Animal traction in Zambia: status, progress and trends 1991

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Part 2

Provincial reports and organizations contacted

Inside 'cover'
PDF 'web' version

This publication has been made available on the web in pdf format. Due to changes in the software since its initial publication there are a few differences compared to the original 1991 version. Among the known differences are:

- Some missing captions (Figs 23-39)
- Three small tables missing (pages 98-100)
- Vertical justification and text flow within sections differs from the original (spacing different but content unchanged).

However the text and overall chapter pagination are the same and should allow people to gain from the large amount of information that was presented in the original publication.

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Northern Province

Ministry of Agriculture, Kasama

Staff of the Ministry of Agriculture at Kasama reported that one major constraint to the development of animal traction in Northern Province was the shortage of weaner steers. The shortage was most noticeable in the Kasama, Chinsali, Mporokoso and Mpika Districts where demand for draft animals is increasing but where few farmers are traditional cattle keepers. In these districts the introduction of animal traction involves the training of farmers and oxen.

The MoA is actively encouraging oxenization and has launched a school information programme on the subject with extension pamphlets in English and Bemba. The MoA has also promoted oxenization through ox-plowing competitions.

MoA staff considered that the present demand (estimated by some at 1000 oxen per year) is far beyond the present supply capacity. The supply problem is exacerbated by the veterinary restrictions that prevent the movement of cattle from the cattle raising districts of Mbala, Isoka and Nakonde. As long ago as 1978, it had been proposed that quarantine stations should be established to allow animals to move westwards. Two possible stations existed. It was suggested that such stations should be used to allow heifers, bulls and oxen to be purchased from the border areas. Farmers could then be assisted to purchase (say) one bull and three heifers to start small breeding herds. There were not enough heifers available within the non-quarantine districts to establish such herds. Without such breeding herds "oxenization" might be unsustainable. The upgrading of the quarantine stations to alleviate the animal supply problem was discussed by Dibbits (1990).

In the three districts in the east where cattle were available, animal traction adoption was also slow. This was partly due to lack of externally-assisted development projects in these districts, shortages of implements, lack of credit and limited marketing opportunities for farm produce. MoA staff noted that throughout the province the maize marketing system was a major problem. It was a severe constraint to animal traction and all other farm investments. Last season's maize had not all been collected, and farmers had not been paid. This made repayment of credit difficult for farmers, who became reluctant to invest in maize production.

Some staff of MoA considered that lack of commercially available feed stuffs for oxen could be a limiting factor, since farmers had been taught to feed their animals every working day. There were also suggestions that the poor quality of local breeding bulls represented a limiting factor to animal traction. [The authors report these two views without necessarily agreeing with them].

It was generally agreed by MoA staff that although animal health constraints existed, they could be overcome with good management. There exists persistent threats of rinderpest and foot and mouth disease along the Tanzanian border. There was concern that the Department of Veterinary and Tsetse Control Services was overstretched. It had limited drugs and veterinary materials, few staff and no extension materials. The Department will receive donor assistance to set up a revolving fund for drugs that will be distributed to the district and sold to farmers. The dipping programme has suffered from insufficient dip tanks. Furthermore, the increase of the fee from K1 to K5 per animal per dip made farmers reluctant to dip their animals. (The actual cost for dipping has been estimated to be K15-20 per animal). Where dip tanks do not exist, spraying against ticks was quite feasible, but expensive.

In order to improve the efficiency of project activities relating to animal traction, MoA has proposed a Provincial Animal Draught Power Project (MoA, 1990; Karlson and Nestande, 1990). Under this, the animal traction activities of VAP, IRDP and the Rice Development Project would be merged. The various projects are already cooperating, and if funding can be obtained, the new arrangements could start in 1991.

Provincial ADP Steering Committee

A Provincial Animal Draught Power Steering Committee was established in 1988. The Committee is chaired by the Permanent Secretary and all the main projects and associated institutions (such as the Northern Cooperative Union) involved in animal traction are represented. The committee remains active, and sometimes meets at field sites. For example, at a forthcoming meeting was to be held at the Chilube Mission, where demonstrations of the use of the imported donkeys were to be held.

Village Agricultural Programme

The Village Agricultural Programme (VAP) is a development programme supported by NORAD. A total of 560 oxen (280 pairs) had been distributed by

VAP from the beginning of its oxenization programme in 1982 until the end of 1989. The programme has never reached its target output of oxen, owing to various constraints, primarily related to logistics and the supply of oxen (VAP, 1989; VAP, 1990). Formerly VAP worked outside the normal MoA structures and staff were employed by the project. VAP activities were being integrated into the MoA. The project is expected to be phased out in 1991, with its animal traction activities being merged with others in the planned Provincial Animal Draught Power Programme.

Rice Development Project

The Rice Development Project is implemented by the MoA with assistance from the European Community. The project is developing rice production in the Chambeshi Flats, in Kasama East and on the other bank of the Chambeshi River in Kaunga Ward in Chinsali District. The project, which builds on earlier work of the IRDP, includes an oxenization programme, with extension work, credit support and assistance with the development of cooperatives. Earlier attempts at mechanization were not successful, and production declined when the tractors broke down.

It was reported that the ox programme, although small, seems most encouraging, and ox power now contributes significantly to the production of rice. The total area of rice increased from 2500 ha in 1989 to 3300 ha in 1990, and much of this increase could be attributed to the use of oxen. Manual farmers can cope with about one hectare of rice, while oxen-using farmers can farm 4-5 ha. Only 25% of the land was cultivated with oxen in 1987, but this had increased to 75% in 1990. There were likely to be 120 oxen in use in 1991, and further expansion seems likely. It is envisaged that the area could sustain 2000 farming families, who between them could use 1000 oxen (500 pairs).

Farmers have been assisted to purchase oxen and plows, and ox-owners provide a hire service for other farmers, who pay in cash or kind. Farmers could hire out their services for K1600 per hectare (K400 per lima) and could earn K5000 per season. A plowing competition had been arranged for extension purposes, and it had been found both successful and enjoyable.

As the Northern Cooperative Union (NCU) was not providing a regular supply of implements in the project area, the project had been supplying ox-drawn implements and cart axles bought in Lusaka. Both Lenco and Northland plows had been sold to farmers and both were considered acceptable in the light sandy soils. Farmers complained that the Lenco plow was heavy, but thought its wide cut allowed faster cultivation. Farmers tended to prefer the Northland plow, although some quality problems had been noted. Farmers did not use the adjustment on the Northland plow, and some replaced the wheel with a skid.

The use of ox carts to transport rice to depots is profitable for farmers, and economical for the project. Farmers could charge K500, or one bag of rice, for transporting ten bags of rice over 3-4 km. The project reported major problems with the Northland cart (bush bearings), and minor problems with the SKF axle (locally-manufactured hubs with ball bearings). The Lenco cart (imported roller bearings) had been found best, but it was expensive.

Although the cost of oxen increased rapidly during 1988 and 1989, the value of rice also increased, and farmers were actually in a better position to buy oxen in 1989 than in 1988 (RDP, 1989). However, although animal traction is affordable, there were doubts whether the supply of animals could be maintained in the absence of the project (which may terminate in September 1991). Only a few farmers in the area have breeding herds. While these are being encouraged to sell weaner steers, the supply of animals from outside the area will be necessary for some time.

IRDP Kasama

The Integrated Rural Development Programme (IRDP) based at Kasama has been supported by SIDA. It has worked with and through the MoA, NCU and the District Councils in Chilubi, Luwingu and Kasama West. IRDP provides loan packages for oxen and implements. IRDP supports two holding grounds for oxen in Matiba and Chifwile to alleviate the problem of ox supply. Steers are bought from ranches and transported to holding grounds where they are castrated and trained. The initial training of animals occurs prior to their purchase by farmers. Between 1982 and 1989, IRDP was responsible for the placement of about 130 oxen. IRDP plans to maintain its oxenization programme until its activities are taken over by the Provincial ADP Programme. Staff of IRDP noted that only a very small proportion of farmers in its target area used oxen. However, oxen were likely to increase in importance, not only for cultivation, but also for crop marketing using ox carts. Much would depend on whether maize production in the province could be sustained by an effective marketing system.

DDSP-Mpika

The District Development Support Programme (DDSP), Mpika, was formerly part of the IRDP that

was active in promoting oxenization in Mpika, Chinsali and Serenje Districts. The work of the IRDP in promoting animal traction in areas where it was little known has been documented by Francis (1988) and others. He reported some of the benefits of animal traction, with adopters of animal traction being able to increase their cultivated areas and thus their total yield of maize. Although DDSP continues to support the oxenization initiatives of MoA in three districts, it ceased playing a direct role in 1989. Its ox-training centre and ox-holding ground in Mpika have been handed over to the District Council, and this has apparently led to a severe reduction in the activities of the centre.

Northern Cooperative Union (NCU)

Staff of NCU reported some of the problems of attempting to supply animal traction implements. The working capital of the cooperative union and the purchasing power of the farmers were both severely limited. It was difficult for NCU to assess the market demand, as farmers did not place orders for implements at NCU Kasama. Similarly the various District Cooperative Unions did not place firm orders with the provincial NCU, and they might be ordering plows directly from suppliers. NCU estimated the demand for ox plows in the province might be 400 units a year, but it was not clear to NCU in which Districts they would be required. At the time of the review mission NCU had 25 plows in stock and on order. The Lenco plow was not popular as farmers found it too heavy. They appeared to prefer the Northland Engineering plow that was cheaper. They had had one consignment of plows from Zimbabwe and these had proved popular.

Zambia Cooperative Federation

Zambia Cooperative Federation Finance Services (ZCF/FS) has been actively involved in the animal traction programme in the Northern Province. Several donor agencies have channelled loan packages through ZCF/FS. In such cases ZCF/FS operates as follows:

- The medium term loans for animal traction are not given as cash, but are dispersed “in kind” in the form of oxen, implements, etc.
- Potential oxen are identified and branded. Their value is determined before the loan agreement is drawn up and oxen are handed over.
- ZCF/FS is responsible for the loan agreement and loan recovery.
- Money reimbursed is used to create a revolving fund.

Unfortunately, ZCF/FS has little capacity to supervise the oxen loans due to lack of transport. To support its programme, ZCF/FS has employed two ox-trainers. It would like more ox-trainers but these are too costly and no training fee is charged at present. It also feels that ox-training should be the responsibility of the MoA. ZCF/FS noted that animal health was a risk to the loans, particularly as drugs and dip tanks were not readily available in the province.

Zambia College of Agriculture, Mpika

Activities relating to animal traction at the Zambia College of Agriculture at Mpika are reported to have increased markedly in recent years. Prior to 1986, the syllabus, developed with Swedish assistance, had been biased towards the use and maintenance of tractors. Since then, there had been an increasing emphasis on animal power, both in theory and in practice. Lack of good publications and training materials are a constraint to effective teaching. A shortage of available oxen has restricted the numbers of animals that classes of students have been able to train and use.

In 1988, following a request from the Provincial ADP Steering Committee, the college started to train oxen and ox trainers. It has subsequently trained staff of several development programmes in the region, including IRDP and VAP. One course was arranged on the harnessing of single animals. The college has also been working with ox carts, but it is restricted in its ability to purchase inputs. The college could carry out more training, if it could obtain more animals. Its own herd of 130 cattle is too small to meet the demand for oxen (and heifers). The college has sufficient land to expand its herd, but not the resources. Due to budgetary restrictions and cash-flow problems, the College has great difficulty in building up funds and assets. It would therefore appreciate external assistance to help it play a greater role in the development of animal traction.

Vocational Training Centre, Musa

The Vocational Training Centre at the Farm Training Institute, Musa, was formerly known as the Appropriate Technology Centre. It was taken over from VAP by the MoA Agricultural Engineering Section in 1989. The Centre is being renovated and plans to hold three three-month courses in blacksmithing and carpentry each year. Trainees will be taught to make their tools. The Village Industry Service (VIS) and the Small Industrial Development Organization (SIDO) will help in conducting the planned courses.

Chilube Catholic Mission, Kasama

In 1990, the ILO Road Maintenance Project in Kasama imported 34 donkeys from Botswana. They are intended for use in road maintenance and transporta-

tion. The donkeys are now kept at the Chilube Catholic Mission. The donkey herd will be partly used for breeding purposes. It was reported that obtaining the donkeys from Botswana was slow, with many bureaucratic processes to be followed. The mission staff were not entirely satisfied with the selection of donkeys. They would like to have a few strong male donkeys for breeding purposes.

Farm visits

Among the farmers contacted was one in Mpika District, who had been using oxen since 1981. He was transporting goods in his old cart, and reportedly also owned a plow, harrow, weeder and a cart. He used all, but mainly the plow. Since adopting draft animals he had increased his cultivated area (to about 0.7 ha) and also plowed for 12 neighbours for a fee of K300 per day.

Three farmers were contacted at the Kasama Demonstration Farm Settlement Scheme. This model settlement scheme is within easy reach of Kasama, and appears to have received much attention from MoA. The farmers visited had been provided with animals and equipment free-of-charge between 1986 and 1988.

One farmer had come from the Southern Province and was familiar with draft animals. He considered the main problems for the spread of animal traction were the shortage of animals and farmer unfamiliarity with the technology. He had access to a communal ox cart that could have been used for transport into Kasama, but it had fallen into disrepair (motorized transport was often available from visiting MoA staff and others). He owned several plows and weeders. Only one plow looked well used, and this was in need of repairs. He would like to increase his animals, with one pair of animals for each of his three wives. He would also like to start breeding cattle.

A second farmer had also received animals from the scheme. He had plowed 3 ha, before one of his animals had died of “bad management” (according to the farmer). His remaining animal had been slaughtered by his family while he was away. Due to his lack of success, he would not be able to approach the scheme for more animals, but felt confident he could buy them locally, should he have the need and the resources.

Another farmer on the scheme had recently plowed 2 ha in nine days. He had then helped his neighbour to plow and train at the same time, by hitching his own trained oxen in front of his neighbour's young animals. He had been given a wooden spike-tooth harrow to evaluate. He reported (in the presence of the supplier/designer of the implement) that it was good. (Actually it had several broken tines and appeared neglected and/or abandoned).

In a very different area, far away from the provincial centre, an ox-owning farmer was visited in the remote district of Mporokoso. He had obtained animals in 1989, from the Chitoshi oxen holding ground run by VAP. His animals were in good condition, benefiting from the by-products of his maize mill. Although he had used his animals very little, plowing just one hectare, they were very docile and used for pulling a simple sledge. He wanted to use them for carting, and so had purchased a pair of very large, cast iron wheels that may have come from the mining industry. As they were excessively heavy he was therefore still searching for a more suitable cart. Although there were few cattle in the area, and little land without stumps in it, he was confident that his oxen would prove useful for farming as well as transport.

Luapula Province

Ministry of Agriculture

Staff of the MoA, Mansa, reported that in 1986 there had been about 50 pairs of oxen in use in Luapula Province. By 1990, this number was thought to have increased to about 200 pairs. (The Investment Plan had suggested there had been 470 trained oxen in 1985). Since 1988, MoA has been assisted in its Cattle Development/Animal Draught Power Programme by Finnida, who were providing technical assistance, logistical support and funds for credit programmes.

MoA runs animal traction training courses at its Lubwe Ox Training Centre, which has been undergoing refurbishment. The number of animal traction courses for extension staff and farmers increased from three in 1986, to eight in 1990. Training relating to animal husbandry is considered particularly important as few farmers in Luapula have any tradition of cattle keeping. Blacksmith training has been arranged in villages and at Lubwe.

The Province has established an ADP Steering Committee that includes representatives of organizations involved in animal traction and cattle development activities, including MoA, Finnida technical assistance, Lima Bank, LCU and ZADL.

MoA staff considered that the shortage of oxen is a major constraint to the development of animal traction in Luapula Province. The number of weaner steers from Chishinga Ranch and Mansa Rural Dairy cannot meet the demand. Of the small number of farmers who own cattle, very few seem willing to sell weaner steers. In order to relieve the animal supply constraint, the MoA ADP/Cattle Development programme has plans to help a few selected farmers to establish breeding herds of indigenous cattle. The target is five farmers per year who will get each 20 animals for breeding. The farmers will receive loans and technical support to construct fences and cattle handling facilities and to develop 10 ha of pasture. Farmers will be trained in cattle management and farm economics. A bull exchange programme is also envisaged to improve herd productivity.

In October 1990, a joint GRZ/Finnida evaluation of the Luapula Rural Development Programme recommended the development of an import support programme for blacksmiths, with tools, steel and coal being supplied through LCU. It was also recommended that the programme should assist the local production of low-cost ox cart wheels, such as the wooden ones used on the Kasisi “Flintstone” cart. SKF axles had been tested, but their bearings had worn rapidly and three had failed.

The Department of Veterinary and Tsetse Control Services considers that the animal disease situation is favoured by the present low population density of animals. It plans to set up drug revolving funds at district level.

The provincial Adaptive Research Planning Team (ARPT) is intending to carry out some simple trials on animal traction technologies in 1991. This may include trials on the use of ridgers, which are not yet employed in the province.

Chishinga Ranch, Mansa Rural Dairy

Chishinga Ranch and Mansa Rural Dairy, which are run by Zambia Agricultural Development Ltd, are the main suppliers of weaner steers for oxen. Traditional herds are few, and their owners often will not agree to sell their young animals (unless they urgently need some cash). Mansa Rural Dairy has a Boran breeding herd. It received funding from Finnida on the understanding that it would be able to supply both young oxen and some breeding heifers. It has sold some oxen, but has yet to release heifers for sale to farmers. Mansa Rural Dairy uses three pairs of animals on the station for transport operations. Chishinga Ranch is the main supplier of weaner steers for the animal traction loan scheme. Steers that have been sold are kept at the Chimengwa farm holding ground before they are trained at Lubwe Ox Training Centre.

Credit institutions

Loan facilities are provided by Finnida through ZCF/FS and Lima Bank. These facilities are for packages, which may include oxen, a plow, chain and sometimes an ox cart. While the Luapula Cooperative Union (LCU) has a standardized procedure, Lima Bank has a more individual approach to the farmers' needs and financial capabilities. Sometimes loan packages cannot be given owing to shortages of funds or oxen. For example, in 1990, Lima Bank promised 50 loan packages but could only give out 17, mainly due to lack of readily-available oxen for purchase. One farmer considered that the package system made it difficult for someone already owning animals to obtain a loan simply for an ox cart. It was mentioned that some farmers who had obtained loans to purchase oxen did not have sufficient funds

to purchase implements, so they eventually slaughtered their animals.

Implement supply

Implements and spare parts are supplied through LCU. At present the demand for implements within the province is quite small, and it was reported that availability of implements at Mansa is not currently a problem. The small numbers of implements are kept in Mansa, not in the various districts.

Manufacturers

The Boat Building, Carpentry and Joinery Workshop in Mansa had made the ox carts used in the loan schemes. Production continued erratically, and did not seem a priority for the workshop. Orders placed with the workshop were not always met on schedule, and this had limited the placement of ox carts through the loan scheme in 1990.

Farm visits

The four farmers visited all obtained their oxen and implements through the ADP/CD programme and were trained by the Department of Agriculture. Two of them had ox carts and used the animals for both plowing and transport. Two farmers reported there was a great demand from neighbouring farmers for the hire of their ox carts. In 1990, they had delivered 720 and 800 bags of maize respectively to the depots over distances of 2-5 km. Their charges varied between K30 to K40 per bag depending on the distance. They had both earned considerably more than the cost of their carts in one season. One farmer, who had in recent years had his fields plowed by tractors, had started using oxen on part of his land. He reported that the high cost of tractor hire, and the unreliability and uncertainty of tractor availability at the optimal time, had encouraged him to adopt animal traction in 1990.

Copperbelt Province

Ministry of Agriculture

The Ministry of Agriculture reported that there were 65,000 cattle in the province, 44,000 in the commercial sector and 21,000 in the traditional sector. Of these 13,000 were "oxen and tollies", and 7300 of these were in the traditional sector (MoA-CBP, 1989). Only a minority (perhaps 30%) of the oxen in the traditional sector were used for work. Despite this small number of oxen in use, the MoA staff reported a shortage of draft power. The area of land under cultivation was apparently being progressively reduced as tractor power became less available, or less affordable.

