

# Transfer of animal traction technology in Zambia: an historical perspective

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## Abstract

*Technological change is central to the development of traditional agriculture. Increased productivity of labour is necessary if farmers are to progress from subsistence levels of cultivation to production of regular surpluses for sale. In Zambia the development of small-scale, semi-commercial farming has been closely associated with the adoption of the plow and animal draft power. This paper reviews the evolution of animal traction technology in Zambia from its introduction in the last part of the 19th century to the present day. It identifies the factors which have facilitated the diffusion of this technology and the arguments which, in the past three decades, have surrounded its contribution to rural development.*

## Introduction

Animal traction is central to Zambia's agricultural development at present. Increased ox cultivation could lead to the increased involvement of small-scale producers in market-oriented agriculture, the expansion of agricultural output without increased foreign exchange costs, and the generation of attractive rural employment opportunities to encourage urban-rural migration and reduce urban unemployment. The adoption of animal draft power provides the economically viable method by which small-scale producers can overcome the labour constraint to increased output and thereby expand sales and raise their incomes. The productivity of rural labour can also be increased by the adoption of ox cultivation, and higher yields may be obtained because of more timely cultivation and better preparation of seedbeds. Increased use of ox carts could facilitate the growth of rural trade and marketing without dependence upon mechanised

transport with its high foreign exchange costs, while the production of ox-drawn farm equipment could become a rural artisanal industry, provided suitable materials can be made available.

While many papers relating to animal traction in Zambia have concentrated on recent initiatives, this paper provides an historical overview of animal power in Zambia since the late 19th century. This is important in order to identify the circumstances which have facilitated the adoption of this technology, and to ensure that the lessons of past debates and analyses are taken into consideration in current and future activities in support of animal traction technology.

## Origins of animal traction

Cattle keeping has been a tradition for many centuries in several parts Zambia, especially on the plateaux in the east and south and on the Zambezi floodplain and adjoining areas in the west. In much of the rest of the country, comprising over one-third of the land area, tsetse infestation has prevented the keeping of cattle. Over the centuries, considerable skills in cattle keeping have been built up by several ethnic groups, especially the Tonga, Lozi, Ngoni and Mambwe, but cattle were not used for draft power before the colonial period (Müller, 1986); instead they were kept for their production of milk, meat and leather, and as a store of wealth and a symbol of status. Consequently, in all the traditional farming systems cultivation was done by hand, using the hoe (Trapnell 1953; Trapnell and Clothier 1957), while trade and local transport of agricultural produce used either headloading or carrying poles and baskets.

The use of animal draft power was first seen in the 1870s when European traders and missionaries, such as Westbeeck and Coillard in Barotseland, used mules and oxen for transport purposes (Huckabay, in press). By the turn of the century ox-drawn carts and wagons were widely used by traders and settlers trekking north into the newly opened-up territory. In Southern Province, where cattle and oxen were

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common, district commissioners used ox-drawn carts (Rangeley, 1965), while by 1900 several transport companies were operating services from Southern Rhodesia (Zimbabwe) into Southern Province using wagons drawn by 12 to 18 oxen (Murray, 1965).

Although the earliest use of animal draft power in Zambia was mainly for transport, oxen began to be used for cultivation during the first years of the 20th century as Europeans settled in the country. At that time ox cultivation was the most appropriate farm technology for the settler farmers and missionaries, who wanted to make the then Northern Rhodesia their home. European farmers, however, had no particular interest in transferring ox cultivation technology to the indigenous population. If anything, they would rather have prevented Africans from acquiring this technology because it was bound to make them unwelcome competitors in the agricultural produce market. As a result, settler farmers played only an indirect and passive role in the transmission of ox cultivation to the indigenous population through their advertisement of the value of the plow on their farms and through the employment of villagers as farm labourers (Dixon-Fyle, 1976).

Often African expatriates, such as Xhosa, Ndebele and Mfengu, who were employed as ox drivers on European farms because they were familiar with animal traction, were the main agents of diffusion, helping spread the techniques of ox plowing by training their Zambian work-mates (Vickery, 1978).

