are adequate for their purpose and the Central Veterinary Laboratories in Lilongwe are able to offer facilities for proximate analyses, microscopy and microbiology to accompany any research which may be conducted in Malawi. Any specialist testing would require importation of appropriate equipment and reagents.

107 Laboratory facilities at Bunda College could be used if any programme was started in Malawi.

Further studies and observations

108 Other work was discussed at length with Dr Phoya of Bunda College including the problems of informal slaughter. It was felt that the village butcher might have difficulty disposing of his meat at the end of the day and would be forced to reduce the price of the meat to cut his potential losses. It was felt that if he was able to manufacture a dried meat product (Biltong) which had a good market in the towns he could maintain his prices while adding value to any remainder. The practical difficulties of this plan were discussed and it was agreed that Dr Phoya would undertake a brief survey to ascertain the extent to which butchers had meat which was left over and attracted a lower price, while NRI would look into the production technology and marketing aspects of the process and product.

> ACTION: D Silverside to write to Dr Phoya of Bunda College to enquire of progress regarding meat production and its possible wastage in villages.

Conclusions of the visit to Malawi

109 Although Malawi has the processing infrastructure and institution necessary to take up the proposed NRI technologies it does not have the right determinants to encourage their use eg the need for long distance transport between production and consumption areas. Electrical stimulation might prove a useful future technology for the CSC but at present the supply constraints, its management and lack of competition means that CSC does not have to look at seriously at technologies to improve meat quality. Work conducted on ES of hot boned meat before plate freezing is therefore inappropriate to the Malawian meat industry.

Namibia

Introduction to country

110 Namibia lies in South-West Africa and has an area of 824,270 km^2. It borders Angola, Zambia, Zimbabwe, Botswana and the Republic of South Africa (RSA). The current population is about 1.5 million inhabitants with a population increase of 3.2% *per annum*. The average *per capita* income is about $1,060/year which, although relatively high by African Standards, is skewed, leaving the population in Communal Areas amongst the poorest in the world. Agriculture is relatively important and occupies about 34% of the population and accounts for 11.3% of GDP.

111 Namibia is similar to Malawi in that it has a dualistic economy due to the long history of separate development. There is a highly developed commercial ranching sector, the products from which enter international trade and the "expensive" domestic market, and an under developed smallholder semi-subsistence sector which supplies products mainly for the domestic consumer. The beef industry dominates the agricultural sector of Namibia contributing 74.9% of gross agricultural income (Meat Board 1992)* . There are very few agricultural alternatives to livestock production due to the climate and vegetation. Namibia has a very low rainfall ranging from 50mm in the south to 700mm in the north. There are three climatic types, cool desert along the coast, warm deserts in the southern interior and steppe type of climatic region in the central and northern areas. It has been estimated that 51% of the country is best suited to cattle farming.

112 Since Independence in 1989, the Government of Namibia has increasingly tried to integrate the communal and commercial sectors of the livestock production industry by extending the activities of Meatco, the national meat processing and marketing company.

113 In this report the communal sector will be focused on as this is one target group identified for attention in the Renewable Natural Resources Research Strategy (RNRRS) of the Overseas Development Administration (ODA).

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* Annual Report 1992. Meat Board of Namibia

Production, slaughter, consumption

Table 3

Class	Number (million head)	Number Slaughtered (million)	Meat Production (tonnes)	Per capita Consumption kg/year
Cattle	2.10	0.20	68,000	44.33
Goats	1.97	0.51	6,000	3.91
Sheep	3.00	0.70	11,000	7.17
Pigs	0.05	0.44	4,000	2.61
Poultry	na	na	na	na

Source: FAO Annual Production Yearbook, 1992.

Marketing

114 Namibia has two main cattle raising areas which are delineated by a Veterinary Cordon Fence (VCF) which stretches from west to east at approximately 19°S. In the disease free area south of this cordon , there are mainly large scale commercial farms with some small scale communal areas dispersed amongst them. The large scale commercial sector comprises 34.9 million hectares under freehold tenure producing high quality livestock mainly for the export sector. The communal smallholder sub-sector occupies 33.3 million hectares, with land tenure based on customary rights for cropped lands and communal user rights for on grazing land. Production is largely on a subsistence basis in both pastoral and agro-pastoral units with the build up of herds during drought free years and offtake in response to seasonal income needs and as distress sales in drought years.

115 The commercial areas contribute the great majority of marketed livestock offtake and historically have received the bulk of government subsidies and support services. This sub-sector is very profitable due to the high prices the livestock commands whether for processing for export markets or for the supply of weaners and slaughterstock for the fattening sector in the Republic of South Africa.

116 The communal areas north of the VCF comprise four main areas; Kakaoland, Ovamboland, Kavango and Caprivi. The small scale sub sector in these Northern Communal Areas (NCA's) is characteristic of traditional sub-Saharan pastoral and agro-pastoral systems, with herd sizes related to socio-cultural practices such as status within the community, the rôle of cattle in traditional exchanges and rituals, as well as having a defined rôle in a fragile and precarious agro-ecological system. Offtake levels are low and positive attributes are at variance with commercial slaughtering criteria with old mature oxen being favoured.

117 Disposal is regulated by social needs such as marriage and the need to pay Lobola, or by annual cash requirements like the need to pay school fees. Offtake also rises in response to emergencies such as drought which has reduced harvests, with a direct negative correlation existing between the size of finger millet harvests and the number of cattle sold in certain areas. The majority of communal farmers have small herds of less than 20 cattle, although there is a widespread system of farmers looking after other peoples' cattle who have other non-agricultural jobs or who are migrant labourers.

118 Overstocking is a major problem in these areas with the degradation of grazing particularly around water holes. Fencing of land is increasingly widespread and some large scale farmers have been set up on former government land with herd sizes of over 500. The majority of cattle are sold to local butchers at rural markets, often through traders, organised by traditional authorities such as Tribal Councils. These butchers slaughter in the bush and sell the meat hot off the bone with no grading or weighing. The volume of sales will be low with one carcase per trading day sold. Prices for livestock at these markets are around N$ 1000 and is paid on weight which therefore means mature oxen fetch better prices.

119 Increasingly, the Meat Corporation of Namibia (Meatco), a private nationwide processing and marketing concern, is trying to persuade farmers in the NCAs to sell more livestock to their abattoirs which are situated at Oshakati in Ovamboland and at Katima Mulilo in Caprivi. Farmers who sell to Meatco do so at rural procurement points organised by local procurement agents. The animals are then moved to quarantine farms for 21 days before being taken to the abattoirs in Katimo and Oshakati.

