Transfer of animal traction technology to farmers in the North Western Province of Zambia

by

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Abstract

This paper presents the case study of the introduction of animal draft power in the North Western Province of Zambia within the framework of an Integrated Rural Development Programme (IRDP) sponsored by the German Agency for Technical Cooperation (GTZ). Following a brief analysis of the natural and socioeconomic conditions in North Western Province, the paper highlights the specific oxenisation approach of IRDP, which combined individual ownership and joint use of work oxen. Special attention is paid to the methods applied during the implementation of the work oxen component in order to make this technological innovation socially and economically viable. Finally, empirical data from various monitoring surveys are presented and analysed to give an assessment of the impact of the IRDP Work Oxen Project in North Western Province.

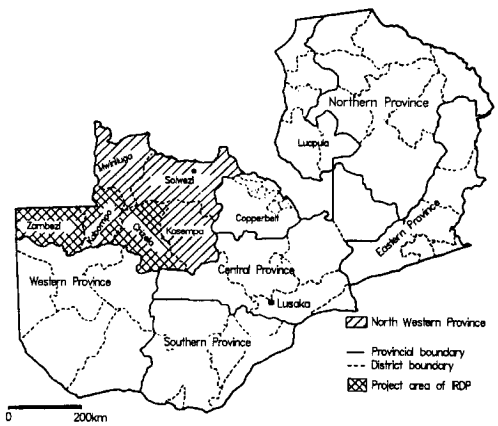

Figure 1: Map of Zambia, showing the North Western Province and IRDP programme area (CATAD, 1988)

Regional characteristics

Natural environment

The North Western Province of Zambia is a plateau region at an altitude of 1200–1500 m, which is covered by a thick layer of Kalahari sands and which merges in the east into the Barotse Plain along the upper Zambezi. The homogeneous topography of the plateau region is interrupted by scattered, shallow linear depressions (dambos) following the major drainage lines. The climate is moderately tropical with five humid months and an annual rainfall well above 1000 mm. The predominant soils are highly leached, ferralitic sandveldts, but there are numerous pockets of fertile alluvial/wetland soils. Except for the treeless, grass-covered dambo areas, the natural vegetation is a dry tropical forest (Miombo woodland).

Large parts of North Western Province are infested with tsetse flies. Only Zambezi District, in the extreme west of the province, is largely tsetse-free: this is the only area where ownership of cattle is traditional.

Socioeconomic conditions

The infrastructure of North Western Province is very underdeveloped. The only important access road runs from the economically important Copperbelt Province (Figure 1). The distance from Zambezi (the old colonial provincial capital of Balovale) to the Copperbelt is 700 km. Transport, communications and banking facilities are very poor. Even to supply the area with basic commodities is very difficult.

Following the upswing of copper extraction in the Copperbelt since 1930, North Western Province has been a reservoir of migrant workers for the mines and urban centres. For several decades, this selective population drain has been destabilising the rural communities in social and economic terms. Since the mid-1970s, the fall in the international demand and price for copper has badly affected the socioeconomic situation in North Western Province. Today, 90% of the population depend on subsistence farming (farm sizes average 1–2 ha), supported by fishing, hunting and occasional employment as the major sources of cash income. Farmers generally cultivate the land using axes and hoes in various shifting cultivation systems summarised by the term *chitimene* (Schultz, 1976).

The key constraint for these subsistence farmers is the lack of access to inputs and markets, which prevents them from making better use of their

productive potential and from earning the necessary minimum cash income (CATAD, 1988). The linear design of the formal transportation system in Zambia denies easy economic and physical access to the majority of the rural population. This can be a decisive factor in discouraging subsistence farmers from producing cash crops (Fincham and Markakis, 1980; Müller, 1986).

With an average population density of 2.6 inhabitants/km^2, North Western Province offers abundant land resources for the extension of smallholdings. However, the key area along the major road from the Copperbelt has experienced a decrease in the duration of the fallow period. Such a decrease, which corresponds with an increase in land-use intensity, can be regarded as a decisive precondition for the adoption of a new agricultural technology (Pingali, Bigot and Binswanger, 1987; Strubenhoff, 1988; Schmitz, Sommer and Walter, 1991).