In 1988, the province arranged for six MoA extension workers to be trained as ox trainers at the Masaiti Farm Institute. In 1990, these were based at training centres in the province. They trained farmers and their oxen, as part of a free MoA service. Nevertheless, most farmers using animal traction did so without assistance. MoA staff considered that their animal traction extension activities were constrained by a severe lack of transport and other resources. MoA has had few project-supported interventions relating to animal traction in in the province. The Smallholder Development Project (supported by the European Community) has recently started, but its operations are confined to the Mpongwe area.

The MoA staff considered that a key constraint to the development of animal traction was the shortage of steers in the province. Some steers could be bought from commercial farmers and institutional farms (such as Nchanga Farms). Other steers were bought in from Central and Southern provinces. In an attempt to alleviate the oxen supply problem, MoA was developing a cattle breeding centre in Mufulira. It intends to sell animals at low cost to farmers wishing to adopt animal traction. [N.B. The authors report this, and other information, without necessarily agreeing with it].

Smallholder Development Project

The Smallholder Development Project (SDP) has been established with assistance from the European Community. Based at Mpongwe, it commenced its activities in 1988, with a detailed baseline survey of its project area (SDP, 1989a). This reported that prior to the start of the project there were about 1000 trained work oxen in the project area. While 7% of farmers owned trained oxen, 23% of farmers reported plowing with oxen, indicating that hiring out of oxen was widespread. Immigration, from other provinces and from neighbouring countries, appeared to be an important influence on the spread of animal traction. Although only 9% of all households in the SDP survey were immigrant households, over 40% of farmers owning work oxen were immigrants (SDP, 1989a).

SDP planned to assist a total of 300 farmers in five years to obtain oxen. It was envisaged that the number of project credit packages for oxen would steadily increase during the project lifetime. They would increase from 35 pairs in 1989/90, 55 pairs of oxen in 1990/91, 85 pairs in 1991/22, to 130 pairs in 1992/3. The purchasing power of the loan fund might be adversely affected by inflationary price rises, but other loans would be available to farmers from ZCF. The project was trying to obtain animals for the farmers, and found it best to purchase steers from local commercial ranches, including Nchanga Farms. However at K38 per kg, these animals were not cheap. The project takes the recipient farmers to identify the animals at the ranch. The animals are then trained on the farmers' fields, with the assistance of project ox-trainers. The first oxen supervised by the project were insured against death at a premium of 6.7% per annum for the full period of the loan.

The project initially organized the placement of 20 pairs of cattle, but an outbreak of corridor disease in 1989 temporarily stopped the project from purchasing and moving cattle. Restrictions had since been lifted and the project was now hoping to place 15-20 pairs of oxen per month, provided supplies could be maintained. Credit was being provided by the project itself and by ZCF.

Locally-made ox carts were used in the project area, and it was thought that carts might become increasingly important as liberalization policies affect maize marketing. The project hopes to facilitate the establishment of marketing cooperatives. The project would like to assist local workshops to manufacture ox carts. It arranged for two ox carts to be constructed, but neither were very satisfactory. SDP has purchased five SKF axles for sale to local workshops, and will also arrange for the purchase of imported axles. The project considered that Lenco equipment was acceptable. It had been having discussions with Lenco to help establish two private agencies to supply Lenco implements and spare parts in the project area.

The project aimed to establish a revolving fund for veterinary drugs. One proposal was that loans would include an animal health element. This part of the loan would automatically go to the revolving fund as a deposit. Farmers would have the right to that value of drugs in the coming year(s).

Project staff have developed a computer programme, based on Lotus spreadsheet software, to assess the economics of animal traction. This has been tested in collaboration with staff of Palabana and it has been found useful in performing sensitivity analyses. These have shown that the animal traction loan package appears economically attractive, provided soya bean and groundnut prices remain high and interest rates do not exceed 30%.

Credit institutions

In 1990, the major institution providing credit for oxen in the Copperbelt was ZCF/FS, working through the Copperbelt Cooperative Union. SDP provided some oxen loans within its limited project area. The Cooperative Union was reported to have provided eight pairs of oxen to selected cooperative societies.

Implement supply

The Copperbelt province is the most industrialised province in Zambia. Several companies set up as "jobbing" manufacturers to service the mining industry have recently diversified into the production of agricultural tools. The companies manufacturing ox-drawn implements include Northland Agriculture Ltd, MDM Engineering and Gilmer Engineering Company. Demand for implements within the Copperbelt province itself is low, and these firms hope to meet demand from other areas of the country.

Implements and spare parts have been supplied through the Copperbelt Cooperative Union. Supply at the provincial level does not appear to have been a major constraint. Nevertheless farmers have often had to travel into the towns to buy equipment, which is both time-consuming and costly. In the Mpongwe area, the SDP was trying to encourage the establishment of local agencies that would sell implements and spares.

Northland Agriculture Limited, Ndola

Northland Agriculture Ltd of Ndola is the oldest and largest producer of animal-drawn implements in the country. It was formed in 1978 as a subsidiary of Northland Engineering, a large "jobbing" engineering firm serving the mining industry in the Copperbelt. It is part of the Anglo-American group of companies. Northland Agriculture derives 70% of its revenues from agricultural implement production. It started making ox-drawn implements using old machines and "jobbing" techniques, without a clear production line and without specialized jigging and tooling. It has continued this system of production for twelve years, although in the past five years, the company has attempted to improve both quality control and tooling. It has recently installed a forging unit to manufacture hand tools. This unit can also be used for heat treatment of plow parts, and this should allow the company to improve the quality its mouldboard plows and other ox-drawn implements. In the coming years Northland expects to place greater emphasis on hand tools.

Most of the implements made by Northland are of long-standing "Safim" designs. These include (in descending order of sales volume) a mouldboard plow, ridger, cultivator and harrow. Northland considers that the designs it manufactures have been well-proven in the region, and its sustained sales figures over many years illustrate their popularity with farmers.

Northland prepared an original design of ox cart, using bronze bearings, spoked metal wheels and solid rubber tyres. The tyres were specially made in Zambia by Dunlop, but by late 1990 their cost had risen to K6000 each. This is likely to be prohibitively expensive. The bronze bearings wore rapidly, and this, together with relatively high price, meant the cart did not sell well. In late 1990, Northland was no longer making carts regularly. In recent tests by ADP-RDP Magoye, the cart passed its first on-station test. However it failed its longer on-farm test, because its bronze bearings wore very rapidly, and causing axle damage. It was complemented for its light weight and puncture-proof tyres, although farmers felt its wheels were too narrow (Dogger, 1990).

The Northland management acknowledges it has had problems in quality control and in meeting production targets. One reason cited for low production and poor quality was the limited availability within Zambia of suitable sizes and grades of steel. In order to obtain I-section beam steel and share profile steel of suitable quality foreign exchange was needed. The steel then had to be purchased from South Africa, in minimum orders of 400 tonnes.

Northland also attributes its quality control problems to its current method of production, its old machines and its lack of accurate jigs and tooling. It anticipates it could increase production and improve quality if there were major investment in new plant and equipment. This would allow accurate and cost-effective production techniques to be introduced. Northland is prepared to make such investment, but it is difficult and expensive to obtain foreign ex-

change. The procedure involves advance payment followed by long waits for foreign currency transactions, for the dispatch of the goods and for shipping. This means capital is unproductively tied up for long periods, and at a time of high interest rates, this is expensive.

The major customers of Northland are the cooperative unions, which buy large quantities of plows. Other organizations, projects and customers may also purchase direct from the company. Northland noted that transport costs could be reduced if the provincial or district cooperative unions were to establish assembly units. Damage in transit would also be reduced, if implements were sold in kit form. Northland did not itself wish to establish such subsidiary assembly workshops or agencies. Northland does not generally win export orders, but it once exported a large consignment to Tanzania.

Northland has participated in several national activities relating to animal traction, including shows, seminars and technical committees. It has tried to respond to criticism of its cart and plow made by the MoA Agricultural Engineering Section. It has been in contact with ADP-RDP Magoye in this regard. Apart from this, Northland does not feel that it has received sufficient useful technical feedback from the Ministry of Agriculture. While it has heard many criticisms of poor quality, it does not feel that it has been kept abreast of technical developments in implement design and current farmer requirements.

Northland feels that donor-assisted projects are distorting and undermining the market for animal-drawn implements in Zambia. They do this both by the dumping of cheap imports and by selectively supporting some manufacturers. The company does not feel threatened by genuine local competition, provided all firms have equal access to donor and government support.

Although Northland regularly receives visits from personnel employed by aid agencies, the only external support it has received is through the SIDA steel importation programme, of which it was the major beneficiary. In 1990, it received 1039 tonnes of steel, including 236 t plow beam steel, 485 t flat bars, 160 t steel plate, 50 t nuts and bolts, 17 t angle iron and 26 t welding electrodes. It was allowed to pay for these in Kwacha, at a highly favourable rate of exchange. [According to Jonsson et al 1991, by March 1991, Northland and other manufacturers had only paid for a small proportion of the steel they had received under the SIDA programme.]

The company did not feel that it needed technical assistance. It would like foreign exchange support to allow it to tool-up for effective production.

Northland provided figures that indicate that in the five years from 1985, it manufactured, in total, approximately 19,000 plows, 4000 ridgers, 3000 cultivators, 2000 harrows and 500 carts. With improved tooling, access to steel and market demand, it feels it could manufacture such quantities annually. Its past and projected production levels were given as follows:

Implement production at Northland Agriculture

Implement	Annual production					Projected production	
	1985	1986	1987	1988	1989	1990	1991
Plows	6,398	2,819	2,256	1,888	5,704	13,000	20,000
Ridgers	1,384	946	865	391	292	2,500	5,000
Cultivators	493	567	331	1,073	567	3,500	5,000
Harrows	698	114	75	411	664	1,920	5,000
Ox carts	-	108	41	168	153	200	5,000
Value of spares manufactured (in million Kwacha)					1	7	

Source: Northland Engineering quoted by Sindazi (1990)

MDM Engineering, Kitwe

MDM Engineering company started manufacturing agricultural tools and equipment in 1989 and formed an Agricultural Division in 1990. At present this division represents 20% of the company, but it could increase to 50% if markets were secured. It produced 500 steel harrows in 1989, and hoped to increase this to 3000 in 1990 It has started manufacturing spare parts for plows (1000 each of some items), but it is unlikely to start production of complete plows in the near future.

MDM developed a prototype toolbar with cultivator tines. [Initial tests have suggested several design problems.] MDM has marketed its products mainly through the ZCF Commercial Services Division, although it also encouraged direct sales. The company

felt its production levels were initially constrained by lack of raw materials and foreign exchange restrictions. However, MDM Engineering benefited from the receipt of 92 tonnes of steel imported under the SIDA-supported steel scheme.

SKF Zambia Limited, Kitwe

SKF Zambia Limited provides engineering services to the mining industry, with specialization in the supply of bearings for conveyors and other machines. Its multinational parent company, based in Sweden, has an international reputation in the manufacture of bearings. SKF Zambia had no business connections with agriculture, but during the mid-1980s, it heard that several donorassisted projects had tried to develop ox-drawn carts. Many of these carts had had problems with bearings made of wood, bronze or PVC. Therefore, SKF undertook the development of a stub axle specifically designed for ox carts.

SKF developed a stub axle with locally-forged hub fitted with a double row of ball bearings. The bearings were those used on a popular small car in Europe. The hubs could take Landrover wheels, and could be easily modified for other types and sizes of rims. In 1988, 576 hub units were made, and a further 409 were made in 1989. The company made about 800 hub units in 1990, and by 1991 had produced a total of around 2000 complete axles. It anticipated producing 3000 per year thereafter, subject to market demand.

SKF has advertised its products and sells them to provincial cooperative unions, projects and manufacturers. Several workshops in different parts of the country have made carts with SKF hubs. Among cart manufacturers that have used SKF hubs are Power Equipment, Foxy Metal, Turning and Metals and Muzama Crafts.

The reception of the SKF axle has been mixed. Some axles have reported to be working well, but some have seized and some have worn rapidly.

[The Magoye ADP-RDP tested several carts that used the SKF axle, both on-station and on-farm. All carts failed the tests, for various reasons, and although some axles survived the tests, several did not. Some axles were reported poorly assembled and the dust seals were generally inadequate. A more serious problem was signs of internal damage that implied the bearing units were not strong enough their task. The most serious design "fault", noted by ADR-RDP Magoye and some manufacturers, was that the stub axles were factory-sealed units, and could not be easily repaired or replaced in the event of problems. Repair was impossible at village level, and even Magoye ADP-RDP could not repair damaged bearings. Thus the stub axles were effectively expensive "disposable" items: many worked well, but those that failed were unrepairable (Dogger, 1990).]

SKF has been assessing the various reports it has received, but considered that most feedback has been very encouraging. It had doubts about the ADP-RDP testing procedures and conditions. Nevertheless, SKF decided to develop a new design of stub axle, which would take a tapered roller bearing, similar to those used in ox carts elsewhere. This new design is likely to be ready for testing in mid-1991.

Two donor-assisted attempts were made to assist SKF in its ox cart axle initiative, but neither proved particularly helpful. In 1988, a project was drawn up whereby SKF would receive foreign exchange support from Dutch aid, in order to import the bearings and materials for making the hub units. However, due to Dutch doubts as to the acceptability of the hub design, the first shipment of bearings supplied under this project only arrived in Kitwe in March 1991. This consignment, sufficient for the production of around 1200 axles of the old design, arrived when SKF was already working on its new design. SKF had also been offered assistance through the SIDA-supported steel importation project. Due to difficulties in obtaining suitable steel in Zimbabwe, by mid-1991, SKF had not yet received the ten tonnes of steel it had requested.

Gilmer Engineering and CODECO

Gilmer Engineering and CODECO are both "jobbing" engineering companies serving the mining industry. They are ready to manufacture any product, if they are provided with technical drawings and a firm order. During the 1989/90 agricultural season Gilmer started to manufacture prototype harrows. A total of 40 harrows were made, but the company found them difficult to sell. Gilmer would like to produce more implements for the agricultural sector, but it is unlikely to expand in this direction unless it is assured of a market outlet. CODECO made some spiked hoes, but is unlikely but it seems unlikely to take further agricultural initiatives in the near future.

North Western Province

Ministry of Agriculture

The MoA provincial headquarters are based in Solwezi, in the north east of the province. Most of the animal traction is in the west of the province, in the area of operation of NWIRDP. MoA staff reported that there were 52,000 cattle in the province, most of which were in the Zambezi and Mwinilunga districts. There were estimated to be about 1800 trained oxen, most of which were in the Zambezi and Kabompo Districts (Mukuka, 1990). [More recent survey data suggests the figure may be 2100 trained oxen]. Animal traction is increasing in the province, and, consequently, so is the demand for oxen. Some animals are trained at Farm Training Centres (FTCs) with the help of MoA ox-trainers. In the 1989/90 season, MoA trained 23 farmers in the Solwezi area in the use and management of oxen. NWCU also conducted some ox training courses in conjunction with MoA.

The provincial MoA staff reported that there are 500 artisanal blacksmiths in the province. These are mainly farmer/artisans with few facilities. The MoA agricultural engineers intend to provide technical support to these people, and initially four artisans per district have been identified for assistance.

The PAE reported that demand for implements is not very high in the province. Farmers are not adopting animal traction due to the lack of available steers. Plows supplied by Lenco are said to be readily available through the NWCU, but farmers have complained that they are not appropriate. No other animal-drawn implements are said to be available from the NWCU (Mukuka, 1990).

A recent report (Strahl, 1990) considered that the Agricultural Engineering Service in the province lacked staff, resources and professional supervision, and that moral was low. In relation to the provincial animal traction programme, the report complained of poorly-trained staff, excessive prices for oxen and implements, lack of coordination between donors and institutions, unrealistic targets and unreliable data. It also complained of MoA administrative procedures, lack of supervision from MoA headquarters and lack of feedback on the submitted provincial reports. The report called for more emphasis on promotion of cattle breeding by local farmers to make animal traction sustainable. It also called for more support to village artisans, which were essential for maintaining and repairing implements (Strahl, 1990).

The veterinary department considers that support to animal traction is an important aspect of its work in the province. It manages revolving funds for the purchase and resale of drugs, and these are supported by IFAD and IRDP. Cattle are free to move in the province, except close to the Angola border, where contagious bovine pleuropneumonia (CBPP) and haemaerrhagic septicaemia (HS) are prevalent.

Integrated Rural Development Project

The Integrated Rural Development Project (IRDP) of the North Western Province, with headquarters in

Kabompo, has been operating in the Zambezi, Kabompo and Mufumbwe Districts since 1977. It has received considerable financial and technical support from GTZ. In the interests of long-term sustainability, the project itself is now phasing out, with its activities being taken over by other organizations. The animal traction work has been implemented by the NWCU since 1987.

IRDP Kabompo reported that about 600 pairs of oxen had been introduced in its working area between 1983 and 1990. In addition, loans had been given for the purchase of implements by farmers who already owned animals, or who could obtain them. About one quarter of farmers that were growing cash crops in the project area were using oxen. In 1989, about 37% of the area planted with maize or other cash crops was plowed with oxen (IRDP-NWP, 1990). Ox transport had been widely adopted, and over half the marketed maize was being carried to the NWCU in ox carts. The project believed that there were now sufficient ox carts to transport the maize harvest, and so it was restricting the provision of ox cart loans.

The work oxen activities of IRDP are widely seen as successful, and they have been the subject of many studies, carried out by project staff, GTZ and Berlin University. An early evaluation study highlighted that oxen-using farmers were increasing their areas of cultivation (Mack, 1984). Sommer (1987) agreed with this, but suggested that while farmers might achieve an early increase in area as high as 50%, this might later be reduced, so that, in the longer term, a 20% increase might be sustained.

Studies have stressed the very positive effect the project has had on the project area. The provision, by farmers, of hire services for ox plowing and animal-drawn transport has been beneficial to rural communities (Börgel, Fischer and Holler, 1989). Women have benefited from being able to hire plowing teams and ox carts, but few have been able to own them themselves (Beck and Dorlöchter, 1987). Other studies on the animal traction component of the project included those of Löffler (1987), Smotzok (1988 and undated) and Soko (1990).

The project has not been without its problems. It took several years to develop a suitable ox cart, and attempts to use PVC bearings had proved a significant failure. The project had intended to assist in the supply of animals through the creation of a cattle breeding unit, under the Zambezi District Council. This aspect of the project has had little impact and most oxen derive from the private sector. Nevertheless, on the positive side, the project believes its oxenization programme has contributed substantially to an increase in cropped area and the production of maize. It has also helped marketing through its ox cart programme. It attributes its long term success to an appropriate programme, gradually developed over many years, and to a suitable environment. Conditions favouring oxenization included a suitable climate, little animal disease, nearby availability of animals and underutilized dambo grazing areas.

Kabukafu Cattle Breeding Unit

Kabukafu Cattle Breeding Unit (KCFU), located in the southeast in Kasempa District, was started in 1976. This unit was set up to provide a reliable and inexpensive source of work oxen to emergent farmers in the district. Once the herd had grown to 140 breeding cows, it was intended to supply heifers as well. In 1986, it was estimated that cattle population at KCBU was 234, including three oxen and 44 steers. The unit had hoped to have produced 362 steers between 1986 and 1990. This was not achieved due to slow herd growth, limited government funding and financial procedures that prevented revenue from cattle sales being retained and reinvested. The Dutch development agency, SNV, was considering support for the revitalising and upgrading of the unit, to enable it to supply and train at least 50 steers per annum. There were problems over KCFU's pricing policy (it was selling animals at a fraction of their commercial rate) and its lack of revolving fund. Consequently the proposal has yet to be implemented.

Provincial Planning Unit

In 1988, the Provincial Planning Unit organized a workshop to plan the provincial work oxen programme. This brought together many people involved in animal traction at district, provincial and national level. One aim was to allow the areas of new introduction in the east of the province to gain from the experience of the western districts. It was hoped that the benefits of ox transportation could be brought to the eastern districts. A report of the meeting and its conclusions was circulated (PPU, 1989).