The National Meat Corporation of Namibia, Meatco,

120 Meatco is the monopoly organisation originally set up by the Government of Namibia (GON) as a parastatal for the slaughter and processing of livestock for export to the EU and RSA markets. It processed 41.7% of all cattle formally marketed in Namibia from 1983-1992 (Meat Board of Namibia Annual Report 1992). Meatco supplies the EU and RSA markets, which are two of the most profitable in the world and has made attractive margins on its processing activities. Its success is based on the production of premium disease-free beef in the commercial areas processed in modern abattoirs. The main products are frozen or chilled cuts for the EU, corned beef for the UK and carcasses, chilled and vacuum packed cuts and canned beef for the RSA market.

121 Following Independence, the Namibian government persuaded Meatco to expand its activities into the Northern Communal Areas. In order to do this it has instituted a marketing strategy for these areas for which it hopes to get European Development Funding. Meatco has also been expanding into the Northern Communal Areas because the commercial areas in the south are unlikely to be able to increase their production beyond their present levels. From an increase in marketing activity in the NCAs, Meatco hopes the number of communal animals taken for slaughter will increase thereby expanding its commercial base.

122 Previously the meat from livestock procured in the NCAs could only used for canned meat for export to South Africa or used in the local retail market. Recently however, Meatco won approval from the South African authorities for its NCA abattoirs to produce carcasses

and chilled and frozen cuts for the South African market. This has significantly increased the potential profitably of the northern operations. To exploit these new markets, Meatco has to be able to increase and then maintain the quality of carcasses it gets from communal farmers. At present the delivered livestock are old and in bad condition and therefore Meatco has to use its quarantine farms as fattening stations to improve the condition before slaughter.

123 Meatco has no equity and is virtually without status. As a previous "parastatal" in a less developed country (LDC) of low Gross National Product (GNP) it was entitled to soft loans, one of which it is paying back following refurbishment of some of its abattoirs.

124 Meatco has recently undergone restructuring and will become an independent commercial organisation, owned by and accountable to the livestock producers, and possessing a national monopoly on livestock slaughter for export. Meatco will then restrict itself to slaughter and processing, leaving procurement in the hands of trained agents.

Livestock Slaughter

125 Butchers in the Communal areas slaughter and sell hot meat with the bone in towns and villages throughout the country. The carcases are not inspected, weighed or graded. Although each town and village has small slaughteries and markets, their number is unknown as records are not always kept up to date. Assistance to this sector is difficult, particularly without effective and enforceable legislation. The means to enhance productive capacity of the industry is to provide incentives to market livestock through the likes of the Meat Corporation of Namibia.

126 Meatco operates three abattoirs south of the VCF which have licences to export to the EU and the RSA. The abattoir at Windhoek slaughters all species of stock although only the beef is permitted to be exported to the EU. The abattoir has a capacity of 600 cattle/day although it slaughtered an average of only 240/day in 1992 of which 50/day were from the Southern Communal Areas of the Hereros and Reheboth. All cattle are inspected before slaughter and, immediately after sticking, subjected to High Voltage Electrical Stimulation set up on an automated line. Hot boning is regarded as difficult under EU regulations so, after dressing, carcases are subject to a sophisticated 24 hour chilling programme. The air temperature is brought down slowly so that a carcase temperature of about 14°C is achieved within 10 hours. The programme is undertaken to prevent cold shortening in the smaller of the wide variety of carcase weights (180-300kg of a wide variety of breeds) which are processed. At 10 hours, the temperature is reduced rapidly for the carcases to achieve 2°C within 24 hours. At 10 hours the pH is measured and only carcases below pH 5.9 are exported. Windhoek abattoir also produces Corned Beef and Corned Meat for the EU and RSA markets.

127 Commercial beef, produced as chilled cryovac packs, is said to have a shelf life of four to six months if kept under strictly controlled temperature conditions of 0°C. After storage, the meat spends sufficient time in transhipment through Cape Town and on by sea to achieve the EU incubation requirements.

128 At Windhoek, communal beef is deboned chilled and frozen in one of 17 plate freezers before transport to the RSA as manufacturing beef. Specifications of the plate freezers in use in Meatco are given in Appendix 6.

129 Okahandja abattoir, 71 km to the north of Windhoek, and Otavi 363 km also to the north have a capacity to slaughter 500 and 100 cattle/day respectively. Okahandja slaughtered an average of 360/day and Otavi slaughtered 56 during its first years' operation in 1992. Both abattoirs operate in a similar way to Windhoek except that they only slaughter cattle for export and use blast freezers rather than plate freezers.

130 North of the VCF, Meatco have taken over three abattoirs from the Namibian Development Corporation. Rundu abattoir was closed soon after purchase as there was no economic justification for its continued operation. Production was transferred to Oshakati in Ovambo and Katima Mulilo in Caprivi. Both of these abattoirs have the capacity to slaughter 50 head of cattle/day. Both are undergoing renovation and both will have two, fifteen station plate freezers fitted as standard. Oshakati has a licence to export boned out meat to RSA from cattle which have undergone a period of 21 days quarantine. The meat must also be held in frozen storage for 14 days prior to shipment by refrigerated vehicle. Meatco provides these facilities. All meat produced north of the VCF will be for manufacturing purposes as there are very few commercial cattle.

131 Oshakati abattoir has a cannery but this has ceased production following severe depression of the corned beef/meat trade which has lead to a build-up of 4 months' export supply. Canning operations have been transferred to Windhoek.

132 Katima Mulilo abattoir was closed at the time of the visit to Namibia for renovation. It will slaughter communal cattle for local and domestic use until licences are obtained to export to RSA. It is hoped to start exports in mid-1994. Arrangements for quarantine must be made and there are thoughts that the responsibility for quarantine may rest with the farmer rather than a central facility. It is planned to debone hot carcases and plate freeze the meat directly afterwards. The frozen meat will be taken by truck to Johannesburg through Botswana as this is the shortest route to the RSA.

133 The northern abattoirs operated at a loss during the first two years of Meatco's ownership but it is hoped to rectify the situation within five years. Current problems include:

the difficulty and cost of procurement, eg in 1992 the producer price offered by Meatco did not exceed N$700 per head which is over N$300 less than a producer can get at rural markets. Informal butchers have few overheads and can therefore pay more than Meatco

marketing the low grade products and

the difficult quarantine arrangements which should help to act as a buffering force but simply seem to hold back gluts

transport losses of over 50kg in communal cattle which take at least 21 days to recover.

Biltong

134 Biltong is made at Oshakati abattoir. Details of the production methods are given in Appendix 7.

The Meat Board of Namibia

Export quota

135 The function of the Meat Board is to ensure the orderly marketing of livestock and meat in Namibia. It is an extension of the Ministry of Agriculture. Namibia has an EU quota of 13,000 tonnes/year (60,000t over 5 years) although it actually exported only 10,500t in 1992. Meatco exports through the Botswana Meat Commission (as does the CSC in Zimbabwe) but none of the three countries achieves its quota. Although production of slaughter stock in Namibia is 350,000, only 220,000 are slaughtered for export. This number should be 250,000 to 260,000 to fill the export demand adequately. Shortages of slaughterstock in Namibia are due to the recent drought and the export of weaners and quality slaughterstock to the RSA. The Meat Board of Namibia has the responsibility of dividing the quota amongst the commercial producers in the country.