### Diffusion of ox cultivation

The major role in the introduction of animal traction cultivation to African farmers in Southern Province should be credited to the Christian missionaries, the more far-sighted of whom made a conscious effort to improve the economic lot of their converts by actively promoting ox cultivation. Prominent among these was the Jesuit priest Father Joseph Moreau of Chikuni Mission in Monze (formerly Magoye) District. The plowing demonstrations he held at the mission in 1905 were immediately appreciated (Vickery, 1978), and he promoted ox plows by selling them through the mission (Dixon-Fyle, 1976). Moreau, who was popularly known as *Siabulembe* (the good gardener), is still lovingly remembered in the Chikuni area, 40 years after his death, as the man who brought about agricultural development in the area (Dixon-Fyle, 1976). Other missions assisted, to varying degrees, in introducing animal draft power among the Tonga of Southern Province so that this area became the earliest and

largest concentration of African ox-plow cultivation in the country.

The adoption of the plow in Southern Province was rapid and remarkable. While there were only three or four households with an ox plow in 1911, by 1916 every kraal in the neighbourhood of Chikuni had trained oxen and a plow (Vickery, 1978). Within Magoye District there were 200 plows by 1921, but following the introduction of the lighter Victory and Solomon plows in the 1920s (Müller, 1986), the rate of adoption increased so that by 1931 "plow cultivation had replaced hoe cultivation" (Vickery, 1978). Maize production from the Tonga plateau as a whole (of which Magoye was a part) almost quadrupled in 15 years from around 15 000 bags (1 bag = 90 kg) in the late 1910s to 55 000 bags by 1933 (Dixon-Fyle, 1976).

Labour migration also assisted, to some extent, the adoption of animal draft power. During their travels, particularly to the "south", migrants received further exposure to the use of oxen for draft power purposes, including plowing, as ox cultivation was more widespread in Southern Rhodesia and South Africa. Labour migration also provided some migrants with capital sums which they could use to buy oxen and plows.

The depression years of the 1930s and the Second World War slowed the process of oxenisation in Southern Province, and by 1945 farm implements in Tonga households were in a poor state (Allan, 1949; Colson, 1954). However, as the copper mining industry revived and the market for food increased, opportunities for expanding agricultural production grew. While agricultural marketing opportunities were the major stimuli to the wider adoption of ox cultivation, in the late 1940s the government introduced a number of measures to encourage the development of African agriculture.

In Southern and Central provinces the African Farm Improvement Scheme was inaugurated. This included subsidies on the purchase of ox-drawn equipment, aimed at increasing the number of plows, cultivators, wagons and scotch carts in use. This contributed to the growing importance of African agricultural production in this area (Anthony et al, 1979).

By independence Southern Province dominated in the process of oxenisation, with widespread African ownership of plows and ox carts (Hellen, 1965). Farmers in Eastern and Central Provinces, however, were also adopting animal draft power. Credit for farmers without plows, and in many cases without cattle, was provided in Eastern Province through the African Peasant Farming Scheme which, combined

with the general growth of market-oriented agriculture in this area, led to a major expansion in the ownership of farm equipment. Whereas in 1936 Africans in Eastern Province owned only two plows, by 1965 there were 10 000 plows and more than 4000 scotch carts (Kay, 1965). In Central Province the progress was also later than in Southern Province, but rapid once it began. In Kabwe Rural, the most accessible district in Central Province, a threefold increase in plows occurred during the 1950s (Muntemba, 1977).

Elsewhere oxenisation progressed more slowly. Although Lewanika, the Lozi king, had tried to introduce ox-drawn equipment into Barotseland (Western Province) in the first two decades of the century, the adoption of the plow was less rapid in the province primarily because of the limited opportunities for marketed agricultural production (Kimmage and Wood, 1988). The cattle-keeping areas of Mbala and Isoka in Northern Province were other localities where some use of animal traction was adopted before independence. In addition, in the 1950s Shona settlers from Southern Rhodesia (Zimbabwe) introduced the plow into Ndola Rural District of Central Province (Müller, 1986).

In other parts of the country tsetse infestation and, to a lesser degree, limited agricultural marketing opportunities retarded the adoption of animal draft power, leaving much of the north of the country without this means for increasing production above subsistence level.