Credit institutions

Ox loan packages have been available through NWCU with funds provided by ZCF/FS, IFAD (ADP area), GTZ (IRDP area) and SNV (Zambezi District). By 1988, IRDP (GTZ) had provided loans for 482 pairs of oxen while ADP (IFAD) and ZFC/FS gave out 30 and 34 pairs respectively. The Lima Bank financed five pairs of oxen in 1988, and approve ox loans for nine farmers in 1989. In 1989, SNV provided funds to the Zambezi Agricultural Project to assist 30-40 farmers with pairs of oxen.

Implement supply

The NWCU is responsible for purchasing and distribution of animal-drawn implements and spare parts. NWCU obtains the implements, mainly plows, from Northland Engineering and Lenco. It was reported, by the PAE, that NWCU distribution of spare parts within the province was not related to actual demand.

Manufacturers

Muzama Craft Limited is the main manufacturer of ox carts in the province. It has workshops situated at Manyinga (20 km from Kabompo), Zambezi and Mufumbwe. Muzama was established with assistance from the IRDP, and has been the main supplier of ox carts to the work oxen programme. It is also supported by SNV.

The workshop has tried many cart designs, including ones with wooden wheels and with bearings made from PVC, bronze and wood. It has now standardized on carts with imported axles using roller bearings and pneumatic tyres. The wooden bodies are fabricated from local timber, but most (over 90%) of the manufacturing cost of the cart relate to the costs of purchasing and transporting the axles and tyres.

Manyinga workshop has a capacity of about 20 ox carts per month, while 10 carts can be built at Zambezi workshop. It was felt that production of the carts at the central workshops would assist quality control. However, the cost of distributing fully manufactured Muzama to all districts in the province were high. It was therefore recommended, in 1989, that ox cart production be decentralised as far as possible. Manufacture/assembly was due to start in the Nyangombi and Jiwundu settlement schemes.

Farmers contacted

One young farmer contacted near Kabompo was plowing with small, young oxen in a field with many stumps. It was his first year of using animal traction. He had purchased and trained his animals himself, without project assistance. His Northland plow had been bought from the Cooperative Union. He had tried to obtain an ox cart loan, but had been told that this would be unlikely. He anticipated increasing his area, and would be plowing for other farmers as well.

Several cart-using farmers were contacted near Kabompo. They had obtained their carts through the IRDP/NWCU. All considered their carts to be very profitable, and all were used several times a week. One farmer, who was seen selling his tomatoes directly from his cart, had that morning come in several kilometres from his farm. He had been able to increase his production greatly now that he had a means to market the tomatoes easily.

One farmer in Kasempa District had started using oxen with his brother. He had recently retired, and had come to settle in the province. He had not received assistance, but had managed to purchase oxen and implements. There were few cattle in the area, and no nearby farmers using animal traction, but he had started plowing for neighbours, and several people had expressed interest in animal traction. A big problem was marketing the produce of the farm.

Western Province

Ministry of Agriculture, Mongu

The MoA reported that the use of animal traction for sledge transportation and crop cultivation and has had a long history in the Western Province. Although animal traction is widespread, animals are seldom employed intensively. In many parts of the province, crop production is not the major economic activity for rural communities. Cattle herding, fishing and forest exploitation are often of more importance to people, and crop production is primarily for family subsistence requirements. Much land is only marginal for crop production due to several factors including (in different areas) poor soils, limited rainfall and seasonal flooding.

Some, but not all, ethnic groups have a long history of cattle keeping. About 550,000 cattle are owned, of which 87,000 are oxen and tollies. Only about 50,000 of the oxen in the province are trained for work. The others are retained as a source of wealth. Within the province the social and geographical distribution of cattle is highly skewed, and the many farmers do not own cattle. Nevertheless, the majority of fields are cultivated using oxen. Traditional systems of loan and hire operate for farmers who do not have their own oxen. The families who hire or borrow oxen are at a disadvantage, as their fields are generally plowed later than those of ox-owners. Although about 35% of households are female headed, few female farmers own cattle or oxen. Village transport is important. Ox carts are expensive and scarce. Farmers generally use traditional sledges, pulled by two, four or six oxen.

On a provincial basis, the availability of draft animals is not a problem, but there are local shortages. Cattle and oxen are least common in the maize-growing Kaoma District. This area is considered by MoA to be of relatively high agricultural potential. The farmers in Kaoma are more oriented to crop production than elsewhere in the Western Province. Kaoma district has relatively little grazing land, and MoA advises farmers to give supplements, such as crop residues and maize bran, to their working animals.

Oxen are commonly worked in teams of four, or even six. In most of the province, farmers train their oxen themselves and there is no need of ox-trainers. Standards of training are often low for animals that are only used occasionally for plowing, but animals that regularly pull sledges are generally well trained. In areas of introduction, such as Kaoma, training services may be required by farmers unfamiliar with animal traction.

It was reported that the river valleys south of Mongu, such as the Lui River Valley, have a high potential for rice production. MoA staff expect an expansion of the area used for rice production. Animal traction is expected to play an important role in this.

It was reported that the Forestry Department had carried out some investigations into the use of animal traction. Shallow plowing was found to have given better yields than deep plowing. This was possibly due to the resulting depth of manure placement. Cultivators were considered as an alternative to plows. Five cultivators were purchased for evaluation, but their quality was poor, and spares were not available. Plowing was found superior to tine tillage for suppression of weed growth.

The MoA Women's Extension Programme and the Peoples Participation Project have been involved in training women in ox-handling. Traditionally, women do not handle oxen. Most of the women who had been trained did not continue to work with oxen. Instead they assigned a male relative to plow

with the oxen. Women have more problems in obtaining a loan than men as they have less collateral. [The ADP-WP has other experience of the training women for animal traction, as mentioned below].

A provincial ADP steering committee has not been established. Some MoA officers consider that it would be superfluous since there are already other technical committees including a livestock development committee. One suggestion was to organize a ADP technical committee under the Provincial Crop and Livestock Committee, but there are no immediate plans for this.

MoA has several development projects that include work on animal traction issues in the Western Province. Most of them are supported by The Netherlands. They include the Western Province ADP Project, the Adaptive Research Planning Team, the Livestock Improvement Project and the Masese, Kalabo and Senanga Agricultural Projects.

Western Province ADP Project

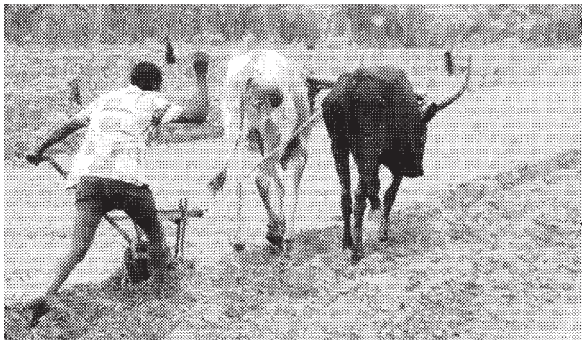
The Western Province ADP Project (ADP-WP) of MoA started in 1989, with support from The Netherlands. The Project has an expatriate Technical Adviser, who is counterpart to the Provincial ADP Coordinator (the PAE). The ADP-WP aims to coordinate ADP activities in the province, and to strengthen ADP infrastructure at provincial and district levels.

The training programme, which accounts for about two thirds of project activities, has been largely based on the earlier experiences of the Looma Oxen Supply and Training Centre. The ADP-WP has been attempting to carry out ADP training and extension functions in all districts. This has stretched its resources considerably.

The project initially concentrated on residential training courses at Looma. These were designed for small numbers of extension workers, farmers, carpenters and veterinary assistants from various districts. The courses covered ox-training, implement utilization and yoke-making. As attendance at courses was sometimes disappointing, greater emphasis has been placed on mobile training. About 20 mobile courses, demonstrations and field days were conducted during the 1989/90 season.

It was observed that extension staff in Mongu District who had been trained in animal traction were not effective in passing on their knowledge to farmers. Courses for contact farmers themselves were considered more effective. About 24% of farmers trained have been women farmers. A survey has been carried out to assess the impact of the training. This concluded that training was beneficial, particularly for those with easy access to oxen who could readily apply the skills taught. Women were worried by lack of basic knowledge and skills in handling animals and fixing yokes, and the courses gave them confidence in these areas. Single women appeared more likely to make use of practical skills in animal traction than married women (Hocking, 1991).

The ADP-WP has been involved in a number of other animal traction activities in the province. It has funded the animal traction revolving fund of KADICU, and assisted WPCU in obtaining oxen and implements for sale to farmers. The project commissioned a staff member of UNZA to undertake a study of blacksmiths in 1990. The project has provided funding for the two mobile ox hiring units that are based at Looma. ADP-WP has also cooperated with ADP-RDP and the Adaptive Research Planning Team in trials of animal traction equipment and techniques. Despite such liaison, the project reported that coordination of animal traction programmes in the province was difficult to achieve, since no formal or regular contacts exist between the



ADP-WP programme and various departments and institutions involved with animal traction.

Department of Veterinary Services

The Department of Veterinary and Tsetse Control Services (DVTCS) reported that disease was not a serious constraint to animal traction in the Western Province. Calf mortality could be high, but once animals had survived to the age when training for work could start, their chances of further survival was high. Trypanosomiasis was a constraint in some areas. The cattle population in the province was steadily increasing, and it was thought that it would stabilize at about one million.

A retail scheme for veterinary requisites such as tick grease and healing oil will be set up in collaboration with the WPCU. To keep the revolving fund operational, the drugs will be sold at replacement prices, and these will be frequently adjusted for inflation.

Animals exported from the Western Province (except Kaoma), had to be slaughtered within 24 hours, in order to stop the spread of contagious bovine pleuropneumonia (CBPP). This meant that the cattle trade was controlled by butchers, and it was difficult to establish a new trade in young oxen for use as work animals work.

The DVTCS is responsible for a livestock development project, funded by The Netherlands. This includes a Socio-Economic Analysis Team (SEAT). SEAT noted that cattle have many roles, and one of their main functions is as a bank. Women seldom handled animals. In some areas up to 30% of animals were owned by women, but they were generally kept in the kraal of a male relative. Women find it difficult to obtain credit for buying oxen and plows. Some farmers who had no animals would buy a plow, as it made it easier to borrow oxen. Socioeconomic studies relating to cattle ownership and use (including aspects of animal traction) have been published by DVTCS, and these include two by Beerling (1986 and undated).

Looma Oxen Supply and Training Centre

The Looma Oxen Supply and Training Centre in Mongu District is a provincial MoA training centre for animal traction courses. It has been operating since 1982, under the auspices of a series of projects. It is currently funded by the ADP-WP. It conducts refresher courses for extension staff, veterinary assistants, contact farmers and cattle buyers.

Following the practice of the earlier Looma project, the Centre still has two small ox-hiring units. Although they achieve some income, they are not fully self-supporting. The argument for their retention has been that they have demonstrated techniques and levels of training. Traditional forms of ox-hiring are widespread in the area, but support may be given by ADP-WP to entrepreneurial farmers who want to start private ox-hiring units in Kalabo and Kaoma Districts.

The Looma centre developed a design of withers yoke in which the point of contact had been shaped into a curve. This yoke has been promoted, and carpenters have been trained to make it. Farmers are said to appreciate them, and small numbers have been sold by Looma and carpenters. However there is little evidence of wide diffusion.

Adaptive Research Planning Team

Since 1988 the Adaptive Research Planning Team (ARPT) has worked on animal traction topics in two areas; Senanga West and Kaoma District. ARPT is supported by the Royal Tropical Institute (KIT) of The Netherlands, and the team includes expatriates.

In Senanga West, the team found that about 90% of household use animal traction, mainly for plowing and sledge-pulling. As the ownership of cattle is very skewed, the majority of farmers borrow or hire oxen. About 25-30% of households were headed by women. These households generally had more difficulty in obtaining adequate draft power, since women generally owned fewer animals than men, and seldom worked with animals, themselves. ARPT considered that the efficiency of animal traction in Senanga West could best be improved by greater daily and monthly use of animals, working of animals as pairs rather than fours, better kraaling and earlier training of oxen (Vierstra, 1990).

In the wetland farming systems, ARPT found great variation in the ownership and use of oxen. In one flood plain area (Liagati) 50% of farmers had oxen and 35% had both plow and oxen. In one dambo area (Mumbwana) 5% of farmers owned oxen, and

10% of farmers owned plows. Male headed households were more likely to own oxen and plows than female headed households. Access to oxen was important for rice production, and this was thought to explain why 70% of male headed households produced rice in Litawa, in comparison with 30% of female headed households (Dicko and Heemskerk, 1990).

The farming systems of Kaoma District are generally based on maize cultivation. ARPT reported that oxen were the main power source, cultivating over 65% of cropped land in the "system" (small scale commercial farmers with maize-based crop production). However, only 25% of farmers owned animals. Oxen-using farmers could plant 2-3 ha of maize, but only 0.6-0.75 ha if they cultivated by hand (Muwamba, 1989). Shortage of animals were serious and resulted in high hiring fees and late planting for many hirers. The ARPT had tried to introduce a jab planter, but this proved inappropriate (Muwamba, 1990).

Trials were carried out with Lenco and Northland plows. The Lenco plows were found to be too heavy for most farming systems, but they could be used for dry season plowing (Vierstra, 1990; Muwamba, 1990). Design and manufacturing faults were noted with both plow types. Farmers preferred the Northland plows. The larger size of the Lenco plow, made it unsuitable for the traditional system of hand-seeding every three furrows (Muwamba, 1990). ARPT noted that at least 90% of farmers removed the hake from the Northland plows, but it advised them not to do so.

ARPT has carried out various on-station and on-farm "research" studies on draft animal management, plowing practices, work output, yoking and supplementary feeding of oxen. Comparisons were made of the effect on work output of different numbers of animals plowing in a field at the same time (Dicko and Mwandira, 1989). If two teams of animals were plowing in a field, this appeared to stimulate work output (a competition effect of the animals or their handlers). However, if one team was significantly weaker than the other, the stronger team reduced its work rate to that of the weaker team. If more than two teams worked at the same time, work output per team decreased (presumably an effect of congestion).

Another ARPT trial attempted to assess the working abilities of oxen, cows and donkeys: apparently this demonstrated that oxen are stronger than donkeys, and oxen stronger than cows. ARPT has initiated a supplementary feeding trial in Kaoma District. One trial demonstrated that oxen receiving supplementary rations grew better than those that did not (but the growth of the unsupplemented animals was found to be satisfactory the year of the trials). ARPT recommended that more training was required in selection, training, cattle management and yoking. ARPT is hoping to find a means to improve planting depth of maize following animal-drawn plowing.

Land and Water Management Project

The Land and Water Management Project (LWMP) has identified the Lui River Valley as being of high potential for rice production. Farmers use oxen for rice cultivation, but have difficulties in obtaining implements, spares and animals. LWMP considers present production is limited by poor marketing facilities and insufficient animal draft power. A development initiative has been proposed that would improve the marketing infrastructure, and assist farmers to obtain oxen and plows (MoA, 1991).

Masese Agricultural Project

The Masese Agricultural Project, supported by SNV of The Netherlands, is a small project trying to stimulate development in Sesheke, in the southern part of the Western Province. Soils are poor, yields are low, and profitability is marginal. Most farmers use animal traction. There are four main types of users: owner, sharers, borrowers and hirers. Sledge transport is widespread, but farmers seldom make more than one trip per week with their sledges. Carts are rare as few farmers could afford them, and the local tracks are sandy are narrow. Animals tend to be poorly trained.

The project has cooperated with ADP-RDP, Magoye, in the assessment of implements and carts. First impressions were that a simple, lightweight plow and a lightweight ridger would be an appropriate combination of implements.

Cooperative Union

The Western Province Cooperative Union (WPCU) has stocked plows in Mongu, but not ridgers, har-

rows and cultivators. Few spare parts have been available. The Union is afraid to tie up money for implements that may not be sold. At one time, projects in the Western Province linked loans to the provision of the Rumptstad/Lenco plows. Despite this, few of these plows were disseminated, as farmers judged them too heavy, and were concerned that spare parts were unavailable.

The WPCU Cattle Development Section is one of the 23 cattle buyers in Western Province. In total 23,931 animals were sold in 1989 (15,659 animals sold outside the province and 8272 slaughtered within the province). It was reported that the Section had about 10% of the market in 1989. It buys oxen for resale to farmers, and can buy 300-400 young oxen per year. If all cattle buyers differentiated between suitable work oxen and ordinary meat animals, it was estimated that 3000-4000 work oxen could be bought and sold annually.

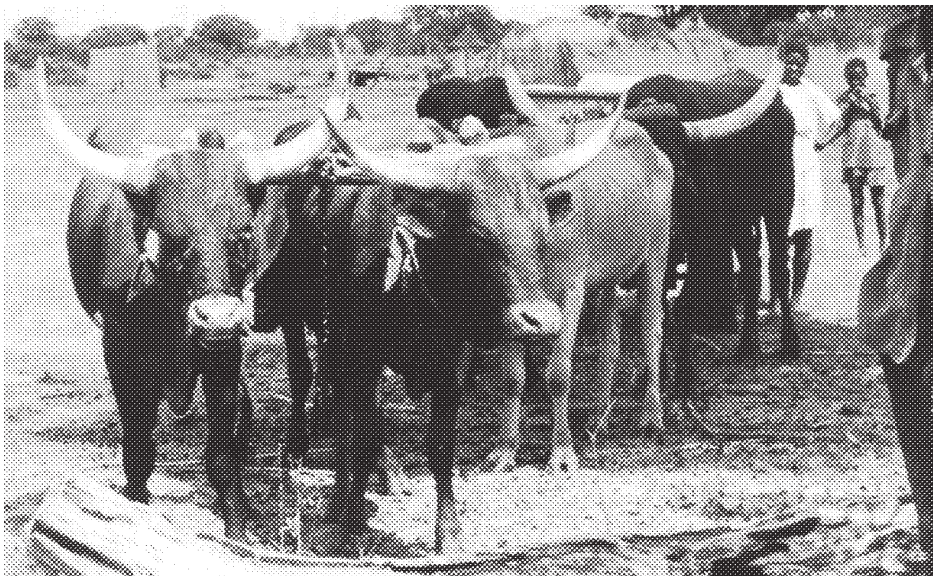
KADICU

The Kaoma District Cooperative Union (KADICU) has established an animal traction revolving fund, with assistance from ADP-WP, supported by The Netherlands. It is designed to enable KADICU to purchase implements, spares and oxen for sale to farmers in the District. The revolving fund was created in December 1990 with an initial capital of K1.1 million. The fund is intended to allow the KADICU to purchase consignments of oxen from Mongu, and implements and spares from Lusaka and the Copperbelt. Decisions on what items to purchase are made by KADICU, in consultation with the DAE and ADP-WP. In order to make the fund sustainable, given the high level of inflation, implements and animals are due to be sold at replacement cost. Whether KADICU will be able to monitor price movements and increase its own charges rapidly and regularly has yet to be determined.

Lima Bank and ZCF/FS

The Lima Bank at Mongu has been giving medium term loans for oxen and implements. The interest rate in late 1990 was 39%. Most loans are given to rice growers as they generally have some form of security for the loans. The supply of oxen has been a limiting factor and the WPCU Cattle Development Section has not been able to meet the demand. Repayment has been unsatisfactory because the production during last season was low and many loans have had to be rescheduled. Applications for loans for ox carts loans will be considered positively, however the carts themselves are in short supply.

It was reported that the ZCF/FS had no money for medium-term loans for animal traction in the Western Province.



Southern Province

Ministry of Agriculture

The Ministry of Agriculture staff reported that work oxen were widely used in the province. Although animal traction was well established, there was need to improve the:

- maintenance of animal-drawn implements;
- health and nutrition of the animals;
- training of oxen.

The most urgent need was to improve support to blacksmiths and village artisans. There were problems with animal health, insufficient veterinary supplies and the cost of dipping. Animal nutrition was poor due to over-grazing and lack of conservation of fodder. The traditional system of training and yoking differed from that recommended by the Palabana Animal Draft Power training course, and so should be improved (Chikwanda, 1990).

Four extension workers had recently been trained in animal traction at Palabana. MoA staff thought that oxen trainers were desirable to improve the standards of animal traction. The figure of two per district, as recommended in the 1985 Investment Plan, still seemed appropriate (Chikwanda, 1990). A detailed proposal to support animal traction in the province within the context of a mixed farming project had been prepared for the consideration of The Netherlands aid programme (Anon, undated). It had not been accepted.