Livestock pricing

136 The Meat Board is also responsible for setting the minimum price that Meatco must pay for slaughterstock. Each week, the prices on the livestock markets in Johannesburg, Cape Town and Durban are fed into a formula which adjusts for marketing costs. This is the price for all stock. An additional premium is paid to stock of exportable quality called the "Lomé Premium".

Livestock procurement

137 Agents, managed by the Meat Board, procure animals for Meatco and organise transport of commercial cattle from the farms to the abattoirs. They also procure other cattle from auctions and private negotiations. The agents get a commission from the contracted commercial producers and collect a levy from Meatco for other cattle.

138 The system operates differently in the NCAs, where there is a project of education, extension, veterinary health etc to bring about an improvement in animal production and slaughter numbers. Meatco buys the cattle from collecting points and puts them to quarantine for 21 days.

Livestock grading

139 The Meat Board of Namibia is also responsible for grading cattle bought at auction and carcases at the abattoir. Live grading is based on age, fat and three conformation classes. Carcases are graded on the number of permanent teeth (None, six teeth and over six teeth) six fat classes and three, sometimes four weight ranges). Prices are based on the grade awarded to each animal. Animals which are kept for commercial production are generally young and fat, thereby attracting the Lomé Premium but Communal cattle are kept for many purposes, including draught and milk and are usually presented at the abattoir too

old for the Lomé premium. These animals attract a low price and there is some resentment by the Communal producers that a young, well fleshed but light ox attracts a higher price than an old heavy bull of poor conformation.

140 In its rôle of monitor of marketing, the Meat Board noted that some meat was exported once to Ivory Coast and Congo but now the total goes to virtually assured markets in the EU and the RSA which appears to absorb, at the market price, anything Namibia can produce. Other than the day-to-day management, meat marketing appears to be no real problem.

Ministry of Agriculture, Water and Rural Development, Directorate of Planning, Pricing, Marketing, and Co-operatives, Windhoek

141 Although donor co-ordination is carried out by the Directorate of Extension, some agricultural projects are co-ordinated by the Ministry of Planning. There are several donors interested in working in Namibia. These include the Franco Namibian Rural Development project, which includes training and rural development elements, a livestock development project and a rural development support project, both funded by the EU. Again these include farmer training. IFAD is funding a crop and livestock project which integrates crop residues and livestock feeding. The African Development Fund has an interest in extension services and GTZ is funding the SARDEP pasture management project.

142 Livestock development in the NCAs is a Government of Namibia priority. One objective is to reduce the number of cattle and improve its quality. Another objective is to increase cash into the economy rather than increase meat consumption in the region (it is already adequate). First attempts to carry out this policy were to offer N$120/head slaughtered in Meatco's northern abattoirs. This succeeded for a while but the scheme was discontinued as numbers fell back to original levels. As a consequence the Government of Namibia made application to the EU regarding a livestock project designed to improve marketing infrastructure and abattoir renovation. Although top of the GON's list, early applications proved too costly and the EU asked that the budget be reduced. Meatco has pushed ahead with its plans to refurbish the abattoirs at Oshakati and Katima Mulilo, in the hopes that they can claim retrospectively.* Should the application to the EU for funds prove successful, the project will be co-ordinated by the Ministry of Planning and executed by Meatco.

143 From discussions with the Ministry of Agriculture, Water and Rural Development, the GON welcomes any form of research which could lead to development of Namibian resources. A socio-economic survey of farmer attitudes to livestock ownership and relationship with Meatco was conducted by Peat Marwick in early 1993. Results exposed predictable data and there is seen a need to study the subject in much greater detail if farmers in the NCAs are to benefit from the opportunities which a reformed Meatco has to offer. In favour of an extension to the study is the existence of a real purpose for the exercise and tangible benefits are possible from the outcome. *Post harvest* and marketing

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* The EC-funded adviser from NRI says this will not be allowed. Also, the EC is not in favour of abattoir development projects.

work are not undertaken centrally by institutions employed by the Ministries, this being left to the private sector or devolved institutions. Any research conducted in collaboration with Meatco will not be opposed by the GON and NRI would need to liaise directly with Meatco regarding details. Once settled, a project proposal should be directed through the Directorate of Planning for approval. In the case of work with Meatco, NRI would face no difficulties.

Constraints to further development of the Namibian Meat Industry

144 Meatco has no research or development staff. Their technical innovations come from reading literature and reliance on technical expertise from RSA. This expertise is expensive and there is a growing reluctance to invest in further technological advice. This situation has been forced on the company as its solvency is now threatened as a consequence of take-over of the facilities in the north. The provision of technical advice at this critical stage of development should pay dividends later to Meatco, and through them, to their suppliers, the Communal farmer.

145 The freezing process in Oshakati is such that cold shortening of the beef is a real possibility. Electrical Stimulation of carcases was considered by Meatco at the planning stage of the refurbishment of their northern abattoirs but it was decided not to fit it to either abattoir. Given operating experience elsewhere in the organisation, however, this decision is being reconsidered and its introduction is now almost certain. The system of electrical stimulation in Windhoek is based on reactions on prime commercial stock which have been established by meat scientists in the RSA. The specifications used on commercial stock will probably be inappropriate to communal stock slaughtered in the newly refurbished abattoirs in the north. The ES protocol for this stock needs determination to maintain the quality of the meat and assist with continued marketing of the product.

146 As all carcase meat in Namibia is boned out after chilling, experience in hot boning for a specialised market is unknown. Correct ES and hot boning techniques are essential if improvements in quality and yields are to lead to an improvement in profitability and returns to producers.

147 Cattle from the communal sector often produce dark meat which is very dry. This creates marketing problems for Meatco as the meat must be canned rather than sold as fresh or frozen. Prices offered to the communal farmer for cattle which produces meat for canning are therefore lower than that for meat of better quality. Dark, dry meat may be derived from stock which is simply very old or poorly handled. The phenomenon may be characteristic of the breed. Sometimes poorly watered cattle can produce the fault or the meat may be Dark Firm Dry, a syndrome brought about through depletion of glycogen in the muscle which prevents accumulation of lactic acid and an adequate fall in pH (to below about 6.0). The resolution of poor meat quality found in communal cattle, particularly that of the dark dry meat, would attract better prices in the RSA, diversify the use of meat from communal cattle and allow better prices to be paid to the farmer.

148 Chiller shrink, the loss in weight between production of the hot and fully chilled carcase, is very high with communal cattle. Figures of 3% were mentioned but the actual figure is probably double this. Considering the value of the carcase a reduction in chiller

shrink will lead to direct percentage increase in the production of meat with considerable benefits to the returns to the producer, Meatco and Namibia.