## Tractor technology

In contrast to the growing adoption of animal traction by many African farmers after the Second World War, this form of farm technology was being abandoned by the European commercial farmers. In place of oxen the settler farmers were increasingly using tractors, and the number of these was seen by the government as one of the major indicators of agricultural change on the commercial farms during the 1950s. The colonial authorities encouraged the adoption of tractor farming as a way for the country to regain food self-sufficiency and for the settler farmers to remain viable and competitive against the growing number of market-oriented African producers.

## Post-independence policies and strategies

In the years immediately following independence, concern for developing African agriculture to redress the imbalance favouring settler farmers led to a search for ways in which traditional agriculture

could be most rapidly developed, mostly using technology adopted by the large-scale commercial farmers in the 1950s. Government thinking was influenced by the Seers Report (UNECA/FAO, 1964), which saw the wider use of tractors as a way to expand arable production and produce food more efficiently. The government was particularly concerned about maintaining food production for the towns after the departure of about half of the settler farmers. Western donors also encouraged tractor mechanisation by supporting a transformation approach to African agricultural development.

Various measures were introduced to encourage the use of tractors by some groups, especially cooperatives: for example, the direction of credit in favour of tractor farmers rather than ox cultivators; and the introduction of heavily subsidised units that were established in the latter half of the 1960s (Siddle, 1971). In the following years, the use of tractors was also favoured by other aspects of economic policy, especially the overvalued local currency, which made fuel and machinery imports unrealistically cheap.

## Comparison of tractors and oxen

Despite the strong support for tractor mechanisation as part of the government's modernisation and transformation strategy for African agriculture, there was concern over the appropriateness of this form of mechanisation, given its capital intensive and labour replacing characteristics (see, for example, the speech by President Kaunda at Mulungushi in April 1968, quoted by Müller, 1986). In recognition of this problem and the potential role of animal traction, an animal training (ox cultivation) project was begun in 1968 (MAWD, 1985). Further doubts about the appropriateness of tractors for small-scale producers continued to grow through the 1970s. Problems were encountered in keeping the tractors in the government mechanisation units operational. The rising prices of oil and spare parts led to the services becoming highly subsidised (MAWD, 1984).

As foreign exchange became scarce from the mid-1970s, shortages of spare parts disrupted tractor plowing services, while the decline in government recurrent revenue made it clear by the early 1980s that the subsidy for tractor plowing services could not be maintained. The foreign exchange shortages and the rising prices of fuel and spare parts also affected individual farmers. Small-scale farmers found it increasingly difficult to replace their tractors because, with small areas in cultivation, they were not covering their depreciation costs. Even large-scale commercial farmers began to look

for ways of reducing their reliance on tractors at this time, and while some reduced the arable area and hence mechanised operations on their farms, others began to use animal draft power for some tasks.

An analysis of the relative costs of oxen and tractor cultivation, undertaken in the early 1980s, confirmed the economic problems that small-scale farmers faced with the use of tractors (FAO, 1981). This showed that a yield of 50 bags of maize per hectare was needed to break even on a farm of 20 ha if tractor plowing was used: this is a very high yield for Zambian small-scale farmers. On the other hand, if oxen were used the break-even yield would be only 23 bags per hectare. Several other studies have confirmed this situation. Figures for Eastern Province in 1984–85 showed tractor cultivation to be between 2.3 and 10 times more expensive than oxen cultivation (de Toro, 1984), while a national estimate for the same time period suggested that tractors were 2.6 times more expensive on a 20 ha unit, and almost six times more expensive if labour costs were not included (Müller, 1986).

Full cost/benefit data would be needed for a definitive analysis, but these figures suggest that in the mid-1980s animal traction was much more attractive for a farmer; not only were capital investment costs lower, but profits could be realised with much lower yields and a smaller farm area. In subsequent years, the situation moved increasingly in favour of ox traction, due to the rapid devaluation of the Kwacha.

### **Animal draft power initiatives**

While the need for increased use of oxen is clear financially and economically, and supports the rural development goal of involving more small-scale producers in market-oriented agricultural production, leaving the adoption of ox cultivation to the market forces of innovation diffusion might result in a decreasing rate of adoption of ox cultivation (MAWD, 1985). The most suitable areas for oxen already have quite high rates of ox use, and only the poorer households in these areas do not use animal traction (Kimmage and Wood, 1988). Further, logistical problems are now being faced in obtaining oxen and training them, especially in areas where oxen are not common, while there is also a serious shortage of basic ox-drawn implements and a lack of rural repair services.