There was currently no donor-support for the provincial MoA staff to carry out activities relating to animal traction. Transport and resources were severely limited. Lack of transport and inputs had been cited as the reason for not surveying ox-trainers and farm implements in use 1988 (MoA-SP, 1988). The same reasons were given for the inability of the MoA staff to complete the 1990 animal traction survey on schedule.

A provincial Animal Draft Power steering committee had been established and had met twice to assign specific tasks. People had seemed interested and motivated, but there has been no report circulated or follow-up. There were some suggestions of inadequate information flow between the various organizations involved in animal traction at district, provincial and national level.

MoA had been involved in surveys relating to artisans and staff reported that there were 320 blacksmiths, 350 carpenters and 25 welders in the province. These artisans had no external support and mainly used simple tools and scrap materials. This meant that the implement repair and maintenance service available to farmers was limited. Many plows were in need of repair. The wheels on the plows from Zimbabwe wore rapidly. MoA is hoping to start a blacksmith training and support programme.

Department of Veterinary and Tsetse Control Services

The PVO reported that the cattle population had been increasing at 1% per year, but, since 1987 there had been a decline in cattle population. The decline was more marked in the traditional sector that accounts for 78% of the provincial herd. The major problem had been the tick-borne "corridor disease". The treatment for this is very expensive, and work on a form of vaccine is still being undertaken. The disease can be controlled by dipping. As most mortality occurs in January and February, weekly dipping is recommended from November to March.

Until 1986, dipping was free and many farmers dipped their animals. In 1987, a dipping fee of K0.50 per animal was introduced. Although farmers

complained to this charge, they continued dipping the animals. When the fee rose to K1.00 in 1988, then K5.00 in 1989, farmers felt that it was too expensive to continue dipping and many stopped. One problem is that cattle in herds may be owned by several people, and some may be lent. It may be difficult for herders to disperse cash on behalf of other peoples' cattle.

For most other diseases, vaccines were available, and these were being administered with support from the EC. Resources to the veterinary department were considered to be a limiting factor, particularly as animal population in the province was so large.

Animal traction survey

In 1989, a survey of animal traction in the Southern Province was organized by the national Animal Draft Power Coordinator Project. This involved questioning 224 farming households, 52 extension workers and 51 artisans in six of the districts of the province (Livingstone was excluded). The report (Tembo and Rajeswaran, 1989) provided some data relating to work animals and implements owned. While it would be unwise to extrapolate from these survey figures to the whole province, the survey did provide some examples of animal traction use in the Southern Province. The survey authors estimated that about three quarters of the 180,000 cultivated hectares in the province were plowed by oxen (Tembo and Rajeswaran, 1989).

It was estimated that in the years 1986, 1987 and 1988 the numbers of plows entering the province were 4,400, 2,500 and 4,400 respectively. In addition there were smaller numbers of ridgers (50, 25, 103), cultivators (15, 122, 210), harrows (10, 6, 812) and planters (0, 2, 0). The authors considered this was well below the market demand (Tembo and Rajeswaran, 1989).

Of the surveyed farmers, 90% owned work oxen and 27% reported hiring in oxen, while 6% reported hiring tractors. About 90% of farmers owned a plow, 53% a cultivator, 48% a harrow, 20% a ridger, 7% a seeder and 45% an ox cart. Ownership of plows was high in all districts, but for other equipment it was lowest in Gwembe and highest in Mazabuka (where 93% of farmers surveyed had an ox cart).

The survey found the average cultivated area in the districts was 7-10 ha, that 81% of farmers survey owned cattle (ranging from 62% in Choma to 91% in Kaloma and Namwala). Of the farmers surveyed, 63% used dips and 20% used sprays to control ticks. Only 10% of farmers provided supplementary feed, and all these were associated with the Small Scale Dairy Development Project which encouraged the use of a maize bran, molasses and cotton seed supplement (Tembo and Rajeswaran, 1989). [In quoting the findings of this survey, the authors of this current report would like to stress that the sample size was small and the household selection procedure was not randomized. Thus while the statistics are of interest, they do not necessarily represent an accurate assessment of the animal traction in the province as a whole.]

Donkey survey

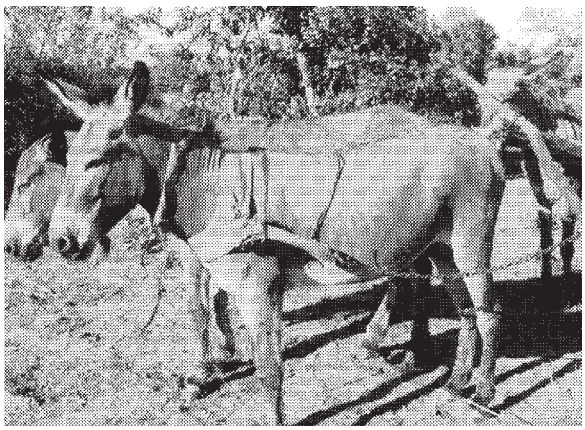
A survey on the use of donkeys in Gwembe South was carried out by the Gossner Mission in association with the national Animal Draft Power Coordinator Project of the Ministry of Agriculture. The survey (Luig and Chimimba, 1989) involved the questioning of 40 randomly-selected farmers in three areas where donkeys were widely used.

All farmers questioned owned donkeys, and some had owned donkeys prior to 1960. There was an average of 3.7 donkeys per household, and all households owned work oxen as well (average 5.1 oxen). It appeared that the donkey population was declining (the farmers reported owning a total of 230 in 1987, but only 148 in 1989). The birthrate (10% a year, births relative to total population) had not kept pace with the deaths. Most deaths were caused by other farmers who had found the donkeys in their fields. Therefore, 95% of the donkeys were herded (mainly by children) and only 30% were allowed to free-range even in the dry season. They were generally herded with the farmers' cattle. Most farmers reported castrating all males except one breeding jack, but they also frequently used males from other farmers for breeding (Luig and Chimimba, 1989).

Farmers considered the breeding performance of donkeys to be similar to that of cattle. About half reported that donkeys foaled every year, and half every two years. Farmers reported few management problems or sickness: the main problem was simply herding the animals when they were not being used.

Donkeys were mainly used as pack animals and travelled long distances to market towns. Almost all (38 out of 40) farmers reported travelling with their donkeys to Kabanga, about 65 km away. Three farmers reported travelling to Livingstone, a return trip of over 500 km. One farmer reported bringing a plow back from Livingstone on his donkey. Loads were generally about 50 kg per donkey (two 25 kg bags of mealie meal; three 15 kg tins of maize; one 50 kg bag of fertilizer or salt). Young donkeys only carried half an adult load. All farmers reported that donkeys were used to carry sick people, but none were ridden otherwise.

One quarter of farmers (10 out of 40) used donkeys for plowing, four farmers used them for pulling logs



and three used them for cultivating. Oxen yokes were used for harnessing donkeys for plowing, cultivating and carting. Almost all farmers were aware that some other farmers used donkeys for cultivating or pulling carts. Most did not do so themselves because they had oxen, because they did not have enough donkeys, or because they did not have a suitable cart or harness. Most farmers would have liked to have purchased donkey carts and donkey harnesses. Donkeys were hired out to transport goods, with most fees being K10-K20 per trip, even for far-away places such as Kabanga. Most donkeys were obtained by bartering, and few farmers knew the cash value of a donkey. Most farmers considered donkeys were superior to oxen in ease of training and handling, feeding and resistance to disease; their main problem was that they were more difficult to herd (Luig and Chimimba, 1989).

SPCMU and credit institutions

The Southern Province Cooperative Marketing Union (SPCMU) is responsible for maize marketing. Maize marketing has been a a major logistical problem and the Logistic Planning Unit is helping SPCMU to develop effective strategies for future marketing arrangements. In late 1990, there was still grain left from the 87/88 and 88/89 seasons in some depots. Farmers had been paid for this, and according to the Union, most farmers had been paid for the 1990 harvest. [A demonstration by irate farmers during the time of the mission suggested not all had received their money.]

The Southern Province has 80 major depots and some satellite depots. There was growing interest in the potential to use ox carts to bring maize to the depots. Under one system in operation, farmers registered with the union were paid K15 per bag of maize transported from the satellite depots to the main depots. This would generally be a distance of 7 km. However the satellite depots are due to be closed, and farmers will now be expected to bring maize to the main depots in future. The price of maize will be adjusted to compensate for this, so that ox carts, pick-ups and tractor-trailers delivering maize will receive the same transport cost per bag.

It is envisaged that 8-12 ox carts will be needed to collect maize at each of the 80 depots, so that a major investment in ox carts is envisaged. ZCF Commercial Services has been allocated K4,000,000 to assist cart manufacture, the money coming from Australian aid, channelled through LPU. In 1990 there had been difficulties in obtaining sufficient numbers of carts of acceptable quality from local manufacturers, and little of the money had been spent. The carts will be sold to farmers on credit (Herbig, 1991).

It has also been proposed that at each main depot there should be a workshop run by the primary society. This should be capable of making carts, maintaining carts and plows, and repairing punctures. It might also be appropriate to build a dip tank by each depot. The establishment of these might be supported by SPCMU and the Logistic Planning Unit.

The General Manager of SPCMU stressed the importance of animal traction in the province. Two thirds of the maize in the province was grown using draft animals. Animal health was a major problem now, and the imposition of high dipping fees had made the situation worse. The union was supporting animal traction through loans and the provision of equipment. The farmers preferred plows from Zimbabwe as they were better and cheaper than locally-produced plows. Plows from Malawi were also good. Northland Engineering had made efforts to improve its plows, and had visited the Union on several occasions. Nevertheless its plows were expensive. The Lenco (Rumptstad) plow had been found too heavy. In the future, SPCMU hoped to develop animal traction support centres at its depots, and would be actively encouraging the transport of maize in ox carts.

Some loan packages are available through the SPCMU, using funds provided by ZCF/FS. These packages usually involved the purchase of oxen, plow and trek chain. Lima Bank is reported to have had a programme targeted at benefiting 832 small-scale farmers. In 1988, Lima Bank provided K 209,840 in loans for 207 items of animal traction equipment. In the 1988/89 season Zambia National Commercial Bank provided loans totalling K319,000 to 68 farmers for oxenization. This represented

about 7% of the general purpose loans to small scale farmers in that year.

Integrated Farm Mechanization Development Project

The Integrated Farm Mechanization Project of the SCMU is funded by a grant from the Italian aid programme. It started in 1989 and aims to increase agricultural production through assisting the mechanization of smallholder and emergent farmers.

The project proposal (Motocultura, undated) envisaged the initial importation of Italian two-wheel tractors and Italian animal drawn equipment. The 8,500 animal traction plows and 2,000 ridgers were valued at just over US$1,000,000 (US$1,500,000 for initial supply of all animal traction equipment). These were to be distributed to farmers in the Southern province, with back-up provided by Italian Technical Cooperation Staff. Lightweight animal-drawn implements would be selected for use with the local N'Dama cattle. [N'Dama are a dwarf West African breed that do not exist in Zambia]. In the second year of the project as study was planned to assess the demand for animal traction implements and local manufacturing capabilities.

In 1988, the Agricultural Engineering Section of the Department of Agriculture had criticized the project document, pointing out that it had no bearing on the national strategies for mechanization and animal draft power. The project did not appear to take account of other Zambian and aid-donor supported initiatives in this field. Furthermore the project appeared back-to-front, starting with major importation of untested equipment, and following this with studies on what was required (Sindazi, 1988).

Despite the disquiet expressed, the project went ahead as planned. The project imported 8500 Italian plows and 2000 ridger bodies. These are of three different makes (Otma, Nardi and Biagioli). The ridger bodies can be fitted to the plow beam. The plows all weigh about 29 kg, which is light compared with the Safim type plow. These plows will be offered on credit. Since the implements came as a gift, project staff consider that their pricing is entirely arbitrary. In the project document, the plows had been costed at US$115. At the end of 1990 they were priced at K1275 (about one quarter of their cost, and about one half the price of locally-available plows).

After they had arrived, samples of the plows and ridgers were sent to Magoye for testing. The Nardi and the Biagioli failed the initial on-station test, but the Otma passed. There was some optimism that the ridger would be useful for secondary tillage. By late 1990, few Italian plows had been sold, and they had not been thoroughly evaluated by farmers. There was some evidence that plow beams were not strong enough for local conditions, and they became badly distorted if they struck obstructions in the soil, such as roots.

The project had also imported 210 Italian two-wheel tractors, complete with implement packages including seeders, hammer mills and trailer carts. These would be sold to farmers for K147,000, with generous credit terms, repayable over a five-year period.

Neither the Italian technical assistance staff, nor the local counterparts, were aware of any pre-project feasibility studies to determine whether the Italian plows and two-wheel tractors were likely to be appropriate in the local farming systems. Apparently the plows had been used “successfully” somewhere in West Africa (possibly Guinea). Project staff were not optimistic about the suitability of the implements supplied.

Implement supply

The major supplier of implements in the province is the Southern Province Cooperative Marketing Union (SPCMU). This union has depots in all districts. It stocks plows, harrows, ridgers and cultivators. SPCMU deals in both locally-manufactured and imported items. Local plows are usually from Northland. A very few plows were bought from Lenco, but the Rumptstad/Lenco plow is yet to be well-established in the province. The imported plows and cultivators are mainly from Zimbabwe. As noted above, there has recently been a very large consignment of 8500 Italian plows through the Integrated Farm Mechanization Development Project.

ZATCO is a private cooperative that has existed since 1927. It has retail outlets in four districts in the Southern Province. It sells animal-drawn implements, which it generally buys from Zimplow in Zimbabwe. These plows have a good reputation for design, quality and price and they are delivered rapidly by rail, often within one week of a letter of credit being issued. In 1989/90, ZATCO imported 1200 plows, 3000 harrows and 5-10 tonnes of spares such as plow wheels, axles, shares, nuts and bolts. ZATCO would order more (2000-3000), but it does not have sufficient capital to meet the Kwacha cost of the foreign exchange. ZATCO had sold about 40 Zimplow double-furrow plows to emergent farmers. The ZATCO officer considered the Northland plow was not popular and was more expensive than the Zimplow, particularly if the price of spares was considered. The Rumptstad/Lenco plow was considered too heavy.

Manufacturers

Private workshops in Mazabuka, Monze and Choma produce ox carts. Most carts are based on parts from scrapped cars and pick-ups. Choma Coach Builders is one such workshop building steel framed ox carts with axles from old vehicles. Another small workshop, Choma Carpentry shop, made 12 ox carts in 1989, and 19 ox carts in 1990. SKF axles were used for a time, but they became too expensive for the price-sensitive farmers. The workshop has therefore reverted to axles from car breakers. The managers of Choma Carpentry shop and Choma coach builders both reported that demand for their ox carts was highly dependent on the success of the harvest and the payments farmers received.

Kaleya Engineering in Mazabuka was created to service Nakambala Sugar Estates in Mazabuka. The workshop has started some repair and maintenance services for the implements of local farmers and it has made some animal-drawn harrows.

Farm visits

One large-scale commercial farmer (Mr. Beckett of Momba Farm, Choma) was using 80 oxen (40 pairs) for on-farm haulage. During peak periods 60 oxen would be working on the farm each day, in shifts. Most pulled two-wheel carts, but some pulled four wheel trailers. Oxen also delivered milk into Choma each day. The use of ox carts was considered more economical and efficient than using a pick-up. Oxen were not now employed for plowing. In the past, eight pairs of oxen had been assigned to plow a field. They would work four pairs at a time, in shifts, with four simple mouldboard plows. The daily productivity of such ox teams was equivalent to, or slightly greater than, the productivity of tractor pulling a three-furrow plow. This farmer was interested in the possibility of using ox-drawn mowers.

Another large-scale farmer near Choma (Mr. Danckwerts) keeps 20-24 oxen to pull his five 4-wheel carts. These are used every day of the year, each cart moving about one tonne of firewood distance of about 10 km. The carts sometimes carry two tonnes, and occasionally as much as five tonnes. Usually one pair of oxen pulls a cart, but with very heavy loads or on sloping ground another pair may help. He did not plow with oxen, although one of his neighbours had just plowed 5 ha of tobacco using oxen. He had recently started to use oxen for tied-ridging. His tractor-pulled ridge-tiers omitted every fourth row. He therefore tied-ridged these missing rows, using an ox-pulled rotating, acentric ridge-tier that he had made himself from an old tractor-pulled version. The operation was effective and had been used on 60 ha of tobacco. He also used oxen for raking hay. He was interested in the possibilities of animal-drawn herbicide applicators.

Oxen were observed plowing a 5 ha field on a large-scale commercial farm in Kalamo District. Three employees, each with a plow pulled by a pair of animals, plowed around large blocks together. Another employee (a women) dropped hybrid maize seed behind the last plowman, so that every third furrow was planted.

One farmer near Livingstone was observed using a locally-made two wheel cart made from a Landrover axle. It was pulled by four donkeys fitted with breastband harnesses. This technology, and the farmer, had come from Zimbabwe. The owner earned most of his living from transport. He could earn K900 a day, as the cart could hold 30 bags of charcoal, and he was paid K30 per bag, for distances up to 20 km. He had plowed with two and with four donkeys, but thought such a practice was only common in Zimbabwe.

Another farmer near Magoye was using a two-wheel cart made from an old pick-up. This was pulled by two donkeys, fitted with a withers yoke, like those used with oxen. The system of harnessing looked uncomfortable and inefficient, but had apparently been used effectively almost every day for at least two years.

Magoye Regional Research Station

Work on the testing and development of animal-drawn implements has been undertaken at Magoye Regional Research Station for about twenty-five years. The early work of the Farm Machinery Research Unit (FMRU) was reviewed by Cullen (1988). Cullen reported that many prototype animal traction implements and an ox cart had been developed during the early 1970s by the Intermediate Technology Development Group (ITDG). However,

the impact of the programme had been limited by lack of Zambian counterparts, weak extension and the short duration of the project. There had been few animal traction research and development activities undertaken at Magoye from 1973 to 1986, during which time the position of full-time research engineer was vacant. Some collaborative implement development had been undertaken during 1979-1980, when staff of Magoye had helped Northland Engineering to develop a range of locally-manufactured animal-drawn implements (Cullen, 1988).

The FMRU started to receive technical assistance from the British Overseas Development Administration (ODA) in 1986, with a programme of work that emphasized tractor-based mechanization. The complementary Animal Draft Power Research and Development Project (ADP-RDP), also based at Magoye Regional Research Station, started work in 1987.

Animal Draft Power Research and Development Project

The Animal Draft Power Research and Development Project (ADP-RDP), supported by The Netherlands, is a national project, based at Magoye. Its objective is to promote and support the introduction and local-manufacture of an increased range of animal-drawn implements. These should be of appropriate designs and suitable quality for small-scale and medium-scale farmers. The project also aims to support the development and introduction of improved tillage systems.

To achieve this, its main activities are:

- formulation and implementation of standard testing procedures and the testing of animal-drawn equipment;
- on-station and on-farm tillage systems research;
- on-farm tillage systems demonstrations;
- implement development;
- operation of an animal traction demonstration farm at Magoye (IMAG, 1987).

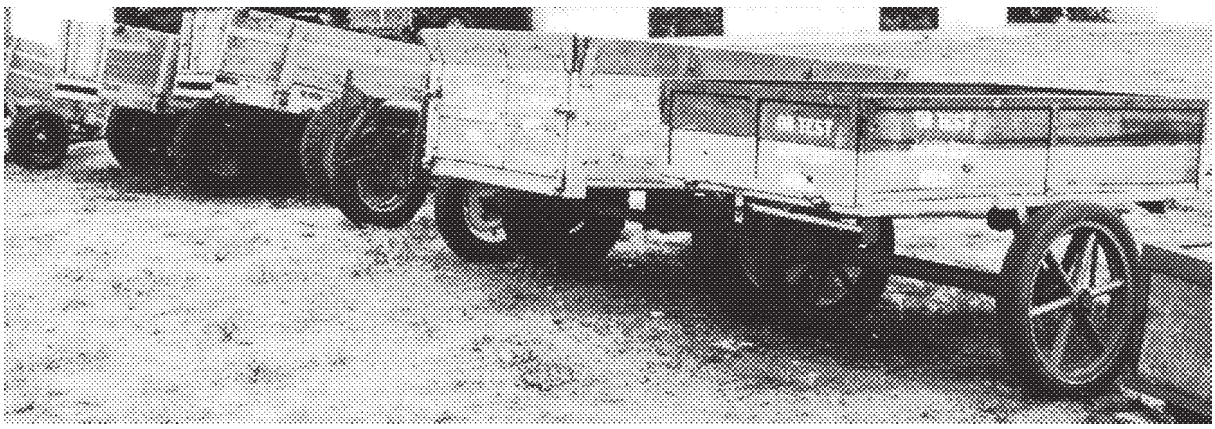
The project has developed Zambian standards for the testing of ox-drawn plows and ox carts and these have been approved by the Zambian Bureau of Standards (ZBS, 1990a and 1990b).