Integrated Rural Development Programme

The Integrated Rural Development Programme (IRDP) in North Western Province started as a project sponsored by the German Agency for Technical Cooperation (GTZ). It was launched in Kabompo District in 1978 and expanded to Zambezi and Chizela (now Mufumbwe) Districts in 1980; it provided technical assistance until 1990. The programme area, covering nearly 50 000 km, has approximately 125 000 inhabitants. The overall goal of the IRDP was defined as improving the living conditions of the majority of small-scale producers, mainly by increasing their productivity and production (Rauch, 1986). In terms of regional planning, IRDP aimed to maximise the use of local resources, in order to reduce dependence on external inputs and markets by creating self-sustaining, locally integrated trading and economic circuits (Rauch and Redder, 1987). The entire programme comprised 19 sector components (rural crafts, beekeeping, rural water supply, etc) with a special programme for farmers below the credit standing of national institutions (1 ha).

The basic function/strategic approach of the IRDP can be summarised as two complementary elements (Rauch, 1987a; CATAD, 1988):

- promoting the social organisation and technical equipment of target groups in order to strengthen their self-help capacity and to articulate and meet their needs and interests effectively
- establishing small-scale producer-oriented service systems which can be institutionalised by providing adequate support to existing service institutions.

For the agricultural component of IRDP this meant, first of all, establishing rural depots or trade centres for agricultural inputs and outputs; these centres can

Photo 1: Transporting grass with a prototype ox cart manufactured by the small-scale equipment section of the IRDP (the wooden wheeled cart design was replaced by carts fitted with roller bearings and pneumatic tyres)

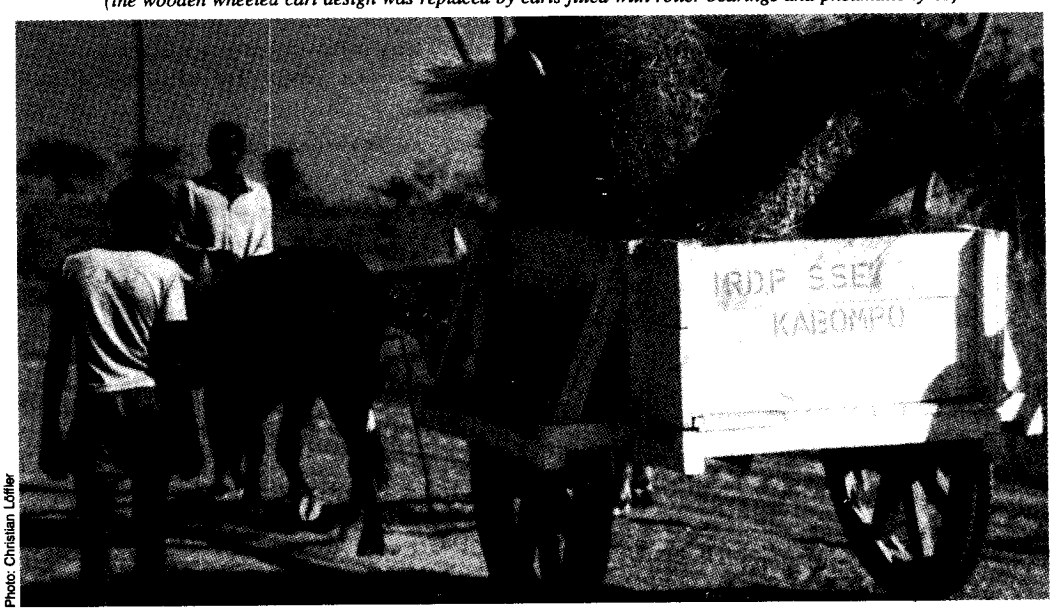

Photo: Christian Löffler

be accessed directly by farmer groups using ox carts and by servicing institutions using motorised transport.

Approach of the Work Oxen Project

The proposal of the foreign project planning team to foster the mass introduction of animal draft power for transport and plowing purposes encountered massive resistance from the district administration, which favoured establishing a tractor-hiring station for around 300 advanced/emergent farmers (Rauch, 1987b). Decisive for the approval of IRDP's Work Oxen Project was the intervention of national authorities that were interested in stopping rural–urban migration patterns and achieving regional self-sufficiency in food production.