149 Meatco's low throughput has caused some concern to the GON, the Meat Board and the Directorate. The movement of weaners to RSA has led to a shortfall in slaughterstock and it is now government policy to allow export of only 25% of the national commercial production herd. The Meat Board is in the position of making livestock marketing orderly, so the pricing formula with the Lomé Premium should help procure more stock. The operation of agents working on commission may help to bring in more stock. In the NCAs the Meat Board has no agents so Meatco is taking on a development and extension rôle to organise markets and auctions. It has approached the EU for funds and these are top of the Government's priority list. Success or otherwise will be known by February 1994*. Other donors are undertaking projects concerned with training, extension and a little infrastructure associated with livestock production. However, there is a shortage of information regarding the socio-economics of livestock ownership and how it fits in with the farming system and desertification etc. A survey to address this issue with a view of overcoming this deficiency would greatly assist the procurement effort and all the benefits which would accrue.

Potential for adaptive research into the application of hot boning, electrical stimulation and plate freezing technologies

150 The meat industry of Namibia is characterised by a well developed infrastructure for farmers south of the VCF and assured markets for all types of meat, although there are temporary difficulties in marketing canned meat. The infrastructure and marketing at Meatco are well advanced and future developments determined to a high level. As a consequence, the organisation is unlikely to consider using results from the project under development at NRI regarding the production of plate-frozen meat from hot-boned carcases.

151 The infrastructure north of the VCF is less developed than to the south for both production and marketing of meat. This problem is being addressed through the provision of livestock markets, feedlots, abattoirs and meat processing facilities by Meatco. Markets have been opened up in South Africa for meat from the area. The abattoirs at Oshakati and Katima Mulilo are undergoing refurbishment and this will include facilities and plant for plate freezing. Hot boning and ES of carcases are under active consideration by Meatco. The project under development at NRI will be of minor application in these abattoirs as Meatco wish to stimulate carcases rather than hot meat.

152 The methods of electrical stimulation of beef carcases in the EU approved abattoirs are based on reactions in prime commercial stock which have been established by the Meat Research workers South Africa. Similar methods used with communal stock are said to be not so effective and are as likely to lead to problems as solve them.

* It has been learned that Meatco proved to be ineligible for EU funding and has been advised to approach the European Investment Bank for funds. If taken up, the funds will be borrowed at an interest rate which will put pressure on prices, perhaps to the communal farmer

153 During discussions about the operation of the abattoirs and the nature of the product, the managers of Meatco and the chairman of the Mangetti Farmers Association asked for help to improve the quality and yield of communal beef which could only be given through research. This will require studies into:

the electrical stimulation of beef bodies to establish practical operational procedures for communal cattle

underlying reasons for the production of dark and dry meat to identify ways of avoiding this problem which reduces its value

reduction of excessive hot boning losses, chiller shrink and other quality defects. This work will lead to improved carcase yield and, potentially, its quality and value

farming systems as they relate to livestock ownership and disposal and the relationship of the livestock farmers with the national trading organisation and its procurement policies. These studies are needed to increase purchases of stock from Communal farmers north of the VCF.

154 These problems are often found in the formal marketing and slaughter sectors for communal cattle observed throughout southern Africa eg. Zimbabwe, Botswana, Zambia, Kenya. The new infrastructure being established by Meatco and its rôle in marketing extension presents excellent opportunities to conduct research into marketing, fattening, processing and handling of communal livestock. The outputs from a research programme undertaken to study ES, hot boning, dark dry meat and chiller shrinkage in Namibia will bring about benefits not only to the communal sector of Namibia but also to other communal farmers within southern Africa.

155 The facilities in Windhoek and Oshakati are suitable for the work each having slaughter facilities and room to conduct experimental work. Laboratories are provided in both factories. The Agricultural laboratory in Windhoek may be used for work which is beyond the scope of the simple facilities provided at the abattoirs. This work is an adaptation of the strategic work conducted by the Livestock section of NRI in Zimbabwe.

ACTION: D Silverside to draw up a concept note concerning studies in electrical stimulation, hot boning, dark dry meat and chiller shrink and submit to the Livestock Programme Manager for funding consideration.

ACTION: M Pritchard to draw up a concept note concerning socio-economic aspects of livestock ownership and disposal and submit to the EU for consideration

156 For visiting research workers, Meatco have offered development facilities, accommodation, transport, local staff and no restriction on publication of results.

Conclusions of the visit to Namibia

157 The NCA processing operation exhibits all the assumed criteria necessary for the adoption of NRI technologies of electrical stimulation and plate freezing eg losses associated with transportation of livestock over long distances to abattoirs, meat supply to distant markets. Considering the benefits which the technologies provide, it is not surprising that both of these technologies are already used, albeit in a more conventional form, in its southern abattoirs and that Meatco is in the process of installing the plate freezers in the north. Distribution of the meat is through a modern fleet of refrigerated trucks (to comply with regulations of the EU and the RSA) along extremely good roads to the long-distant markets in RSA. It uses unrefrigerated, insulated vehicles for local transport of plate frozen blocks. Meatco therefore exhibits the rationale of the NRI research concept and shows its usefulness if the market margins are high enough to support the necessary infrastructure.

158 In Namibia, the development of the plate freezing process is mainly complete and advice is generally available from the plant engineers and their company technologists should problems arise. The difference between the proposed NRI technology and that practised at Meatco appears to be the point at which the Electrical Stimulation of the carcases takes place in the slaughter process in the south and its need in the north. In the south, meat is boned cold to conform to EU regulations and this means that Meatco are obliged to stimulate carcases at the point immediately after slaughter. Unless the quality of the meat can be demonstrably improved by ES under pressure, Meatco is unlikely to change its existing routine for communal stock using the same slaughterhouse. Its need in the north relates to the quality of the meat produced from NCA stock. The meat produced is of manufacturing grade and the ES specification and other production criteria to achieve optimum quality of this type of meat however, are not prescribed. It is in this area of production that research will be most beneficial.

159 The slaughter industry, based on the infrastructure available to Meatco, offers excellent facilities to conduct meaningful research into problems experienced by the industry in Namibia and elsewhere in the region.

160 The Managing Director of Meatco has offered accommodation, transport, access to the abattoirs and local staff to assist NRI with a work programme. He would not stand in the way of publication of results. There are laboratories in Windhoek and in Oshakati abattoirs which would be sufficient for simple experimental work on ES and its monitoring. The agricultural laboratories in Windhoek are well equipped and permission to conduct more advanced work has only to be sought. Work could be carried out under both strategic and adaptive research as the work undertaken in Zimbabwe on development of abattoir technologies in 1986-88 would continue the theme of transferable technology within the region.