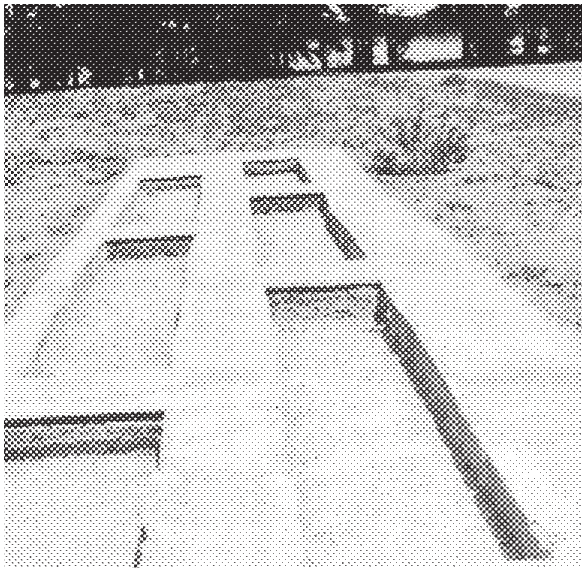
Ox cart tests

The project has tested several ox carts, both on-station and on-farm. To facilitate standardized on-station strength tests, a concrete test track has been made at Magoye. The on-farm testing took place for a minimum of six months in different ecological zones. A group of farmers was arranged in a rotation schedule, and after four weeks, they passed on their cart and received one of a different design. Details were recorded of cart breakdowns and farmer reaction.

The results of tests on 19 designs of ox carts have recently been published (Dogger, 1990). Seven of the carts passed the on-station tests, but only one passed the on-farm testing. This was the cart made by Lenco using imported Italian axles and rims. It was also the most expensive cart. Several carts using the SKF axle passed the on-station tests, but the axles did not generally survive the on-farm tests. It was reported that the wooden block bearings used in the TDAU carts can work very well, provided they are accurately made and fitted. However, the precision required for constructing such axles requires more skill and equipment than is usually available in rural workshops. Thus good wooden bearing blocks are relatively expensive to produce, and poor ones, though cheap, rapidly give problems. Although farmers like the idea of puncture-proof wheels, they generally found pneumatic tyres best.

It appeared that the best solution for ox carts in Zambia, would be a cart based on a high quality axle, such as that supplied by Lenco. A suitable cart should have a cheaper body than that currently sup-





plied by Lenco. Carts based on old car axles (as already widely used) might also be of good quality. Such carts are limited by the shortage of appropriate axles.

Tests of plows

The ADP-RDP has also tested several plows both on-station and on farms, and has carried out on-station comparative trials (Dogger and Meijer, 1989; Meijer et al, 1990). One lesson from these is that on-station testing for technical performance (e.g. plowing quality, draft, wear and tear) is not sufficient. Farmers judge plows on a variety of criteria, including colour, shape and weight and they do not necessarily opt for that which is technically superior.

A good example of multiple criteria for plow quality relates to the first Rumptstad/Lenco plow. Although it had a weak hake, in terms of other technical specifications and on-station performance it was the best ox-drawn plow the project had tested. Yet farmers had firmly rejected it because its was considered "too heavy". It was physically heavier than the other plows. If it were adjusted correctly it could give a large cut requiring a very "heavy" draft (1626 N for 438 cm^2 specific area compared with 536 N for 97 cm^2 for a worn "Safim" type plow). Although the actual draft was high (as perceived by the animals) the specific draft (draft force relative to size of cut, a measure of efficiency) was low for the Rumptstad/Lenco plow (Dogger and Meijer, 1989). In one trial, in three different soil types, the average draft of the Rumptstad/Lenco plow was 943 Newtons, with a specific area (cut) of 360 cm^2. This compared quite favourably with 928 N for a specific area of 290 cm^2 for the Northland plow.

In the same trials, the Zimplow had a lower draft for a comparable area (859 N for 350 cm^2). Based on technical criteria and farmer acceptance, this does appear to be the best plow overall at present. It is very popular with farmers.

The Gameco plow had the heaviest draft of the plows tested, due to its abrupt mouldboard shape. The Northland plow had some defects (notably with the wheel bearing) and the problems were mainly attributable to poor standardization and inadequate quality control at the factory. The overall performance of the Northland plow was considered to be "fair".

Comparison of worn and new plows

During tillage trials, it was found that a Rumptstad/Lenco plow adjusted to plow deeply (requiring a high force) controlled weeds better than worn or shallowly adjusted plows, and led to higher yields (Dogger and Meijer, 1989). However when this trial was repeated the following year, the worn plow performed better. One possible explanation for the different results between the years, was that in the first year, the soil was drier, so the worn plow had difficulty in penetrating. For the present, the somewhat surprising conclusion is that there is little detectable difference in total time of operation and crop yield between plows that are worn and those that are new, nor between badly-adjusted and well-adjusted plows. This may explain why farmers seem so tolerant of plows that seem (to agricultural engineers) to be performing badly.

Case for compulsory testing

ADP-RDP staff felt that testing should be made compulsory. Marketing of implements should not be allowed before the implement has passed the necessary tests. This should be applied to both locally-manufactured and imported implements. This would protect farmers from buying unsuitable implements and save manufacturers from making implements the farmers did not want. The problem is that manufactures and aid donors do not appear willing, or patient enough to accept compulsory testing.

The present technical and farmer-acceptance tests could have prevented Rumptstad/Lenco from importing the first batch of heavy plows. The second Rumptstad/Lenco "Sandy 3" plow was submitted for testing and was found to have major design defects (Meijer et al, 1989), and so these were never marketed in Zambia. As a direct result of the ADP-RDP tests, the latest batch of Rumptstad/Lenco plows ("Sandy 4") have been given stronger beams. However, Rumptstad also made other modifications to

the "Sandy 3" design. Thus the "Sandy 4", which is now being marketed by Lenco, has not itself gone through the standard testing procedures.

Two of the three different makes of recently imported Italian plows had failed the first on-station tests. Several thousand of these plows, costing about US$1,000,000, had already been imported for sale to farmers. Such an apparently unsatisfactory situation could have been prevented, if an initial batch of plows had been tested before such large-scale importation.

Ridgers, cultivators and seeders

Besides the plows and ox carts, the ADP-RDP was also working with cultivators, ridgers and planters. These have been tested in replicated on-station trials and multi-locational on-farm assessments. Provisional observations are as follows:

- Direct ridging can be an effective as an alternative to plowing. It is almost twice as fast, and has comparable draft requirements.
- Ridging and tied ridging can lead to effective soil and water management.
- Primary tine tillage is fast, but is less effective than plowing for weed control.
- Ridgers and plows can both be used for weeding. The use of a plow is more time consuming. The efficiency of tine weeders depends greatly on soil conditions.
- No acceptable alternative to hand-metered, third row planting, nor to the locally-available planter, has been found.

ADP-RDP considers ridgers as most promising implements for both primary tillage and weed control. In one trial ridgers were superior to three designs of cultivator in controlling weeds (Dogger and Meijer, 1989). ADP-RDP believes that ridgers will play an increasingly important role in soil and water management practices in Zambia, and is assessing the advantages and disadvantages of the various ridgers available in Zambia.

Other ADP-RDP activities

The project has a pair of donkeys for research purposes. In comparison with oxen, donkeys play a very small role in Zambia at present. Nevertheless there is increasing interest in the potential for donkeys in Zambia and in most countries in the region.

The project has also been involved in the evaluation of an animal-powered mill, similar to the ones developed in West Africa. The first test results showed that there are still technical problems to be solved before they can be recommended for introduction to the rural communities. The output of the mill is not considered high enough and it varies greatly with the moisture content of the grain. Feasibility trials are being carried out by a GATE/GTZ regional project to find out the socioeconomic acceptability by rural communities.

The ADP-RDP envisages continuing its programme of on-station tillage trials, but it will not continue with its demonstration farm at Magoye. It will be carrying out on-farm testing of implements and ox carts in Southern, Central, North Western and Western Provinces, in cooperation with local farmers and MoA staff. It will continue to liaise with implement manufacturers and participate in field days and agricultural shows.

Central Province

Ministry of Agriculture

Ministry of Agriculture staff reported that there were great differences between the districts of the Central Province in regard to the status of animal traction. The people and the farming systems differed markedly, as did the patterns of cattle availability and disease. Some tribal groups were used to owning cattle and had employed oxen for generations, while in some areas cattle were rarely seen. As a result of this diversity, ways of promoting animal traction varied between the different districts.

The 1990/91 animal traction questionnaire survey, undertaken by MoA, suggested that 21,500 plows were in use, and another 6400 were need of repair. There were 9300 carts in use (plus 3400 in need of repair) and 10,900 sledges. The survey estimated there were 9200 harrows, 6000 cultivators, 5400 ridgers and 1300 planters in use.

The survey suggested there were about 41,000 trained oxen in use, out of a total of 55,000 oxen. The 1989 cattle census had reported there were 100,000 "oxen and tollies" in the smallholder sector in province. The large difference between the estimated 55,000 oxen and the census figure of 100,000 "oxen and tollies" may (possibly) be attributable to the somewhat unclear definitions of what exactly are oxen, tollies and steers. The estimate of 41,000 oxen in use accords well with estimates of plows owned and also with one MoA guestimate that about one third of all steers in the traditional sector are used for work. The animal traction survey did not specifically record the number of female animals used for work, although it has been observed that cows are increasingly being employed.

Most work oxen are found in Kabwe and Mumbwa, with only about 1000 oxen in use in Serenje. The provincial census figures imply that there are many untrained steers available, and so the supply of work animals should not be a constraint for the province as a whole. Nevertheless, the uneven distribution of cattle means that there are some areas (such as Serenje) where few steers are available.

Recent MoA ox-training initiatives have been concentrated in Mkushi and Serenje in the east, where animal traction was being introduced. In 1990, there were two MoA ox trainers in Mkushi, and four in Serenje. The ox trainers usually spent one month in a village, training both farmers and their animals. In 1988 in Serenje District, 100 pairs of oxen had been trained. It was thought that this level of training would be sustainable in 1989 and 1990. There were reported to be shortages of cattle in both Mkushi and Serenje districts. There was one ox supply centre based in Mkushi, run by ZADL. A supply centre for oxen had been established in Serenje District in the mid-1980s by the IRDP, which existed then. It had subsequently been handed over to the District Council. Herd productivity had fallen, and output had become minimal.

In Kabwe and Mumbwa Districts, animal traction is well established and farmers train their own animals for plowing, weeding and transportation. In these areas MoA staff considered that the maintenance of implements and the supply of spare parts was a constraint. Very few artisans are capable of making spares for ox drawn implements. Mumbwa district has five active farmer/blacksmiths, trained under an FAO-supported scheme. They only operate as blacksmiths during the dry season.

Major disease constraints exist within the province. Trypanosomiasis is a threat, particularly in the west and the east of the province. Prophylaxis twice a year with Samorin (costing about K30 a dose) can be effective. The European Community has been supporting such prophylactic treatment. Corridor disease has hit the central areas of the province, leading to high mortality in some herds that had not been practising dipping or spraying.

Maize Development Project

The former Maize Development Project had been supported by the European Community (EC). It had implemented a credit programme to help farmers to purchase oxen. This credit scheme had been implemented through Barclays Bank, with financial backing provided by the EC. The credit scheme was started in 1985 and had a target of 500 loans to be issued by 1987. Repayment figures were reported to be good, being 98% in 1986, and 92% in 1987. The programme was intended to be run on a sustainable, commercial basis, with a commercial bank giving loans at normal interest rates, with donor funds only used for initial capital and security.

In some ways the project had been successful, with 500 pairs of oxen having been placed. However, only about 300 of these were still in use a few years later. The rest had been sold, consumed or stolen, or had died. The demand for meat in the province was such that farmers short of cash were tempted to sell their animals to butchers. If an animal became sick,

there was a tendency to slaughter it immediately, to ensure there was a return on the investment.

As there was a significant tsetse challenge, there had been a campaign to provide Samorin vaccinations twice yearly. In one campaign, the project had vaccinated about 10,000 cattle. In a comparable scheme, the veterinary department had vaccinated about 550 cattle. Corridor disease threatened cattle in the area, but oxen-using farmers had successfully used sprays to prevent death.

The project had undertaken some testing and development work with animal-drawn implements, and had made a forecarriage plow with two wheels to give stability. The work did not reach the stage of manufacture or farmer adoption.

Smallholder Development Project

The Smallholder Development Project, with financial and technical support from the European Community, follows the Maize Development Project. It is also attempting to promote animal traction, but hopes to learn from the previous project. It will provide loans for implements and carts, rather than animals. As farmers will have to provide their own animals, it is thought they will be less likely to sell or slaughter them. In the first year, about 200 loan packages are envisaged. The prevailing high rates of interest and inflation are considered to make the work of the project more difficult.

Implement supply

Implements are normally supplied by the Central Province Cooperative Marketing Union (CPCMU) and by some small dealers. The supply of ox drawn implements is reported to have improved greatly in the past five years. The province receives both imported and locally manufactured implements. Supplies are best along the line of rail. The demand for spare parts is far higher than the limited supply.

Manufacturers

There are no major manufacturers of ox drawn implements or spare parts in the province. Small numbers of ox carts, made from old vehicles, are fabricated by artisans and small workshops in several places.

In some locations, notably in Mumbwa District, artisans manufacture spares such as plow shares, landsides and tines for harrows. An FAO/UNDP-assisted village workshop pilot project had originally established 25 workshops. Artisans had been trained, and had received loans to purchase tools. Only seven workshops were still thought to be in operation.

COMET (Copper Mines Enterprise Trust) is assisting artisans in a variety of ventures. With technical advice from Intermediate Technology Consultants of the UK, it is planning to start manufacturing ox carts. It had recently imported two carts (of long-standing Zambian/Zimbabwean design) from the firm of FarmKart in UK. It was hoped to sell the carts through established organizations like the co-operatives.

Farm visits

One farmer visited in Kabwe Rural District was plowing with four animals, one of which was a female. He did not feel that it was unusual to use female animals, although most farmers would use oxen if they were readily available. His young oxen had only recently been trained. They had developed yoke sores, possibly caused by the ends of the metal rods that passed either side of the animals' necks. The sores had been treated with tick grease. The farmer reported that he, and his neighbours, had lost animals from corridor disease. He now sprayed his animals weekly, using a cotton sprayer. Obtaining dip chemical from the veterinary department was not always easy, and so he tended to buy from a chemist. However at K5000 for a 5-litre drum, he found the cost of the dip expensive. This farmer hired out his oxen and his cart. Last season he carried 100 bags of his own maize, and 400 bags for neighbours. His cart, based on the axle of an old Landrover, could carry 15 bags. During the main transport season he would do two trips a day, and at K20 per bag, he could earn K600 per day.

Another farmer in the same district also used one female animal in a team of four. He did not have a cart, as he could not afford one. He did however hire out his sledge. At the time of encounter, four animals were dragging his sledge loaded with crates of tomatoes, which a woman was planning to sell at a roadside market.

Eastern Province

Ministry of Agriculture, Chipata

In Eastern Province, the MoA oxenization programme started in 1975 in Chipata District, within the framework of the Intensive Development Zone Programme. The province had a large cattle population that were little used for draft purposes. Later, the Integrated Rural Development Programme extended oxenization to all the "plateau" districts in the province. Until 1985, this programme was carried out in conjunction with the MoA Animal Husbandry Section. From 1985 to 1987 the Agricultural Engineering took over animal traction duties. In November 1987, it was felt that enough farmers were competent in ox-training to make oxenization sustainable. Oxen training was phased out. The full-time ox trainers were laid off, and then contracted to conduct special mobile courses on ox-training and the adjustment and maintenance of ox-drawn implements. The Agricultural Engineering Section continues to conduct mobile courses, and there were seven of these between July 1989 to June 1990.

Considerable attention has been given to the training of artisans in the province, and several blacksmith support workshops have been established. Lack of raw materials and technical tools have constrained blacksmiths. This has improved recently through the FAO-sponsored blacksmith programme. The MoA Agricultural Engineering Section is closely involved in the coordination of the Katopola Agricultural Engineering Centre.

The cattle population of the Eastern Province was estimated at 270,000, in 1989. There is no overall shortage of steers, but some areas, such as Chama District, are reported to have insufficient oxen. East Coast Fever is found throughout the province, except for some parts of Petauke District bordering Katete District. Movement of animals into Petauke is therefore restricted. Communal diptanks have been established, but the present fee of K5 per animal has discouraged farmers from dipping their animals. Standard vaccinations are said to be carried out on cattle between the age of three months and one year in Chipata, Chandiza, Katete and Lundazi Districts. Trypanosomiasis is found in all parts of Eastern Province except in some parts in Chadiza. The Veterinary Department is attempting to control the tsetse fly vector with impregnated traps. Cattle in the greatest areas of risk are also inoculated "Samorin".

The Animal Husbandry Section conducted a survey of farmers in cattle development areas, including Mwase, near the Malawi border (Simukali, 1989). The survey of 47 households in Mwase indicated that 96% of the farmers used animal traction. Between them they owned 89 spans of oxen (total of 206 animals), 78 ridgers, 45 plows, 27 carts, 25 sledges, 2 harrows and one cultivator. The great importance of ridgers is noteworthy, and the small numbers of harrows, seeders and cultivators is probably related to this. Despite the widespread use of animal traction, farmers generally cited the production of milk, meat and manure as being their main reasons for owning cattle (Simukali, 1989).

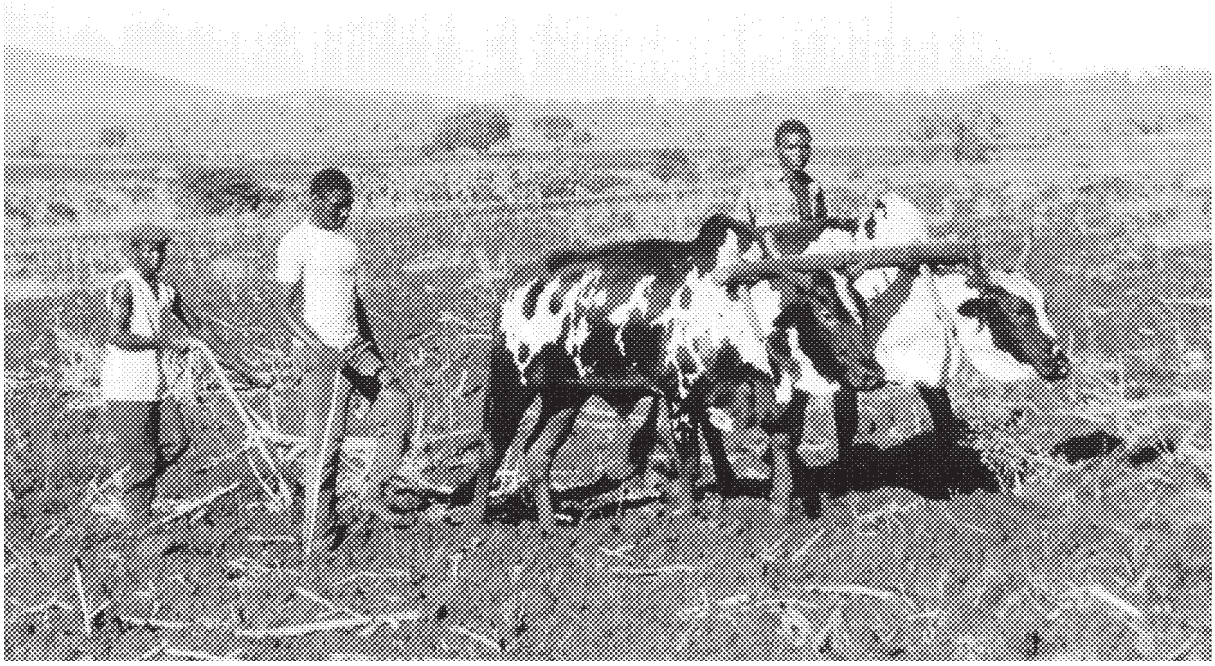
Adaptive Research Planning Team

The Eastern Province Adaptive Research Planning Team (ARPT) carried out some basic implement testing in 1986/7, in collaboration with the Msekocika Project (ARPT-EP, 1987). This compared plows and toolbars supplied by Agrimal (Malawi) and Bulawayo Steel (Zimbabwe), as well as by Northland and Lenco (Zambia). The plows of Bulawayo Steel, Agrimal and Northland were all of Safim-type design, but quality differed. The Zimbabwe plow was best and the Northland plow poorest. The marketing manager of Northland had visited the team in 1986 and assured them that implement quality was being improved. The Lenco plow gave problems with its hake and it was considered heavy. However, its wheel was good and large, the steel was good quality and its potential working rate was high. Having a wider cut, three-row planting of maize with the Lenco plow resulted in excessive inter-row spacing, and so alternate row planting was necessary. ARPT considered that all implements should be made available. They concluded that the most suitable implement overall was the Agrimal toolbar, with plow body and ridger (ARPT-EP, 1987).