Consequently, from the mid-1970s onwards there has been a growing emphasis upon oxenisation programmes. In 1978 a Work Oxen Supply Project was introduced in the Third National Development

Plan to increase the availability of work oxen by some 41% in seven years. This project built on the previous Animal Training (Ox Cultivation) Project (which had provided staff to help farmers training oxen to plow), but now tried to introduce oxen use into areas where traditionally they had not been kept. Hence the supply of oxen and the training of farmers to care for cattle became elements of this new project. This initiative was supported by the promotion of ox cultivation in the extension services, especially those provided at the Farmers Training Centres, and by the importation and local production and repair of ox-drawn equipment (GRZ, 1979).

Because of widespread support of this initiative among most of the Western donors, many of the donor-funded Integrated Rural Development Projects and other major donor schemes have involved some oxenisation element. There have been three common characteristics of these activities. The first, and perhaps most common, feature is the training of oxen and their owners, usually undertaken at a residential training centre, although increasingly use has been made of mobile training units. A second feature is the supply of trained oxen, especially important in areas where cattle are not common. In areas where cattle are kept this supply of trained oxen has often been undertaken on an exchange basis. A third characteristic is the provision, sometimes by local manufacture, of ox-drawn implements, especially plows, harrows, cultivators and ox carts. The availability of a range of equipment is crucial if the adoption of draft power is to be made economically attractive for small-scale farmers. A range of equipment will permit farmers to use their oxen for a number of tasks, besides plowing, while an additional advantage is keeping both the farmer and the oxen familiar with draft power by using it not only in the plowing season but also during the rest of the year.

These oxenisation projects initiated by donor projects and the Work Oxen Supply Project have been undertaken in many parts of the country. Progress in some areas has been quite rapid although in those areas where tsetse infestation occurs it has been necessary to proceed with caution. Overall these initiatives have been effective in improving the availability of trained oxen for small-scale farmers; over the decade from 1976 to 1986 the number of such oxen is thought to have almost doubled from 90 000 to 179 000.

To date, because of the differences around the country in oxen availability, disease restriction,

agricultural history, and social fabric, different programmes have evolved for promoting animal power in different provinces. Animal traction interventions have evolved in a semi-vacuum with the design and implementation taking place without any central direction and formal agricultural mechanisation structure, significantly reducing the effectiveness of animal draft power promotional efforts.

Consequently, in 1985 a national animal traction coordinating unit was established. It has coordinated a wide range of activities including input supplies, credit, local manufacture of equipment, blacksmith support and training. It has also coordinated the provincial animal traction programmes, working through the provincial agricultural engineers. The programme makes use of mobile training teams and emphasises the role of local blacksmiths' skills in constructing and repairing ox-drawn equipment.

Other relevant institutions involved in the national animal draft power programme include:

- Palabana Animal Draft Power Training Project, established to organise the training of provincial and district staff involved in animal traction
- Magoye Agricultural Engineering Centre, where animal traction equipment is tested and evaluated
- University of Zambia, of which several departments (notably Agricultural Engineering) aim to undertake research relating to animal power.

The programme aimed to raise the number of Ministry of Agriculture ox trainers from 58 to 125 over the five years from 1986 to 1990 and increase the number of work oxen in the country from 180 000 to 260 000. It was predicted this might increase the area cultivated by oxen from 250 000 to 375 000 ha.

A recent assessment of how this programme has been implemented and what it has achieved is presented elsewhere in this volume (Mwenya, Mwenya and Dibbits, 1994)

## Conclusion

The popularity of animal traction technology has varied over the decades, as has its adoption across the country. In recent years, the development of oxenisation components in development programmes for small-scale producers has helped re-establish the respectability of animal traction for farmers progressing to semi-commercial levels of production. However, there are still considerable

areas in the country where animal draft power is still little used, while many households in cattle-keeping parts of the country have little or no access to oxen. The challenge to meet the needs of these groups, to coordinate services to support animal traction use, and to ensure that the various aspects of agricultural policy remain favourable to oxenisation, is considerable.

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