The following setup was established for the Work Oxen Project: young steers were bought from Zambezi District and transferred to a work oxen training centre in Kabompo District, where two-week training courses were conducted for farmers. Bodies and frames for ox carts were manufactured from local timber in rural craft centres. Plows, wheel rims and second-hand tyres were obtained from suppliers in the Copperbelt. The major bottleneck, however, was the inadequacy of axles. Because no axles were available when the Work Oxen Project began, IRDP assessed various types of simple axle, including some using wooden block bearings (Photo 1), which did not prove popular. It introduced some carts with axles made from locally available water pipes and plastic bushes. These axles were not very successful; they wore out quickly, and replacements were difficult to obtain. IRDP then imported car axles and roller bearings until the Small-Scale Equipment Section of the project was able to obtain and test various axles from Zambian manufacturers, which were responding to an increasing national demand.

Rukandema (1986) estimated that the minimum farm size for the introduction of a work oxen system (oxen, plow, ox cart) in North Western Province is 6 ha. But the average farm size of smallholders in the project area is 1–2 ha, including both subsistence and cash crop fields. From the very beginning, therefore, the task of the Work Oxen Project was to discover how animal draft power could be introduced in a way that would be viable both economically and socially. Because experience from previous development projects had shown that communal ownership of work oxen and implements was unlikely to be successful, IRDP decided to try an approach that combined individual ownership of work oxen with their joint use within a group of farmers (group approach).

There is a risk inherent in such an approach. The aim of the IRDP was to make animal draft power technology available to everyone, but because adopting animal draft power generally depends on a certain minimum level of available (family) labour, only the upper stratum of the rural population might be able to do so. Thus, this group approach might initiate a process of social segregation, creating a class of rural capitalists operating at the expense of fellow farmers, either by forcing up hiring charges for oxen and implements or by completely denying contract services. The task of the Work Oxen Project thus became one of finding a way to implement the individual ownership/joint use system in such a way that all farmers might benefit from animal draft power technology on a sustainable basis. The measures adopted to meet this aim are described in the following section.

Methodology of animal draft power dissemination

Selection of the ox owner

The members of each farmer group applying for a work oxen package (or part of the entire package) had to select a loan recipient. Following approval of the loan by IRDP the selected ox owner had to sign a contract which obliged him to provide plowing and transport services to the members of his farmer group. Failure to provide adequate services at reasonable hiring charges could lead to the withdrawal of the loan package. Cohesion of the farmer groups and elements of social control among the local communities were supposed to secure the ox owners' contract services beyond the term of the loan.

Selective mechanisation of farm operations

In cooperation with the Cooperative Union, the parastatal service institution in North Western Province, it was decided not to provide planters/ weeders to loan applicants. It was reasoned that the ox owner would thus not be able to increase the size of his own farm because of labour shortages during subsequent field operations.

Close monitoring of the Work Oxen Project

In order to supervise the impact and side effects of this oxenisation model, IRDP commissioned three major monitoring surveys during the implementation of the Work Oxen Project. The first followed the pilot phase of work oxen introduction (Mack, 1984). The second was conducted during the first marketing season fully deploying ox carts, including

the subsequent plowing season (Löffler, 1987). And the third covered a complete agricultural year in order to provide a systematic database for the evaluation of the Work Oxen Project (Löffler, 1989).

Empirical results

Transport component

Ox carts have been used increasingly to transport maize (the major cash crop) to the marketing centres (Photo 2). The figures in Table 1 illustrate the increase between 1986 and 1989 which reflects a boost of agricultural production in the project area. The slightly decreasing share of the hired service to fellow farmers shown in Table 1 was due to the gradual expansion of the ox owners' cash-crop area. Nevertheless, the share of hired service during the two monitored marketing seasons, corresponding to five to six fellow farmers served, clearly indicates the widespread impact of ox-drawn transport on farmers' access to rural depots. However, the potential of ox-drawn marketing in the project area, estimated at up to 300 bags per ox cart, was not yet realised in 1988 (Löffler, 1989).