Agricultural Mechanization Project

The Agricultural Mechanization Project was established with support from FAO. It provides a tractor hire service to cooperative societies. Farmers who ask for early plowing, before the rains, receive a discount. If the rains are late, demand for tractor services becomes excessive; even ox-using farmers try to hire tractors in these circumstances to improve their timeliness.

The plowing charges were intended to allow the project to be sustainable and commercially viable. In



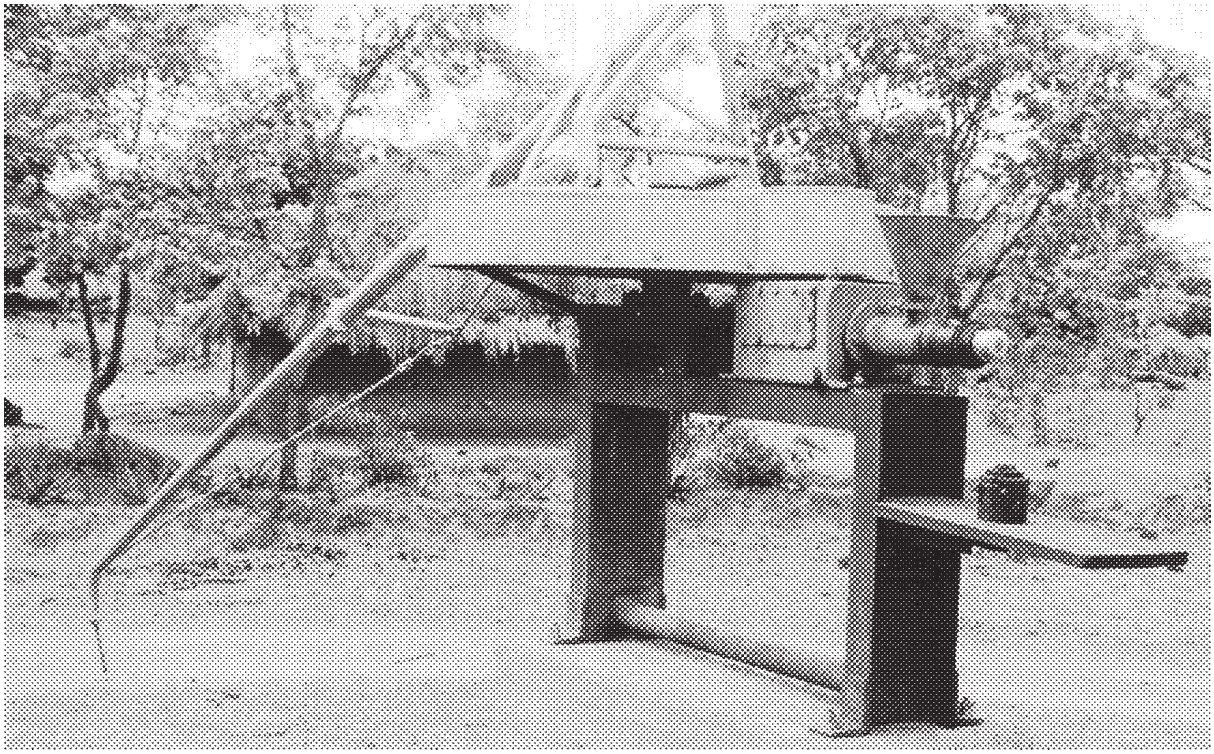
practice, income has covered only the running costs of the service, and replacement of equipment has been impossible. Inflation has been a contributory factor, and insufficient allowance for this was made in the accounting system. In 1990, the cost of plowing with a 70 Kw tractor and a three-disc plow was raised from K267 to K1000 per hour. The Project staff believe that the tractor hire charges are now realistic. They do not think that the further development of oxenization in the Eastern Province will be threatened by subsidized tractor services.

The blacksmithing programme of the Agricultural Mechanization Project is meant to assist smallholder farmers in repairing their implements. It was observed that many animal-drawn implements were abandoned, because there were no repair facilities and no spare parts. In establishing a blacksmith programme, the Agricultural Mechanization Project tried to learn from the experience of a similar FAO-supported blacksmith programme in Central Province. In the Central Province programme village artisans were trained and equipped, but many quickly migrated to urban areas where they could earn more money with their skills and equipment. Village workshops had been set up too close to each other, and they they had therefore saturated the local market.

The blacksmith programme in Eastern Province has been associated with the cooperative movement. The candidates for the blacksmith courses have been members of Primary Cooperative Societies who select their candidates. The final selection is done by the blacksmith training instructors. The village workshops sell their products to the Primary Cooperative Societies. If the market is saturated, they sell their produce on to the district and provincial cooperative societies. The supply of steel and coal is decentralized. There are stores in Petauke, Katete and Chandiza and another is planned in Lundazi. The steel and coal are handled by the cooperatives in collaboration with the District Agricultural Engineers.

Out of the 60 artisans who were trained between 1986 and 1990, only six have failed and had their tools repossessed. These were following a retraining course offered by the project. The trained artisans are visited once a month. Some items of the tool kit, such as the tongs, are made during the training course. Other are imported and sold on credit. The training courses concentrate on the maintenance and repair of ox-drawn implements and the manufacturing of spare parts. It was reported that there was need for refresher courses for blacksmiths as design criteria for ox-drawn implements and basic setting of implements were given insufficient attention in the past.

Village workshops have also been involved in ox cart manufacturing; they make the cart bodies and the project provides the axles and the wheels. The ox carts are bought and sold by the cooperatives. The limiting factor in ox cart production is the availability of axles and tyres.



The project has also assisted other projects, including one in Senanga West, in training blacksmiths. In-service training courses for District Agricultural Engineers have been held in collaboration with the Agricultural Engineering Section.

Katopola Centre

Katopola Agricultural Engineering Centre (KAEC) near Chipata provides services relating to vocational training and rural structures. It has, for many years, received support from SIDA. The Vocational Training Section offers courses on the making of farm implements, blacksmithing and rural technology for women. It also offers in-service training courses in carpentry and blacksmithing for District Agricultural Engineers.

KAEC aims to train school leavers and upgrade rural artisans in blacksmithing, carpentry and tinsmithing. The centre caters for both male and female participants. The farm implements course is reported to be a woodwork course of six months. During the final three months the participants are taught how to make wooden farm implements, including ox carts, push-carts and wheel barrows. This course had been offered since the early 1980s. The mission was informed that **none** of the participants trained in recent years was actually making any of the implements, carts and wheel barrows they had been trained to make. KAEC staff were also unaware of any farmers actually using the ox carts with wooden wheels bearings that had been promoted for many years. Although this was a source of discouragement, no decision had been taken to change to a different cart design. Trainees were still been shown how to make the wooden-wheeled cart. The manufacture of other wooden animal-drawn implements, such as wooden harrows, had been stopped.

The blacksmith course concentrates on manufacturing hand tools, sets of blacksmith tools and blowers, and the repair of ox-drawn implements. The trained participants make their own tools during the course, and have to look for raw materials from scrap. It was reported that in 1989/90 15 participants were trained. Although the KAEC had not followed up all trainees, they believed that about 11 were active, while four were not. Recently it was agreed that all blacksmiths could buy steel from the Cooperative Union, although Katopola graduates who are not members of the Primary Societies are expected to pay cash.

Village Oriented Development

Village Oriented Development Programme (VODP), of the Diocese of Chipata, is a rural development programme focusing on social organization and training. Supported with Austrian aid, it works in three areas of the Eastern Province, Msekhocika (600 km^2), Magodi (300 km^2) and Katete

(100 km^2). In these districts, traditional village social structures are considered predominant and stable (Wenger and Rauch, 1990). The work of VODP involves the organization of village youth groups, with training in agriculture and basic skills in village training centres. When the trainees, male and female, become self-employed farmers and craftsmen, VODP provides refresher courses. Since the start of the programme, 15 years ago, the achievements have included:

- 14 village centres for training young people;
- 440 young villagers ben trained in agriculture, carpentry and/or blacksmithing;
- 450 ox carts produced by VODP members.
- within the project areas, oxen are used to a higher standard, for more purposes, and are also handled by women.

The programme installed three ox-powered oil presses. The oil presses are used by women groups, each group having one pair of oxen. They pay a fee of K300 per day for using the press. It was reported an animal-driven grinding mill was installed, with assistance from the GATE project. This had had problems with the tyre and the grinding stone. One women's group was waiting for the installation of another animal-driven grinding mill. All women's groups were making their own ox carts and used them for marketing their products in Chipata. Efforts to manufacture axles locally had not been successful, and so the ox carts were now fitted with axles imported from Austria. The Msekhocika centre had a four-wheel ox cart for transport to and from Chipata. This was considered more affordable and sustainable than a pickup.

Luangwa IRDP

The Luangwa Integrated Rural Development Project (LIRDP), based at Chipata, was started in 1988, with support from NORAD. It is concerned with agriculture, wild life, women's participation and infrastructure development. LIRDP operates in Luangwa Valley area, which is heavily infested with tsetse flies. Wild animals are common in the area, and the project hopes to promote agricultural production systems that are compatible with the long term conservation of wildlife. The project is collaborating with the Department of Veterinary and Tsetse Control Services (DVTCS) to reduce tsetse infestation. Tsetse traps have been set up in Msoro as a pilot area.

The project, working with the Department of Agriculture, is introducing the use of work oxen. By the end of 1990, 60 oxen had been bought by the project. Half of these will be used for research purposes under the DVTCSA, and the rest will be given on credit to farmers. The package of a pair of oxen with a plow and ridger is being made available with medium-term loans of K30,000. Short term, seasonal loans are also available for provision of seeds and fertilizers. LIRDP will supply the drugs required to maintain the oxen free-of-charge until August 1992. From August 1992 to August 1993 the project expects to meet 50% of the cost prophylaxis. If the pilot oxenization project is successful, LIRDP anticipates assisting farmers to set up small cattle breeding herds.

Cart manufacturers

Daba Enterprises, Chipata, is a small company that makes a range of products including ox carts. These are based on old car axles and have wooden bodies. If axles are hard to find in Chipata, the proprietor travels to Malawi to find some, or he buys them from SKF, Kitwe. Ox cart price ranged from K15,000 to K25,000 depending on the cost of the axle and wheels. Production in 1990 was estimated to be just over 50 units. Production was limited by the availability of axles and wheels, and the ability of farmers to afford the carts.

The small firm Studio Five had made some ox carts in the past. It found that old axles were increasingly difficult to obtain, and the price of all inputs were rising. Farmers did not seem able to pay higher prices for carts, and so it was no longer emphasizing this aspect of its business.

Implement supply

Implement supply in Chipata was reported to be good, with both the cooperative union and private suppliers holding stocks of plows. The range of plows included some made by local blacksmiths and others from Northland Agriculture. Agrimal plows from Malawi were also reported available. A reasonable range of spare parts made by artisans were available through the cooperatives.

Lusaka Province

Ministry of Agriculture, Lusaka Province

Staff of the Ministry of Agriculture had prepared a report reviewing animal traction in the province from 1985 to 1990 (Sichembe, 1990). An earlier MoA report had also reviewed the status of animal traction and extension work (Chisanga, 1988). These reports both noted that while animal traction is commonly employed in Lusaka Province, it is not used by the majority of farmers. There has not been a major extension programme, and the present utilization and distribution of animal traction is mainly a result of informal diffusion and farmers' own efforts. Historically smallholder farmers copied animal traction techniques that were used on the large-scale farms. Some animal traction promotional work was undertaken by the MoA's Palabana Dairy Training Institute, and by the NGO Kasisi Agricultural Training Project.

Serious promotion of oxenization by the MoA started in 1988, and from 1988-1990 about sixty farmers participated in ox-training courses. Nevertheless, considering the total target population, the MoA extension service acknowledges that, to date, its effect on animal traction development has been marginal. MoA considers that farmers have great interest in using oxen, but the expansion animal traction is hampered by lack of credit, lack of clear extension and, in some areas, shortages of steers.

The provincial MoA headquarters finds itself somewhat overshadowed by the national headquarters. Provincial staff are sometimes called to help at headquarters. The provincial offices are not well known, and so visitors from the province may go directly to the national ministry for information on animal traction. The provincial office has few vehicles and mobility is a constraint for staff. In 1990, ZADL offered to supply the province with 100 weaner steers, but due to lack of transport, staff were unable to identify recipient farmers, and the animals were not distributed.

MoA reported that ox-drawn implements were generally readily available in Lusaka, at the Lusaka Cooperative Union and in private stores. However, implements are less obtainable in the outlying districts.

Most ox carts in the province are made by small workshops using axles from old vehicles. Efforts have been made by several organizations to introduce cheaper ox carts that use wooden bearings and wooden wheels. The acceptance of such carts by farmers has been very low and few private workshops have started to produce this type of cart. Some ox carts, with wooden wheels and bearings, have been made by the blacksmith workshop at Mwembeshi. These do not appear very durable, and those of a comparable design made at Kasisi seemed better. It was felt that there were more broken ox carts in the Province than operational ones, and so the role of rural workshops in repairing ox carts and implements should increase. The MoA is trying to improve the supply of raw materials to allow rural workshops to manufacture and repair ox-drawn implements and carts. Submissions have been made to ZCF Commercial Services for steel to be imported under the SIDA-assisted steel importation scheme.

Trypanosomiasis is a problem for work oxen in some areas, notably Luangwa. Tick-borne diseases, including corridor disease, appear to be increasingly prevalent, and cause the deaths of many work animals. Dipping facilities are available, but not all farmers are in easy reach of dips. Even where dips exist, few farmers dip their animals regularly. In 1990, the number of recorded dips was about 62,000, an average of 1.5 dips per year per head of the traditional cattle population. Farmers in the province (and elsewhere) complain about the price of dipping. Dipped and non-dipped animals often mix when grazing. The veterinary department considers that this lack of stock control, combined with difficulties in implementing compulsory dipping, is hampering the control tick-borne diseases.

Ministry of Agriculture, Headquarters

The Ministry of Agriculture Headquarters in Lusaka includes the Department of Agriculture, the Department of Veterinary and Tsetse Control Services and the Planning Division. The two sections of the Department of Agriculture most concerned with animal traction at a national level are the Agricultural Engineering Section (AES) and the Animal Husbandry Section. There is reportedly much cooperation between these sections: both are members of the Animal Draft Power subcommittee of the National Livestock Steering Committee. Both sections have technical staff in the provinces, and animal draft power programmes in the provinces are coordinated either by an agricultural engineer or by an animal husbandry officer, depending on the local staffing situation. Both sections report that they are understaffed (relative to staff establishment) in Ministry headquarters and in some provinces.

Following the 1985 Animal Draft Power Investment Plan, the Agricultural Engineering Section was assigned major responsibilities for the coordination of the national animal traction programme. The national Animal Draft Power Coordinator programme, supported by The Netherlands, operates within the AES in Ministry Headquarters. Two other national animal draft power projects supported by The Netherlands, the Magoye ADP-RDP and the Palabana ADP-TP, are also technically responsible to the AES. The staffing level of the AES at national headquarters has been consistently below that envisaged in the national animal draft power investment plan. Only recently, has a full-time counterpart been allocated to the expatriate in the Animal Draft Power Coordinator Project.

Palabana Animal Draft Power Training Project

The Palabana Animal Draft Power Training Project (ADP-TP) is located within the Palabana Dairy Training Institute of the Ministry of Agriculture. The project aims to establish a national training centre that will to provide in-service training in animal traction technologies. Few staff in the MoA extension service, or in NGOs and development projects, have ever had practical training in this important field.

The Dutch-funded project was planned to start in 1987, and finally became operational in 1989. It is staffed by a team of five specialist instructors (two expatriates), including a socioeconomist. In its first year, emphasis was placed on establishing the infrastructure of classrooms, stores and training farm. The infrastructure and training facilities were completed in late 1990, and the official opening was held in early 1991. The animal traction training centre has ten hectares of arable land available for practicals and demonstrations. An irrigation system has been installed so that at all times of the year trainees will be able to plow, plant and weed crops. The project has acquired a wide range of implements from different countries for demonstration purposes.

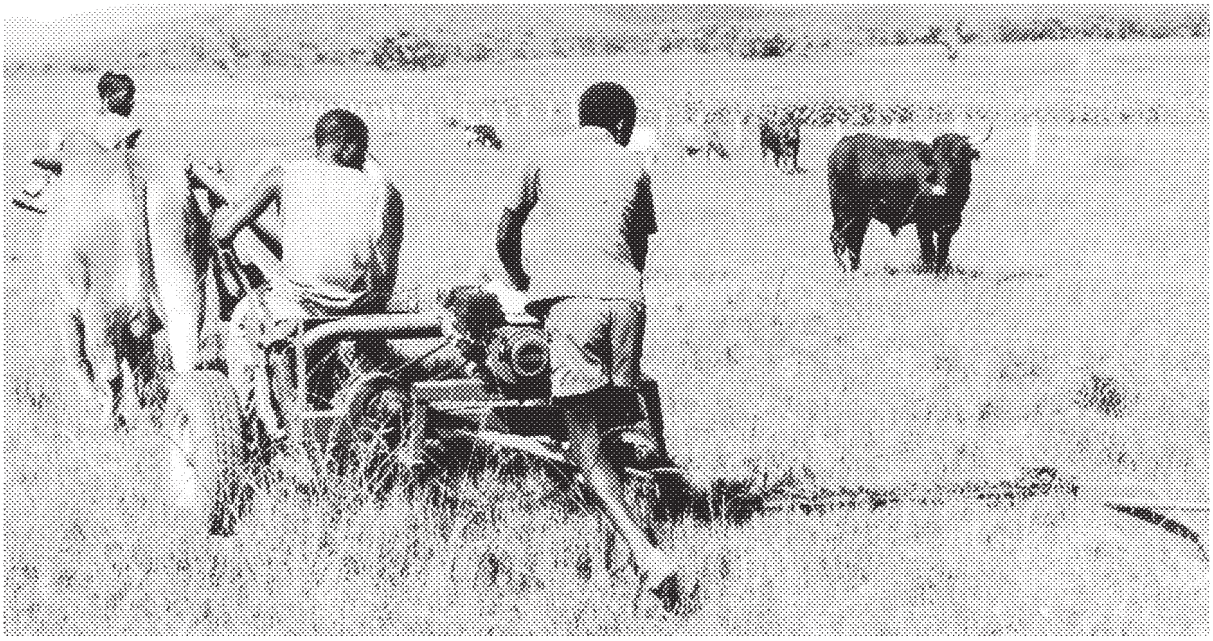
The first intake of trainees was in July 1990. It is planned to hold five highly-practical in-service courses a year, each of 4-5 weeks and each catering for 20 trainees. In addition, each year there are planned to be up to four courses of 1-2 weeks. These will cover special topics or will be targeted at specific professional groups (policy makers, credit agents). Staff will also undertake follow-up activities in the districts, to gather feedback and ascertain future needs, and may assist in courses at farmer training centres. In the first instance, much use was made of training materials developed in Zimbabwe, but work has started on the development of new training manuals.