Conclusions and Recommendations from the three country survey

161 During the visit to Tanzania, Malawi and Namibia, the infrastructure of their meat and livestock industries, potential for development of the industries, potential for adoption of technologies both within country and the region, potential benefits to farmers, traders, producers etc were all assessed and it was concluded that Namibia offered the best option for transfer of meat processing technology.

162 **It is recommended** that research is conducted in Namibia on electrical stimulation of carcases, chiller shrink, resolution of dark dry meat and hot boning of carcases. Facilities for this work are excellent and the work of direct national and regional interest.

Appendix 1

Terms of Reference

Please read these TORs with the background notes to the project. These should be attached

Objectives of the visit

1 To determine the interest of meat producers and processors in the technologies being researched in the UK as described in the background notes

2 To gauge the potential for uptake of the technology in meat processing industries in less developed countries

3 To identify partners with an interest in the technology, prepared to collaborate with NRI and the ability to provide facilities for continuing developmental research and the adaptive phase for transfer of the technology into an operating area.

Terms of Reference for Marketing Economist

In each country:

1 In collaboration with the Meat Technologist, undertake a field survey to:

Identify the major sources of livestock which are used for meat production
Examine the integration of livestock production with meat production operations
Examine the systems of transfer of livestock and their products to urban areas

2 To appraise the market for boneless and frozen meat in a number of urban centres

3 To produce a number of cost models for local production of meat based on existing and proposed systems

4 To outline the socio-economic consequences of the change in meat supply from the present system(s) to those using the proposed new technologies

5 In collaboration with the Meat Technologist, identify the constraints and opportunities for uptake of the proposed technologies

6 In collaboration with the Meat Technologist, assess the likelihood for uptake of the proposed new technology

Terms of Reference for the Meat Technologist

In each country:

1 In collaboration with the Marketing Economist, undertake a field survey to:

Identify the major sources of livestock which are used for meat production
Examine the integration of livestock production with meat production operations
Examine the systems of transfer of livestock and their products to urban areas

2 To define the nature of the livestock which are processed into meat in the major production regions

3 To examine the processing, distribution and general marketing infrastructure of the meat industry

4 To identify suitable partners with an interest in the technology and the capability of collaboration with NRI to continue the research into an adaptive phase

5 In collaboration with the Marketing Economist, identify the constraints and opportunities for uptake of the proposed technologies

6 In collaboration with the Marketing Economist, assess the likelihood for uptake of the proposed new technology

Development of methods of reduction of the energy required to conserve meat without compromising its quality

Background notes to the project

The process is intended for small to medium scale abattoirs in production areas distributing to urban markets or for export as commercial meat.

The project is essentially a combination of existing technologies put together to minimise energy inputs to a processing and distribution system for frozen meat over medium distances, say 150-250km.

The technical aspects of the project involve hot boning, other intermediate steps and plate freezing. Frozen meat is rapidly transferred to freezer storage at the end of the journey. This is seen as a means of introduction of a simple cold chain for boneless meat

Benefits

Reduction in distribution costs of about 30%

The use of frozen block meat packed to give a higher intrinsic cold barrier offers lower risk of thawing over frozen carcases or chilled meat

Because plate freezing involves direct energy transfer, the costs of freezing boneless, moulded meat is similar to air chilling carcases, considering the extra weight of carcase meat, insulation losses and inefficient use of energy for air cooling if the processes allow. May use off peak power and peak shedding

Product must be hot boned very rapidly after slaughter so that ES remains effective. This induces efficient operation and, after adequate training, good hygiene practices. Thus meat quality may be enhanced

Although the costs of processing are relatively high there are many cost savings and benefits. These include:

The possibility of improved livestock quality and increased return to livestock farmers if they react positively to the increased marketing opportunities

The project envisages slaughter in the rural regions rather than transport the animals to the urban areas for slaughter. Livestock entering the system should therefore give increased yield. Generation of income to rural communities. Middle men may move meat rather than livestock

Transport costs. One beef animal occupies approximately $4m^3$ whereas the meat is reduced to about four boxes occupying about $0.1m^3$. About 10 vehicles of 10 heads of cattle are required to transport sufficient animals to make up the meat load of 6250kg which can be carried in one vehicle

Use of materials wasted in the urban situation but fully used in the rural context eg blood and midden

Improved employment opportunities in production areas

Reduced environmental damage in urban areas

Appendix 2

Persons met

Tanzania

Mr J Crees, Livestock Planning Adviser, MALDC
Mr J Airey, FAO Expert, Marketing Development Board, MALDC
Capt SB Mvungi, Kipunguni Enterprises Ltd
Dr WA Millinga, Principal Veterinary Officer (Products Control) MALDC
Dr J Kimati, Assistant Commissioner, Planning and Marketing, MALDC
Mr Lema, Consultant to Capt Mvungi
Mr Moez, Owner/Manager, Zansud Butchery, Namanga
Mr GB Chiponga, Operations, Manager Mbezi Beach Butchery and TPL
Mr Isaac Issae, RLDO, Shinyanga (in Arusha)
Mr Albert Ngondo, Asst Commissioner (Ag) Marketing Development Board, DSM (in Arusha)
Meggie Mboya, Stiggy & Georges, Butchers, Arusha
Mrs MN Michaelides, Director, Happy Sausages Ltd, Arusha
Dr Ghamunga Sudi, General Manager Happy Sausages Ltd, Arusha
Rone Bothma, Consultant Happy Sausages Ltd, Arusha
Mrs Jalal, Tanzania Meat Supplies, DSM
Mr Salim Damji, Home Butchery Ltd, DSM
Mr Mashaka O Millongwe, Officer in Charge, NARCO Nkrumah Street Butchers Shop
Mr Hassan Salum Ahmed, Kizinga Meat Supplies Ltd
Prof LA Mtenga, Prof of Animal Production and Science, Sokoine University of Agriculture, Morogoro
Mr Mpilo, Manager, NARCO Cold Storage, Morogoro
Mr Mwyombela, General Manager, NARCO

Malawi

Mr A Tainsh, BDDCA, Lilongwe
Mr AT Barrett, BDDCA, Lilongwe
Mr Odigna Jere, Programme Assistant, BDDCA, Lilongwe
Mr Jere, Economist, Ministry of Trade, Industry and Tourism, Lilongwe
Mr Alfred Ng'oma, Assistant Accountant, Cold Storage Company, Lilongwe
Dr CB Chizonda, Chief Veterinary Officer, Lilongwe
Dr RCJ Mkandawira, DCVO, Lilongwe
Dr Samu, Lecturer, Communication and Language, Banda College
Dr Wells, Meat Technologist, Bunda College
Dr MW Mfitilodze, Animal Scientist, Bunda College
Mr Marvin L Kamthunzi, Chief Engineer, Cold Storage Company, Blantyre
Mr DJ Chisema, General Manager, CSC, Blantyre
Mr DV Kampani, Operations Manager, CSC, Blantyre
Mr G Behan, General Manager, People's Trading Centre Ltd, Blantyre
Mr JN Bapu, AGM - Perishables, Blantyre
Mr Gavin Craig, Consultant to MDC, on mission to CSC
Mr M Konson, Operations Manager, Kandodo, Blantyre
Mr Naveya, Head of Regional Veterinary Laboratory, Blantyre
Mr George Kanyama Phiri, Animal scientist, Bunda college

Dr Richard Phoya, Animal Scientist/meat technologist, Bunda college
Mr Khropa, Cattle buyer, CSC Lilongwe
Mr Kumsiya, Engineer, CSC Lilongwe

Namibia

Mr Paul J Strydom, Chief Agricultural Researcher, Agriculture Laboratory, Windhoek
Mr von Seydlitz, /animal Scientist, Agriculture Laboratory, Windhoek
Mr van Niekerk, Chief of Meat Inspection, Ministry of Agriculture, Windhoek
Mr Helmut von Maltzhan, General Manager, Meatco, Windhoek
Mr H W Kreft, General Manager, Meat Board of Namibia, Windhoek
Mr Andre Mouton, Agricultural Economist, Meatco, Windhoek
Mr Manie Grobler, Manager Northern Areas, Meatco, Windhoek
Mr E Taylor, Second Secretary, British High Commission, Windhoek
Mr Bernd Rothkegel, Director of Planning, Pricing, Marketing, and Co-operatives, Windhoek
Mr Martin Fowler
Mr Leopoldt, Factory Manager, Meatco, Oshakati
Mt Tom Zwar, Director, Coldpak, (Refrigeration), Windhoek, met in Meatco, Oshakati
Mr David Smith, Cannery Manager, Meatco, Oshakati
Mr Tony Clark, Engineer, Meatco, Oshakati
Mr Filimon Shikongo, Chief Cattle Buyer, Meatco, Oshakati
Mr Gabriel D Shihepo, Meatco Board Member for Oshakati and Chairman of the Mangetti Farmers Association
Mr Andre Pienaar, Meatco, Manager, Windhoek Abattoir
Mr Rolf Ridekke, Chief Engineer, Meatco, Windhoek

Appendix 3

New Abattoir Project in Tanzania: Kizinga Meat Supplies Ltd, Tanzania

1 Kizinga Meat Supplies Ltd has a slaughter slab at Mbagala outside DSM, which is used to slaughter 15-29 head cattle/day. Currently the meat slaughtered at this slab is sold in the ratio 10:90, retail:wholesale. Whole carcases and quarters are sold to other butchers. KMSL plans to build a new abattoir on this site. The new abattoir will have a maximum capacity of 150 head/day and will continue to be used for slaughter for KMSL and DSM butchers. Slaughter will be according to Islam. Once the new abattoir is operational it is hoped the selling ratio will not change.

2 The Director, Mr Hassan, loaned the feasibility study for his abattoir project. The report begins with an explanation of the normal cattle marketing system in Tanzania. A local livestock trader purchases stock from producers in the villages and this stock is sold at primary markets to inter-regional traders. The stock then passes to the terminal markets at Temi (Arusha), Weruweru (Moshi), Korogwe and Pugu (DSM). Over half of all Tanzanian cattle are said to be sold at Pugu market. It is thought that over 2000 head/week arrive in DSM. This figure, borne out by the MDB, indicates a market for 300 head/day in DSM.

3 Stock for the new abattoir will come from Mwanza, Shinyanga, Tabora, Dodoma, Mbeya and locally. Animals will be trekked to Kwala or Pugu and thence by truck to the abattoir. The average weight of the cattle ready for slaughter is taken as 240kg and the plan is to slaughter 100 head plus 60 sheep and goats, 365 days/year. Hot meat will be provided locally (as "frozen meat is not tasty and fresh meat is readily available") and the export will be in cryovac and chilled or frozen.

4 The abattoir will cost TSh 696 million to construct which will come from equity, loans and bank overdraft. The operational costs will amount to TSh 184 million in year 1, TSh 174 million in year 5 and TSh 109 million in year 10. Income of TSh 2940/head will come from a slaughter fee and revenue from handling offal etc. The balance will be derived from exports. The revenue in year 1 should be TSh 321 million and rise to TSh 482 in year 3.

5 There are 17 slaughter slabs in DSM and viability of the KMSL abattoir is based on the assumption that once it is built, the Government will close down all the slaughter slabs. Demand for slaughter is expected to increase from 265/day to 420/day for DSM in 1996. The slaughter fee will have to be competitive and service provided satisfactory if the butcher trade is to be drawn.

6 The present cost of slaughter is said to be about TSh 1000 made up as: Half the skin, Slaughter service (TSh 200) Veterinary fee (TSh 150) manure and blood.

7 The proposed fee is TSh 2950 made up as follows:

Cow rest (12 hours)	200
Processed blood and bone, 5kg @ 200/=	1000
Drying hide	100
Manure, 10kg @ 30/=	300
Tallow, 3 kg @ 350/=	1050
Offals processing	100
Slaughter and skinning	200
Total	TSh 2950

8 It is planned to sell 10-25% of retail production as export beef. It is believed that Tanzania beef will be valued at $3.5/kg fob DSM. The cif prices Dubai, shown on one order sheet as part of the feasibility study are:

Stewing beef	$3.25
Ribs	5.20
Topside	5.20
Silverside	5.20
Rolls meat	6.50

9 The export markets quoted as possibilities to take Tanzanian beef are: UAE, Comoros, Oman (which prefer carcase meat (100kg)/primals(15kg) and Mozambique, Angola, Gabon, Zaire, Kenya, SADC and the PTA.

10 The Director, Mr Hassan, suggested that Zanzibar is also a good export market. He thinks the price of meat in Zambia is 300-400% higher than in Tanzania and that Kenya is about 50% higher. He has no idea of market size and has to rely on the MDB for market information.

Appendix 4

Abattoir facilities in Tanzania: Happy Sausages Limited

1 The abattoir arose from a tourist visit by a party of Austrians from one village in 1986/7 who believed that they could assist the development of Tanzania through construction of a meat processing facility. Happy Sausages Limited took over operation of the business and premises of the Municipal abattoir from the Arusha town council in mid-1993. Since then it has been under completely new management. The new management is trying to establish a business for high quality meat and meat products.

2 The abattoir was designed to slaughter 150/day but now the ruminant slaughterhall slaughters only 50 head cattle/day from 0300 to 0900. HSL employs slaughtermen and charges a fee to butchers. The slaughter fee is TSh 750 for which TSh 50 goes to the muslim slaughterman for the halal ritual. The butchers object to payment of the fee and now slaughtered for themselves outside at the old slaughter slabs. Only one butcher pays HSL to slaughter smallstock, about 5/day.