ADP-TP held a national seminar on animal traction in April 1991, to discuss training priorities. The proceedings of this are being published (Bwalya et al, 1991).

Animal Draft Power Coordinator Project

The Animal Draft Power Coordinator Project (ADP-CP) is a national project, supported by The Netherlands, that started in March 1987. It is based within the Agricultural Engineering Section of the Department of Agriculture headquarters in Lusaka. The 1985 Animal Draft Power investment plan had envisaged that the MoA Agricultural Engineering Section would have a specialist in animal traction, as well as a rural production engineer and a training and extension specialist. These latter positions were not filled.

The ADP-CP is intended to provide the country with:



- Advice, strategies and priorities for animal traction development in the country.
- Improved coordination and liaison between the animal traction research, development and extension programmes.
- Problem identification for animal traction programmes in the provinces.
- Establishment of a national Animal Draft Power Steering Committee.

The project has been implemented by one Dutch expatriate, working within the MoA Agricultural Engineering Section. Until October 1990, he was working without a full-time counterpart. The project helped establish the planned national ADP steering committee, which was formed as a sub-committee of the National Livestock Development Committee.

The project has assisted the establishment of the two other national animal traction projects; the ADP-RDP at Magoye, and the ADP-TP at Palabana. It has also prepared project proposals for the:

- manufacturing of ox-drawn implements at Lenco;
- manufacturing of ox-cart axles at SKF (Zambia) Ltd (MoA, 1988).
- Northern Province Animal Draft Power Development Programme (MoA, 1990).

In 1988, the project organized a national workshop on "Prospects and constraints of animal draft power related tillage research and implement development". The proceedings of this meeting have yet to be published. The project has prepared some extension materials on ox-drawn plows and ox plowing competitions (Dibbits, 1987a, 1987b, 1989).

The project has participated in several meetings of provincial ADP Steering Committees. Plowing competitions have been supported, and provided with prizes. In Southern Province, the project supported surveys of animal traction (Tembo and Rajeswaran, 1990) and donkey use (Luig and Chimbamba, 1989). Agricultural colleges and agricultural engineering sections in the provinces have been provided with demonstration samples of Rumptstad/Lenco plows and Looma yokes. Second hand Landrover tyres and rims have been imported, and supplied to organizations producing ox carts.

The project considered that its links with the extension services have been much stronger its links with research organizations. An important exception to this generalization has been the close contacts between the ADP-CP and the ADP-RDP, Magoye. [During the mission, it was confirmed that most MoA staff and development projects contacted were well aware of the activities of the ADP-CP: many had participated in project activities or received practical assistance.]

Prior to the establishment of the Palabana animal traction training centre, the project organized and sponsored animal traction training at the Agricultural Extension Training Centre (AETC) in Harare. Eighteen staff of Palabana, Magoye, Looma, agricultural colleges and the district MoA offices attended two-month training course at AETC. Zambians were sponsored to attend animal traction workshops in Senegal and Scotland, and to visit animal traction programmes in Botswana and Niger.

The project participated in a regional workshop held in Zimbabwe in 1991, at which the Animal Traction Network for Eastern and Southern Africa was launched. The project has since agreed to act as a secretariat for this network, which will hold its first major workshop in Lusaka in 1992.

SIDA Agricultural Engineering Project

SIDA has been supporting animal traction through its assistance to the national and provincial Agricultural Engineering Sections (AES). The national AES has been responsible for the project, and the Animal Draft Power Coordinator has overseen local disbursements relating to animal traction.

This SIDA project funded the production and publication of an attractive animal traction training manual (MoA, 1989). Most of the text and diagrams were taken directly from the extension manuals of the AETC, Harare. By early 1991, this manual had not been widely distributed. [Few organizations contacted during the mission had copies or even knew of its existence. Several training institutions and provincial MoA staff had complained of lack of training materials. The lack of diffusion of the manual may be partly explained by the resentment expressed by some agricultural engineers within AES. These felt that the manual had effectively plagiarized Zimbabwe training materials, and some locally-produced documents, without giving sufficient acknowledgement.]

Animal powered technology project

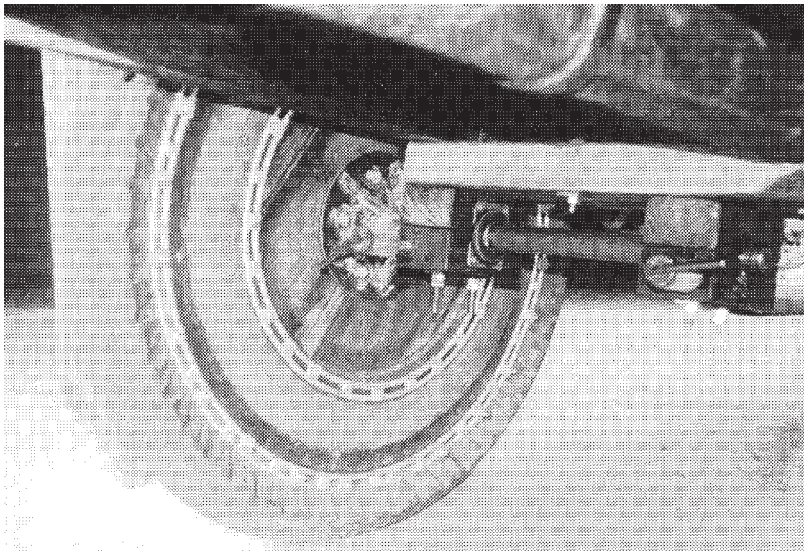
The Animal Powered Technology Project is a regional project, based in Lusaka, that is promoting and studying the introduction of animal-powered grinding mills. It is sponsored by the German Appropriate Technology Exchange (GATE), a division of GTZ, and is implemented by a German consultancy firm. It has worked with other organizations to introduce and evaluate animal-powered maize grinding mills. Among the mills installed for evaluation are those at Msekhocika (Eastern Province), Kasisi Mission (Lusaka Province) and Magoye (Southern Province). The mills are mounted on a rotating beam, and are powered from a friction wheel that runs on a small circular wall. One or two animals walk round in circles, pulling the mill around the wall, and in the process, maize is ground at the rate of up to 20 kg per hour. The project would like such mills to be installed in many rural areas, to relieve the drudgery of women. The technology is innovative, and the design has been modified several times to try to overcome specific problems, such as tyre wear and low output. The present milling rate is considered rather low. Assuming the technical problems can be overcome, the units should be able to cope with the milling requirements of small villages. This may require group ownership, which has social and economic implications that are still being assessed (Löffler, 1991).

Technology Development Advisory Unit

The Technology Development Advisory Unit (TDAU) is an independent organization within the University of Zambia (UNZA), with its own Board of Directors chaired by the vice-chancellor. It works with a range of development-orientated technologies, including milling, oil pressing and rural transport. It is expected to become financially self-supporting within four years, through contract work for aid agencies and private companies. In recent years it has carried out paid work for several aid agencies, including GATE, USAID, NORAD and AGROTEC. It has also cooperated in research, developing and testing with several other organizations within Zambia, including the Kasisi Mission. Although TDAU has produced some original prototypes in the past, it now aims to build mainly on existing experience. It therefore envisages obtaining proven machines or prototypes from other countries, testing them under Zambian conditions, modifying them as necessary, and assisting Zambian manufacturers to take over production.

For many years, TDAU has been working on the developments of ox carts. These have generally had wooden bearings and wooden wheels. Its latest development is an ox cart with wooden block bearings and large diameter wheels fitted with a non-puncture "flexiwheel" tyre. This is made from an old truck tyre that is squeezed and clamped so that the tread and walls produce a narrow air-filled space around a wooden wheel of smaller diameter. It has many characteristics similar to a pneumatic tyre. It is puncture-proof as the shape of the tyre is not dependant on the pressure of the trapped air. The shape and strength depends on the tensions in the walls as the tyre is firmly bolted onto the wheel.

The latest prototype cart, with flexiwheels, has been tested on-station, and TDAU consider it is now ready for diffusion. A NORAD project has purchased six carts with these wheels for testing. A course for entrepreneurs on how to make the wheels and bearings will be held in 1991. The starting entrepreneurs will be provided with jigs. The jigs are expected to cost K300,000 per entrepreneur. TDAU has requested support from the Ministry of Agriculture and some donor organizations for this programme. TDAU is selling this prototype ox cart for K40,000, which includes an element for development costs and high quality timber. In rural areas this could be reduced to K25,000.



TDAU considers its designs have been successful, and that some individual carts have been in use for seven years. TDAU also acknowledges that uptake of its carts has been low. One of its carts passed an on-station test at Magoye. This later failed an on-farm test. Both the flexityre and the wooden bearings worked well, with little wear. However the bearing blocks loosened and split and farmers complained that the cart and wheels were very heavy (Dogger, 1990).

TDAU has also been involved in the testing and modification of an animal-powered mill in collaboration with the GATE/GTZ initiative. It estimates that an output of flour of about 50 kg per hour would be needed to justify such a mill commercially. Output has not yet reached this level.

TDAU was contracted by the regional AGROTEC project to submit details of some prototypes that could be usefully developed. One of these was an animal-powered mill.

Department of Agricultural Engineering UNZA

The Department of Agriculture Engineering of the University of Zambia (UNZA) considers animal draft power as one of several power sources (such as motor, wind, solar, water and human). There is no special emphasis on animal power or small-scale mechanization. The University owns no draft animals, and students are not exposed to animal traction during normal practicals. The Department owns one ox plow, but it has not been used in practicals. In recent years, students have been to Palabana Dairy Training Centre for one residential week of practicals, and this has included work on animal traction.

In the 1985 animal draft power investment plan (MoA, 1985), it had been envisaged that someone from UNZA would specialize in animal draft power. However, the Department of Agricultural Engineering has been seriously under-staffed, and so all existing staff have been over-loaded with teaching duties. The Department therefore could not justify giving particular attention to animal traction issues. Staff time, rather than finance, has been the critical constraint. The department staff felt they could quite easily obtain funds to undertake specific animal traction work (for example, from the ADP Coordinator Project).

The staff of the department had been impressed by the level of publicity relating to animal traction. The subject was widely talked about in the provinces. They did wonder, however, whether actual progress was as good as the publicity. From their perspectives, there had not been much technological change over recent years. The students were more willing to treat the subject seriously than they were a few years ago, but they would probably object to a full course being given on the topic. There were no student texts on animal traction, and the staff had few resource books on this subject. Naturally the staff and students would welcome the provision of these.

Kasisi Agricultural Training Centre

The Kasisi Agricultural Training Centre is a small "appropriate technology" development centre, established by the Kasisi catholic mission in 1982. It started developing animal-drawn implements and carts in the early 1980s. They developed a series of ox carts that have earned the slightly cruel nickname "Flintstone", after the stone-age cartoon characters. The design of these has been constantly evolving, but most have had wood block bearings and solid wooden wheels covered with tyre rubber. Small numbers of such carts have been in use around Kasisi for several years. The one cart failed rigorous

on-station and on-farm tests carried out by ADP-RDP Magoye (one set of wheels disintegrated and the bearings wore excessively). The centre makes about one complete ox cart in three weeks.

The centre has also developed and tested their own groundnut lifter, tine plow, yokes and harnesses. The centre has cooperated with several other institutions, including the University of Zambia/TDAU. It worked with the University of Warwick in the testing of a prototype animal-powered rope engine (which disintegrated when the ox was uncooperative). It is helping to evaluate a prototype animal-powered maize mill, installed under a GTZ/GATE project.

Although one of the key figures in the development of the centre left Zambia in 1990, the centre intends to continue its development, production and training work. Its activities will continue on a modest scale, constrained by staff time, resources and materials.

ZCF, Commercial Services Division

The Commercial Services Division of Zambia Cooperative Federation Ltd (ZCF) took over the operations of the National Agricultural Marketing Board (NAMBOARD) in 1988/89. Although ZCF-CS is widely perceived as a parastatal organization, technically it is a private company owned by farmers.

The work of the division involves trading in locally manufactured items and imported goods, and it is expected to at least cover its costs. It buys implements, from local or foreign suppliers, and sells these to the provincial cooperative unions. These in turn supply the district cooperatives which supply the primary cooperative societies. Unfortunately, the system has tended to break down, as provincial societies have become virtually insolvent due to inflation and the high costs of collecting and purchasing maize.

As the provincial unions are under financial pressure, ZCF-CS no longer supplies implements to them on credit. Since the provincial cooperative unions have little cash available, plow orders placed with ZCF-CS have fallen markedly, and many provincial warehouses are empty of animal-drawn implements. In order to make supplies available in the provinces, ZCF-CS may open (or reopen) provincial wholesale warehouses. They will also sell directly to the districts and to private traders and dealers.

ZCF-CS has imported animal-drawn implements following international tenders financed through IFAD and the World Bank. Under present policy guidelines, local manufacturers are always given priority over imported goods, provided they are not more than 20% more expensive. In 1988/89 it ordered the following implements:

Implements ordered by ZCF-CSD (1988/89)

Implement	Numbers
Plows	3000
Ridgers	50
Cultivators	600
Harrows	650
Planters	100
Trek chains	3000
Ox carts	100

Source: ZCF-CS quoted by Sindazi (1990)

The 3000 mouldboard plows came from Zimbabwe. These are popular with the farmers, and the cooperative unions generally prefer to purchase these. A further 3000 plows were on order (in early 1991) from Tata of India. Although it is too early to judge the consignment that is due to arrive, implements from India have generally been considered to be of

inferior quality. Lenco plows had been unpopular, and were described as "too heavy". In the past, ZCF-CS had not taken into account test results of ADP-RDP Magoye, but intended to do so in future. It would not import plows if sufficient implements of appropriate quality and quantity were available. It had recently withdrawn an international tender for plows.

ZCF-CS sees the main problems with animal traction implements to be cash-flow. It had the capital to purchase large numbers of implements, but there was not enough cash in the system to allow these to be distributed to the regions and purchased by farmers. Ideally cash should be injected through credit to farmers. They could then place orders though the local cooperative unions, who in turn could order from ZCF-CS stocks.

The SIDA steel procurement project

ZCF-CS has been responsible for administering a steel importation scheme to assist local manufacturers of ox-drawn implements. This has been funded by the Swedish International Development Authority (SIDA). Steel is not locally produced in Zambia and foreign exchange to import it has been scarce. Therefore, in 1989, SIDA agreed to provide seven million Swedish Kroner (over one million US dollars) for the procurement of steel on behalf of local manufactures of animal-drawn implements and carts. SIDA made it a condition of the project that none of the steel was to come from South Africa. The Zambian government agreed to allow steel and materials intended for agricultural inputs to be imported free of duty. ZCF-CS was allocated a 20% commission for its role in procurement and project administration.

By October 1990, about 1100 tonnes of steel had been imported under the project, as shown in the table. The largest beneficiary has been Northland Agriculture. Its 1038 tonnes is equivalent to the weight of about 25,000 plows. Support to blacksmith groups has been small, mainly due to organizational constraints, but assistance for these is hoped to increase.

Most of the steel was imported in 1989/90, and came in the form of bars, plates, rods and tubes. Some welding rods and nuts and bolts were included, as were the following ready manufactured items:

2000 plows (as components) for Lenco;

2000 bearings and components for stub axles for SKF;

120 cultivator wheels for MDM Agricultural Division.

Under the project, manufacturers were expected to pay for the steel retrospectively in local currency, at a favourable rate of exchange (US$ 1 = K 26). This should have allowed the establishment of a revolving fund with a value of K 30.9 million (equivalent at the time to about US$ 1.2 million). By March 1991, the smaller importers had paid their bills but the two largest importers, Northland and Lenco, had made only token payments, with K 22 million outstanding (Jonsson, Maipose and Mansson, 1991). Even if all bills were paid rapidly, the late payment and devaluation of the Kwacha will have effectively halved the value of the revolving fund. An evaluation report concluded that, despite the administrative problems, the project had achieved many of its objectives and that the national supply of animal traction implements had been assisted (Jonsson, Maipose and Mansson, 1991).

Lusaka Engineering Company (Lenco)

Lenco is a large manufacturing company, partly owned by Italian companies, and partly by the Zambian Government. It specializes in making the bodies of buses, as well as smaller steel products like filing cabinets and tubular furniture. It is manufacturing a range of animal-drawn implements in collaboration with the firm of Rumptstad, of The Netherlands, with the financial support from the government of The Netherlands (DGIS). It also sells steel ox carts made from components supplied from Italy.

The history of the implement project dates from 1983, when plows were scarce in Zambia, and criticisms were being made of the quality of the plows produced by Northland. Palabana Dairy Training Institute imported two plows from Rumptstad for testing. The Department of Agricultural Engineering of the University of Zambia tested the plow and reported that it performed well. Ten more plows were imported in 1984 for testing at the Magoye Farm Machinery Research Unit (FMRU) and at Looma, in the Western Province. The plow was reported to have passed the test of the FMRU. The plows tested at Looma had bent, and and it was suggested that stronger beams were required for Zambian conditions.

In 1984, Rumptstad contacted Lenco to discuss cooperation in the assembly and manufacture of animal-drawn implements in Zambia. It was agreed that 50 plows would be supplied in the first instance for market assessment, and components for 4,450 plows would be sent for local assembly, together with a few production machines. These were supplied by Rumptstad in late 1985, having been paid for by the Dutch aid programme (DGIS). Marketing of the plows commenced in 1986.

Sales of the first consignment of Rumptstad/Lenco plows were very slow. About the time of first local assembly, the market situation was altered by the importation of 14,000 Zimbabwean plows, of a popular and inexpensive design. Furthermore, Lenco's ex-factory price was higher than that of the competition. Initial marketing was not very rigorous, and the factory depended mainly on orders placed in Lusaka by projects and the cooperative unions. It also became increasingly clear that farmers found the plow too heavy, and generally preferred the Northland/Zimplow types.

As a result of these factors, in late 1990, Lenco still had a stock of 350 plows from the 1985 importation. Other plows from this importation remained in the stores of various cooperative unions. As Lenco has since acquired large stocks of a lighter plow, Lenco intends to scrap the remaining "heavy" plows, and will use the steel and components for different purposes.

Not long after the initial importation of Rumptstad plows, it was proposed that Lenco should be supported by the Netherlands aid programme to move to full local production (Jansen and Dibbits, 1986). A new project proposal was prepared in 1988 (MoA, 1988). Some concerns about the financial viability of the project delayed project approval, but in 1990 Rumptstad was contracted to establish a production line for ox-drawn implements. The project involved the supply of machines, jigs and materials, and the provision of a full-time production engineer for a three-year period. The machines and the production engineer from Rumptstad arrived in 1990, and the production line was in operation in early 1991. In due course, Lenco will be expected to pay in local currency for the machinery and materials supplied.

Large scale production did not start immediately, Lenco still had large stocks of plows. Most of these had come in a consignment of 2000 plows (of a new, lighter design) which had been imported from Rumptstad in 1989/90 under the SIDA steel support programme. Sales for these had been slow, and, in early 1991, Lenco resorted to selling them at below their cost price in order to reduce stocks and capture a market share. [Lenco could afford to do this as it had not paid the full cost of this consignment].

Rumptstad had received feedback that its original plow was considered too heavy. It therefore produced a modified plow that was lighter. The Magoye ADP-RDP purchased samples from Rumptstad for testing. The plow failed its initial test at Magoye because its beam was too weak. Other more minor modifications were also suggested (ADP-RDP, 1990).

Rumptstad therefore supplied stronger beams in the consignment purchased under the SIDA steel importation programme. Rumptstad also made some other changes, some following ARP-RDP recommendations and others for production reasons. The latest version, which will be locally manufactured by Lenco, was being tested by Magoye in 1990/91, and has also been released for sale. At the time of the review mission, it was too early to know whether the new plow would be well-received by farmers, but the staff of Rumptstad were confident that it would.