3 The abattoir appears very large for its throughput. One side has been allocated to various meat and byproduct activities. Behind a metal screen there is a variety of processing equipment including a bowl cutter, mincer, smoker/cooker, sausage stuffer, bandsaw and icemaker. All the equipment is Austrian, in immaculate condition and daily use. Outside the screened off area but still within the abattoir, blood is coagulated in a container heated from the steam generated by a steam cleaner. The blood is dried on open trays in the slaughterhall.

4 The cold storage facilities are minimal. There is one small cold room used for carcases and cooked products (a practice not generally recommended) and another freezer store of the same size used for all products. Generally, here is an adequate water supply but electricity supply is extremely unreliable and the stand-by generator is used beyond its design capacity. The power situation in Arusha, however, is such that there would need to be a considerable improvement before research into meat freezing could be entertained.

5 The condition of the building is generally satisfactory but in need of some attention and maintenance, especially to the floors which have become pitted.

6 The newly opened pork plant, courtesy of the Germans, is well designed and constructed. It is used to slaughter up to 10 pigs/day although capable of more. The only pigs slaughtered belong to HSL. The equipment is made mainly of stainless steel with stunners, blood collection, combined scalder/dehairer, simple evisceration trough, wash down facilities, steriliser, indeed everything required for a good job.

7 There are three walk through cold rooms, one for offals, another for carcases and a third for finished meat products. The meat processing room is very neat and houses a bowl cutter, mincer, stuffer, smoker/coolers, tables, icemaker etc all of German manufacture. The staff are involved in the manufacture a of a wide variety of meat products all at an experimental stage.

8 The effluent from both ruminant and pork plants joins having passed through a coarse comb. It flows into a long channel which passes the hide drying shed (where

the frames are wrongly oriented) and into a sump/balancing tank. When full, the tank is manually switched to pump the effluent through a fine sieve to separate fine solids from liquid. The liquid then passes down a column of large stones into one of two plastic lined evaporation ponds. Dried solids are spread on farmland. The system has not been described to the new managers but they are finding their way slowly.

9 In conclusion however, the abattoir and meat processing room at Arusha is probably the best meat production facility in the whole of Tanzania. This standing may be challenged with the construction of the new Dodoma abattoir and the others planned by other entrepreneurs. At present, it is the only abattoir in Tanzania of a standard which could be modified to accommodate the equipment needed for the NRI research project in modern refrigeration technologies

Appendix 5.

Views of the butchers and officials connected with the meat trade regarding the sales of frozen meat within Tanzania

Happy Sausages Limited

1 The new General Manager of Happy Sausages Limited has taken on the role of Marketing Manager and has conducted a market survey by visiting all the hotels in Arusha and some retail shops. He has managed to sell some of the products but not enough to keep the factory going. There appears a real need for a wider market and, from sampling the products, this is deserved. The Tanzanian market is dominated by Farmers Choice, from Kenya, and it is this market HSL wishes to address. Curiously, Farmers Choice has won a contract to supply US troops in Mogadishu and HSL is filling the vacuum this has created on the Nairobi market.

2 All the management staff of HSL think that the prospect of selling frozen meat in Tanzania is slight even at reduced price.

Dr Millinga, PVO (Products Control) MALDC

3 Dr Millinga expressed the MALDC view on the possibilities of adoption of frozen meat as a commodity in Tanzania. He believes that most Tanzanians like tough meat with bone and that the market for boneless meat would be minimal. He felt that as electricity supply is not continuous, the opportunities for an efficient industry based on electrically powered refrigeration would be limited. He is pessimistic about the opportunities for the technology.

4 He believes that the opportunities for distribution of frozen meat to Mtwara and Lindi from production areas are also limited. The road from Dar es Salaam is open only during the dry season when the journey takes 1½ days. There is an alternative route in the rainy season which involves a five day journey. He described the area as poor and explained that only the Civil Servants in the region could afford meat. This is because the Civil Servants have a special hardship allowance for living under such difficult conditions.

Mr Isaac Issae, the RLDO for Shinyanga and Mr Ngondo, the Assistant Commissioner (Ag) of the MDB

5 Mr Isaac Issae, was recently posted from Lindi. During his posting to Lindi, Mr Issae asked for a study to made of the meat supply situation to Mtwara and Lindi. It appears that live animals are entrained to DSM and then trekked south to Mtwara and Lindi or taken by an extremely irregular and unreliable ship during which time they lose weight. Losses are also suffered through theft and the odd death. Copies of the report are not available but no satisfactory solution to the supply trail was proposed.

6 Mr Ngondo said that Lindi has a holding ground for animals awaiting slaughter. These are stocked during the dry season. He said the road to the south is impassable in the rains, which last seven months. Demand is much higher than the supply of animals and the population, which is growing, lives on locally produced chicken, goats, fish and bushmeat. While it is true that the rural people are poor and have no

cash for luxuries like meat during the rains, the urban demand still remains unsatisfied. At one time there was a shipping service to supply meat but the whole distribution system of frozen foods failed through lack of cold storage facilities.

7 Both government officers agreed that there was no problem with consumer demand for frozen meat. Indeed, in DSM before the collapse of the NCCO, frozen meat was purchased as an everyday item. Both also agreed that fresh meat was preferred but if there was no choice or the sufficient price differentials existed, there was no resistance.

8 Mtwara and Lindi are not on the national electricity grid and so use the town's generators. These are now very old and unreliable and electrical demand far outstrips their design capacity. As a consequence, cold storage using this electrical supply source would probably fail.

Kiosk Butchers

9 There are 250 kiosk butchers in Dar es Salaam each selling a maximum of one beef carcase, all within the day. A handful were inspected. Not one held a refrigerator to store frozen meat.

Butchers' shops

10 A brief survey of the butchers with more advanced equipment was undertaken. Six butchers were surveyed in their shops. They cater for the higher income groups and are therefore a little atypical of the average Tanzanian butcher. However, the trade they conduct will become more commonplace as the country develops further. Most butchers believe that it is not possible to sell frozen meat to anybody. Yet material left over at the end of the day is often frozen and minced the following day and sold with little or no difficulty.

11 Butchers generally thought that the average Tanzanian consumer prefers meat with bone as it looks "more" and is cheaper than meat without the bone. Naturally some nourishment is derived from bone and it is not wasted in the pot. Some butchers believed that some customers like tough meat but there were others who do not.

12 One butchery makes small goods such as sausages, pies, hams, frankfurters etc. The company buys its meat from Ruvu Ranch 60 km from DSM towards Morogoro. The Butchery uses approximately six carcases of beef each week. There are no freezing facilities but the butcher is prepared to accept frozen meat before adding further value to the range of products prepared in the factory. The butcher believes that although there may be some resistance to frozen meat this could be overcome through education and a sensible pricing policy. It was believed that if frozen meat is cheaper than fresh, then it will sell, providing the meat is otherwise acceptable.