During interviews with the mission, the staff of Lenco were only able to report the technical opinions of Rumptstad and Magoye, since no one at Lenco was familiar with the technical aspects of plow design and use. The Rumptstad production engineer had no comparably-qualified counterpart, and plans to recruit a Zambian agricultural engineer have yet to be implemented.

Lenco has also imported some Rumptstad multipurpose toolbars, seeders, ridgers and cultivators for assembly and testing. Under the three-year support programme, the local production of these was envisaged. However, most of these implements have not been fully tested or evaluated in Zambia, and Lenco is unlikely to commence the large-scale manufacture of these in the near future. The Rumptstad ridger body has been tested by ADP-RDP Magoye, and reaction has been quite favourable. The Rumptstad engineer has developed a system whereby ridger bodies can be bolted to the Lenco plow beam, and Lenco ridger bodies are likely to be available for the 1991/92 season.

Lenco has been selling small numbers of steel carts, that use pneumatic tyres and roller bearings. These have passed on-station and on-farm tests arranged by Magoye ADP-RDP, and have been well-received in various projects. Sales have been low due to its high cost (K60,000 in December 1990), limited marketing effort and the high cost of transporting fully-manufactured carts to the provinces. Lenco reported that it has large numbers of axles and hubs to manufacture further carts, and the Dutch production engineer has developed a cheaper cart design (K30,000 in March 1991). This may be sold in kit form, to reduce transport costs.

Lenco reported that it had gained relatively little from the first phase of the Dutch-supported project, as sales had been slow and it could not sell the plows at a profitable price. However Lenco is hoping that the investment of the second phase will pay off. It will have the capacity to make at least 10,000 plows a year, and would like to be able to

capture a market of at least 5000 plows a year. This level of production would represent only 5% of Lenco's annual turnover, and so the company is not dependant on the success of the project. Lenco's recent sales figures are provided in the table below.

Gameco

Gameco is a medium-sized, privately-owned workshop located in the industrial area of Lusaka. It started fabricating plows in 1984, based on second-hand plow beams bought in the provinces. In 1988, it had increased its annual production to 1000 plows. The implements were not produced on a jigged production line, and were somewhat variable in both design and quality. The company then started to import plow beams from South Africa. Between 1989 and 1990 it imported about 6000 plow beams. It continues to fabricate handles, shares and bodies from available materials. Its wheels are made from pipe section. It intends to improve its quality and standardization when all its machines are in operation. It anticipates building a new workshop with partial line production in 1991. It has made a few cultivators, harrows, ridgers and ox carts, but has not been impressed by the market potential for these.

With Swedish assistance, Gameco has invested in workshop machinery, both new and second hand, to enhance its capacity and to improve the uniformity of its work. Equipment is purchased in Sweden with payment subsequently being made in Kwacha under favourable conditions. Under the Swedish scheme, Gameco receives some technical advice from the large, Swedish-based, multinational, agricultural implement manufacturer, Overüm. Overüm is also providing technical support to the SIDA-backed Agro-Alfa implement workshop in Mozambique. There have been contacts between Agro-Alfa and Gameco, and, in future, Gameco expects to purchase plow beams from Agro-Alfa, and benefit from their experience.

Gameco's production has been limited by the availability of raw materials, restrictions on foreign exchange, and market saturation. The small size of the company, and the lack of an agricultural engineer may also have restricted production and product diversification. The company has an active marketing strategy, that allows it to keep low stocks. It seeks out firm orders from ZCF-CS and from retailers in the Southern, Central, Lusaka and Eastern provinces and then manufacture batches of implements to specific delivery dates. A few implements have been made for casual purchasers.

Gameco gave the impression of being a growing company, with a dynamic manager interested in expanding its share of the implement market in Zambia. It is also actively investigating exporting to other countries in the region. The following table is based on Gameco's estimates of its past and projected production.

ZCF Transport and Engineering

The Transport and Engineering Division of Zambia Cooperative Federation Limited (ZCF-TED) transports produce and goods throughout the country. Most of its activities are based on heavy trucks. In 1990, the division became interested in the potential for ox carts. It manufactured 15 carts for ZATCO in Choma, using SKF bearings. The size and the national status of ZCF-TED are such that it could become a major supplier of carts, if it saw the market potential. However it has only recently started production, and it is too early to say whether it will expand and sustain its interest in this sector.

AFE Limited, Lusaka

AFE is a parastatal agricultural machinery dealer, selling a wide range of agricultural implements and equipment. In 1988 it started to stock ox plows. It decided to import them from Zimbabwe, as it understood that Zimbabwe plows were of good quality and were preferred to locally manufactured ones. AFE's importation of these implements since 1988 is as follows:

The 1990 order arrived at the end of 1990, and major sales are not expected before the 1991 buying season (June to November). The animal-drawn implements have normally been sold out by the end of the year. The exception was that 123 cultivators from the 1989 importation remained unsold in November 1990. The level of future importation of the various implements will depend on past sales and perceived market demand.

Another private importer/dealer selling ox plows from Zimbabwe is the hardware company E. W. Tarry Ltd. of Lusaka.

Animal traction in Zambia: status, progress and trends 1991

Report prepared by

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Appendices

1. References and bibliography
2. List of persons contacted
3. Addresses of organizations involved with animal traction

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Persons contacted during mission

(in chronological order of first encounter)

Thursday 15 November

Mr. L. J. Mwale, Assistant Director, Extension, Ministry of Agriculture, Lusaka

Mr. Kees van Baar, Third Secretary, Royal Netherlands Embassy, Lusaka

Mr. H. B. Mwase, General Manager, Lenco Ltd.

Friday 16 November

Mr. Grieve Z. Sibale, General Manager Commercial Services Division, Zambia Cooperative Federation Ltd, Lusaka

Mr. A. M. H. Muyovwe, Gameco, Lusaka

Dr. Alex M. C. Lemmens, Head of Assessment and Extension Unit, Technology Development and Advisory Unit (TDAU), University of Zambia

Dr. Naifi G. Musonda, Head of Dept. Agricultural Engineering, University of Zambia

Dr. Nicholas Kwendakwema, Lecturer in Agricultural Engineering, University of Zambia

Mr. Herman van Slooten, Project Coordinator, Palabana Animal Draught Training Centre (ADTC)

Mr. Martin Bwalya, Agricultural Engineering Training Officer, Palabana ADTC

Mr. Jacques de Graaf, Socioeconomics Training Officer, Palabana ADTC

Mr. Paul P. Jackavula, Agricultural Engineering Instructor, Palabana ADTC

Mr. Sitali Kalakuka, Agricultural Engineering Instructor, Palabana ADTC

Mr. Edson Y. S. Phiri, Extension Worker, Petauke (training at Palabana)

Ms. Sylvia. C. Chilufya, Extension Worker, Chipata North (training at Palabana)

Mr. Enoch Chileshe, Extension Worker, Kasama (training at Palabana)

Mr. Aaron Tembo, Extension Worker, Katete (training at Palabana)

Mr. B. S. Witola, Extension Worker, Isoka (training at Palabana)

Mr. Henry Kaoma, Extension Worker, Kasama (training at Palabana)

Sunday 18 November

Mr. D. S. Musakanya, Principal, Zambia College of Agriculture, Mpika

M. M. Maipambe, Instructor ADP, Zambia College of Agriculture, Mpika

Father Anton Oostveen, Chilubula Mission, Kasama

Monday 19 November

Mr. Bror Karlson, Provincial Agricultural Engineer, Kasama

Mrs. M. K. Lombe, Animal Draught Power Coordinator, Kasama

Mr. H. L. Moomba, PAO, Northern Province

Mr. Japhet V. Musukwa, Provincial Animal Husbandry Officer, NP

Mr. Gershom Mwansa, Animal Husbandry Officer, ETSP Kasama

Mr. Albert Makondo, Senior Veterinary Assistant, Kasama

Mrs. M. G. Katongo, Executive Officer, Veterinary Office, Kasama

Mr. D. Mumbi, Animal Husbandry Officer, IRDP Kasama

Mr. T. Linqvist, Coordinator, IRDP Kasama

Mr. Egil Nestande, Project Coordinator, Village Agricultural Programme (VAP), Kasama

Mr. Richard Gillett, Project Coordinator, Rice Development Project, Kasama

Mr. C. Mandona, Assistant Commercial Manager, ZCU, Kasama

Mr. Nangwale, oxen-using farmer, Kasama Settlement Scheme, Kasama

Mr. Kabwe, oxen-using farmer, Kasama Settlement Scheme, Kasama

Mr. Chilufya, oxen-using farmer, Kasama Settlement Scheme, Kasama

Tuesday 20 November

Mr. Nsenduluka, Oxen farmer, Chinkanga Village, Mporonkoso, Northern Province

Mr. Mwansa, Chairman, Tubalange Multipurpose Cooperative Society, Laishi Village, Luingu, Northern Province

Mr. E. C. Kalaba, Acting P.A.O. Luapula, Mansa

Mr. Fresco Mumbi, Provincial Agricultural Engineer, Mansa

Mr. C. M. Sinkala, Provincial Animal Husbandry Officer, Mansa

Mr. A. Mutali, District Agricultural Engineer, Mansa

Dr. G. Haangoma, Provincial Veterinary Officer, Mansa

Mr. D. Masabo, Dairy Assistant, Mansa Rural Dairy, Mansa

Mr. J. Kapya, Credit Manager, Luapula Cooperative Union Ltd, Mansa

Major Chalwe, oxen-using farmer, near Mansa

Mr. Dan Dahlin, Cattle Development Adviser, Luapula Rural Development Programme, Mansa

Wednesday 21 November

Mr. Rolando Silva, Adaptive Research Planning Team (ARPT), Mansa

Mr. Stanislaus Lubumbe, Livestock Officer, ARPT, Mansa

Mr. Mark Mulenga, Extension Training/Research Extension Officer, ARPT, Mansa

Mr. Peter Luzuwa, oxen-using farmer, Luzuwa Farm, Mansa District

Mr. Anthony Poloki, oxen-using farmer, Sanje Farm, Mansa District

Mr. Fred Kawele, oxen-using farmer, Chibalashi Middle Farm, Mansa District

Calobantu brothers, Calobantu Blacksmith Workshop, near Mansa

Mr. A. N. K. Seketeni, Branch Manager, Lima Bank, Mansa

Mr. John Chiwoka, Project Officer, Lima Bank, Mansa

Thursday 22 November

Mr. Stanley Muntanga, Managing Director, Northland Agricultural Ltd, Ndola

Mr. K. H. K. Goma, Production Engineer, Northland Agricultural Ltd, Ndola

Mr. A. G. Ngoma, Provincial Agricultural Officer, Copperbelt, Ndola

Mr. E. Munganama, Provincial Agricultural Engineer, Copperbelt, Ndola

Mr. E. Choongo, Animal Husbandry Officer, Ndola

Mr. Keith Owen, Agricultural Inputs and Credit Specialist, Smallholder Development Project, Copperbelt

Mr. Peter Stone, Project Coordinator, Smallholder Development Project, Copperbelt

Mrs. Efesa Sengela, oxen-using farmer, Ntwaleni Village, Mpongwe, Ndola Rural District

Mr. Boniface Wari, oxen-using farmer, Kitaba Village, Mpongwe, Ndola Rural District

Mr. Dan Kakunka, oxen-using farmer, Mpongwe, Ndola Rural District

Mr. Sanston Chikotana, oxen-using farmer, Chikotana Farm, Mpongwe, Ndola Rural District

Mrs. Ruth Mutolobale, oxen-using farmer, nr. Mpongwe, Ndola Rural District

Friday 23 November

Mr. C. Tembo, Provincial Animal Husbandry Officer and Deputy P.A.O., NWP

Mr. Mukuka, Provincial Agricultural Engineer, North Western Province

Dr. Jesse Kundaeli, Provincial Veterinary Officer, NWP, Solwezi

Mr. B. Munalua, Coordinator, IFAD Programme, North Western Province

Mr. Kajoba, District Manager, North Western Cooperative Union, Solwezi

Mr. Musa, Credit Manager, NWCU, Solwezi District

Mr. P. J. Sakala, oxen-using farmer, Kazoko Farm, Musamberlombe, Kasembe District

Mr. Nkalamo, District Agricultural Officer, Kabompo

Mr. Henry van der Lande, Management Adviser, Zambezi Cooperative Union, Zambezi

Mrs. Mieke van Grinsven, Management Adviser, Zambezi Workshop, Muzama Crafts Ltd, Zambezi

Saturday 24 November

Mr. Washeni, oxen-using farmer, Sagelenge Village, Kabompo District

Mr. Kenneth Litwai, oxen-using farmer, Samununga Village, Kabompo District

Mr. Justin Lumaya, oxen-using farmer, Mbwela Village, Kabompo District

Mr. John S. Kang'ombi, Chikata Village, Kabompo District

Mr. Tini Ruiten, Technical Adviser, Muzama Crafts Ltd, Manyinga

Mr. A L. Lufuma, IRDP Coordinator, North Western Province

Dr. Ludwig Siege, Programme Advisor, IRDP North Western Province

Sunday 25 November

Mr. H. G. Kamphuis, Advisor, Animal Draught Power Programme, Western Province

Dr. Rob C. de Rooij, Provincial Veterinary Officer, Mongu

Monday 26 November

Mr. Paul M. Maimbo, Provincial Agricultural Officer, Mongu

Mr. C. Kapalasha, Provincial Agricultural Engineer and ADP Coordinator, Mongu

Mr. A. H. Sitima, Animal Husbandry Officer, Mongu

Ms. Mary Masona, Women Extension Coordinator, Mongu

Ms. Lydia M. S. Ndulu, PPP Coordinator, Mongu

Mr. W. A. R. Lauzens, Cattle Development Adviser, Western Province Cooperative Union, Mongu

Willem C. S. Heemskerk, Deputy Coordinator ARPT-WP

Mrs. Dicko, Livestock Specialist, ARPT-WP

Dr. Pheru Singh, Sorghum and Millet Programme, Western Province

Ms. Carin Vijfhuizen, Rural Sociologist, Livestock Development Project, WP

Branch Manager, Lima Bank, Mongu

Tuesday 27 November

Mr. Harm de Vries, Cattle Husbandry Specialist, Masese Agricultural Project

Ms. Wilma Slobbe, Crop Husbandry Specialist, Masese ADP

Mr. Lengwe, Coordinator, Masese ADP

Mr. Mulega, Assistant Coordinator, Masese ADP

Mr. Moses Silinganiso, donkey-using farmer, Nakatindi, Livingstone

Wednesday 28 November

Oxen-using employees of Muzunga Farm, Kalamo District

Mr. J. N. Chikwanda, District Agricultural Engineer (ag. PAE), Choma

Mr. B. Mzumara, Provincial Animal Husbandry Officer, Choma

Mr. N. R. Tebulu, Field Inspector, Logisitic Planning Unit, SPCMU, Choma

Mr. Marco Girelli, Agronomist, Integrated Farm Mechanization Development Project, SPCMU, Choma

Mr. Jairus P. Kambowe, Coordinator, Integrated Farm Mechanization Development Project, SPCMU, Choma

Mr. A. Makani, Buying Officer, Zatco, Choma

Dr. Satwant Singh, Provincial Veterinary Officer, Choma

Mr. T. M. Simutowe, Provincial Livestock Officer, Choma

Coach Builders, ox cart workshop, Choma

Mr. Paul Mswana, Choma Carpentry Workshop, Choma

Mr. Bruce Danckwerts, oxen-using commercial farmer, New Venture Farm, Choma

Thursday 29 November

Mr. Mike Beckett, oxen-using commercial farmer, Momba Farm, Choma

Mr. T. M. Mudaala, General Manager, Southern Province Cooperative Marketing Union, Choma

Friday 30 November

Mr. George Kampekete, oxen-using farmer, Kampekete Village, Chiwambe-Kabwe Rural

Mr. Ronald Simuyi, Provincial Agricultural Engineer, Kabwe

Mr. Stanny Lavu Tembo, Provincial Animal Husbandry Officer, Kabwe

Mr. Aaron Mkandawire, District Agricultural Engineer, Kabwe North

Mr. Moffat J. Phiri, District Agricultural Engineer, Serenje

Dr. M. L. Vyas, Provincial Veterinary Officer, Kabwe

Mr. W. Traugott Hartmann, Animal Traction Specialist, Smallholder Development Project, Kabwe

Mr. Clement Longa, Regional Enterprise Adviser, Copper Mines Enterprise Trust (COMET), Kabwe

Mr. Nicholas Sherwood, Training Officer, COMET, Kabwe

Mr. Golden Dowanga, oxen-using farmer, Shaputa, Chibombo, Kabwe Rural

Saturday 1 December

Ms. Maria Tekülve, Planning, Monitoring and Extension Officer, NW-IRDP

Sunday 2 December

Mrs. A. Marikano, oxen-using farmer, Chalimbana Village, Lusaka Rural

Mr. Lungu, oxen-using farmer, Masangano Village, Nyimba District

Mr. Phiri, oxen-using farmer, Dick Village, Petauke District

Monday 3 December

Mr. Mashati Tembo, oxen-using farmer, Lunkunswe Farm, Chipata

Mr. John Kaenga, Provincial Agricultural Engineer, Chipata

Mr. Paul B. Thole, Team Leader, FAO Agricultural Mechanization Development Project (AMDP), Chipata

Mr. Danny Nyoka, Head, Blacksmith Section, FAO-AMDP, Chipata

Mr. Pascal Chimba, Training Officer (Admin), Katopola Agricultural Engineering Centre (AEC)

Mr. Pekka Kalso, Workshop Instructor (Metalwork) Katopola AEC, Chipata

Ms. Sabine Meyer, Training Officer (Woodwork), Katopola AEC, Chipata

Mr. Thomas Banda, Mutowe School leavers Project, Chipata

Mr. John Nyoni, Chairman, Msokhocika Projects, Chipata

Ms. Christine Takatsch, Msokhocika Projects, Chipata

Mr. D. Banda, Managing Director, Daba Enterprises Ltd, Chipata

Mr. George Mbewe, Managing Director, Studio 6, Chipata

Tuesday 4 December

Mr. Willem B. Hoogmoed, Tillage specialist, Magoye RRS and Wageningen Agricultural University

Wednesday 5 December

Mr. Fred Chisanga, Natural Resources Development College, Lusaka

Mr. Henry Sichembe, Provincial Agricultural Engineer, Lusaka

Mr. Mubanga Mushimba, Provincial Farm Management Officer, Lusaka

Mr. Raymond M. Muzumbwe, Provincial Animal Husbandry Officer, Lusaka

Thursday 6 December

Mr. Willem Lublinkhof, oxen-using commercial farmer, Kafue

Mr. Chitah, Officer-in-Charge, Regional Research Station (RSS), Magoye

Mr. Roelof A. Meijer, Agricultural Engineer, RRS, Magoye

Mr. B. Chanda, Agricultural Engineer, RRS, Magoye

Mr. Piet A. Stevens, Agricultural Engineer, RRS, Magoye

Monday 10 December

Mr. Thomas Selänniemi, Finnish Volunteer Service, Mansa

January and February 1991

Mr. Trevor Cayless, Attaché Aid and Development, British High Commission, Lusaka

Mr. E. Gunnar Ring, Rural Development Adviser, Delegation of the Commission of the European Communities, Lusaka

Mr. Peter Rhode, Head of Project Administration Service, GTZ, Lusaka

Mr. Erik Bergstrand, Senior Programme Officer, Development Cooperation Office, Swedish Embassy, Lusaka

Mr. K. Tomita, Japan International Cooperation Agency, Lusaka

Mr. P. L. Gooren, First Secretary (Development Cooperation), Royal Netherlands Embassy, Lusaka

Mr. K. v. Baar, Royal Netherlands Embassy, Lusaka

Ms. S. I. Toro, Embassy of Finland, Lusaka

Mr. F. Mangano, Italian Embassy, Lusaka

Mr. Gerhard Ritter, Smallholder Development Project - Central Province, Kabwe

Mr. Mark Smulders, Programme Officer, Food and Agriculture Organization (FAO), Lusaka

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R. Luambia, Zambia Cooperative Federation Finance Services, Lusaka

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The opinions expressed in this report are those of the authors.
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