13 This view was held strongly by a butcher in Arusha who buys fresh meat to freeze and a butcher in DSM who indicated that in the days when NCCO was active, frozen meat sold easily. Certainly, the Tanzanian consumer has learned to appreciate frozen fish. In contrast, another DSM butcher with a middle class, African market was quite certain that nobody except the very rich would ever buy frozen meat in Tanzania.

14 It was concluded that whatever opinion was accepted, the market for frozen meat would not be large and that considerable investment in the Capital's infrastructure would be required if frozen meat were to become a standard commodity.

Appendix 6

General Specifications of Plate Freezing equipment in Meatco factories, Namibia

1 Meatco's refrigeration advice is given by Worthington-Smith and Brower PO Box 2674, Randburg, RSA. Zip 2125. Tel 011 789 2785. All Meatco's plate freezers have 15 stations, measure 1.9 x 2.4m to take 250 of 150mm boxes. Each box holds 28kg meat. The boxes freeze to -15°C in 22 hours which, with loading and unloading constitutes a 24 hour cycle. The freezers are of either Australian or Italian manufacture. Australian plate freezers are more robust but also more expensive to purchase. The economics show that the plate freezers will pay from themselves in 2.5 years and are considered such a good investment that blast freezing as a practice in Meatco will not be considered again.

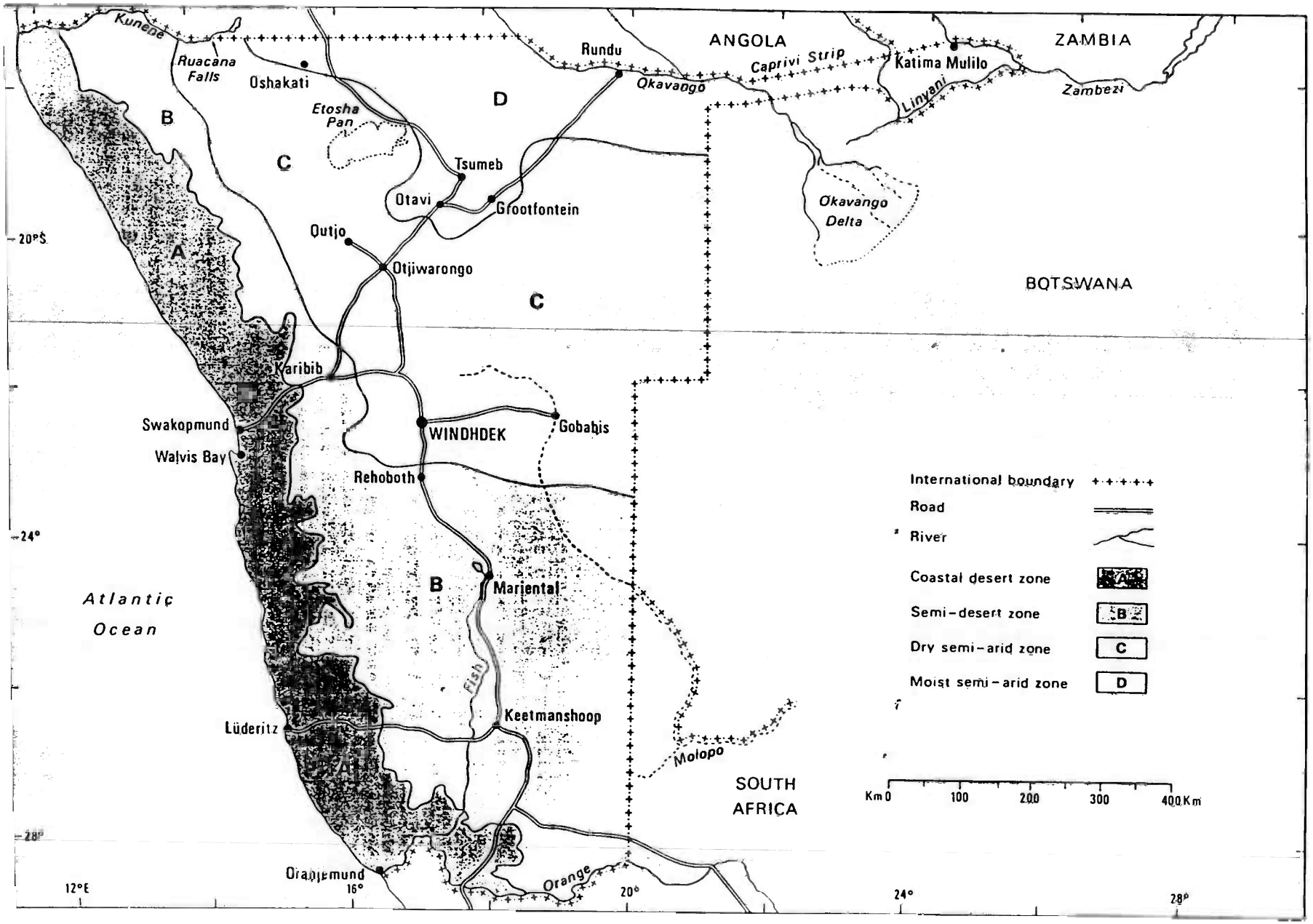
Appendix 7

Biltong Production in Oshakati, Namibia

1 Strips of beef about 50 x 50mm wide and 300 - 400 long of an average weight of 330g and soaked in salt and spices for 24 hours at ambient temperature. The recipe is:

Meat	300.00 kg
Salt	6.60kg
Vinegar	3.25l
Coriander	900.00g
White pepper	3.60kg

2 After the marinade, the strips are suspended by wire "S" hooks to a metal frame situated inside a wire cage covered with woven nylon sheeting to keep insects away. Once hung, the store is ventilated with five fans and the lights turned off so the meat dries in the dark. The meat is kept like this to dry for 4 days at a temperature of about 20°C.


Kunene
Ruacana Falls
Oshakati
Rundu
ANGOLA
Caprivi Strip
Katima Mulilo
ZAMBIA
Okavango
Linyani
Zambezi
Etosha Pan
Tsumeb
Otavi
Grootfontein
Okavango Delta
Outjo
Otjiwarongo
BOTSWANA
Karibib
Swakopmund
WINDHOEK
Gobabis
Walvis Bay
Rehoboth
Mariental
Atlantic Ocean
Fish
Keetmanshoop
Lüderitz
Molopo
SOUTH AFRICA
Orange
Oranjemund
20°S
24°
28°
12°E
16°
20°
24°
28°
A
B
C
D
International boundary
Road
River
Coastal desert zone
Semi-desert zone
Dry semi-arid zone
Moist semi-arid zone
Km 0
100
200
300
400 Km