The development of the total yearly transport performance is another indicator for the gradually increasing relevance of ox carts for local transport requirements. For the agricultural year 1988–89 the average number of transport days per ox cart was 120, compared to 75 days in 1986–87 (Löffler, 1989). This dynamic development is mainly due to the increasing assignment of ox carts for the internal transport tasks of rural households, such as harvesting, collecting firewood, etc (Photo 3; Harrison and Howe, 1989).

Regardless of this increasing status of carts within the economy of rural households, two studies (CATAD, 1988; Löffler, 1989) suggested a restrictive loan policy for the further distribution of ox carts in

Photo 2: Transport of maize sacks by ox cart in Zambezi District

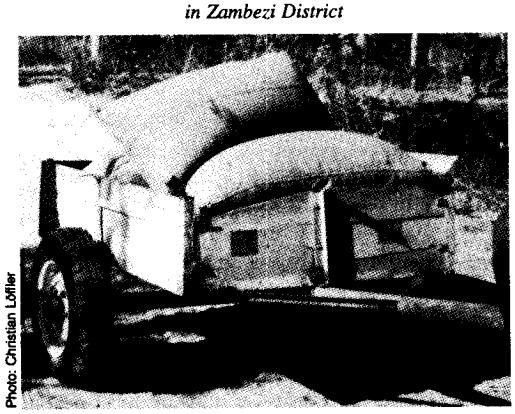

Photo: Christian Löffler

Table 1: Marketing performance of ox carts

	1986	*1989*
Average marketing capacity (bags of maize per cart per season)[1]	65	125
Hired service (%)	60	52

[1] *1 bag = 90 kg*

Source Löffler (1989)

1989–90. These proposals were based on tremendous price increases for the loan package (especially for ox carts), which were caused by an aggravating inflationary trend of prices in Zambia. The IRDP feared that there was a finite limit to the local demand for ox cart services which, together with limits to raising hire charges, might prevent new ox cart owners from generating sufficient income to repay their loans. Thus, additional ox cart loans were limited to certain areas, where the forecast demand for ox-drawn carts to transport maize had not been met.

In retrospect, this approach turned out to be controversial as demand for ox-drawn carts was greater than that forecast. The liberalisation of the marketing system for agricultural produce in 1989–90 provided additional business opportunities and stimuli for ox cart owners (eg, inter-district trade with maize) or revived traditional trade routes for the exchange of food products (eg, maize flour for dried fish).

However that may be judged from today's point of view, this controversy clearly shows the dependency of (regional) project planning on imponderable external factors, whose actual impact cannot be predicted.

Plowing component

Work oxen are widely used for plowing (Photo 4) and their plowing potential seems to be fully utilised, considering the specific regional conditions under which animal draft power technology was introduced (tsetse-infestation, poor animal health, etc). Table 2 shows the impact of plowing with work oxen in the project area.

Table 2: Plowing performance of work oxen pairs/ox owners

	1986/87	*1988/89*
Total area plowed per pair (ha)	6.8	6.5
Number of farmers served per pair	10	7
Average farm size of ox owners (ha)	1.5	2.0

Source: Löffler (1989)

Photo: Christian Löffler

Photo 3: Transporting firewood in an ox cart in Kabompo District

Multiplying the average number of farmers served per pair of oxen by the total number of loan packages (510) shows 3570 farmers had access to plowing services in 1988–89 (Löffler, 1989). As individual ox owners apparently served fewer farmers in 1988–89 than in 1986–87, it was suggested that ox owners might be reducing their contract services after they had completed their loan repayments. This hypothesis was rejected, for ox owners plowing for at least the fifth season in 1988–89 still provided 52% of their total plowing performance as contract service, compared with 54–58% for the categories below five seasons (Löffler, 1989).

The analysis of the relations between ox owners and fellow farmers revealed poor cohesion of the artificial farmer groups created—group membership was not a major determinant in the provision of contract services. Generally, the decisive factors for contract services turned out to be determined by complex, traditionally evolved systems of social obligation among relatives and friends. Some traditional relationships had changed to allow cash payment for hired services.

Disaggregated by gender, the figures of the Work Oxen Survey 1988–89 indicate that only about 5% of the work oxen loan recipients were women and that only 20% of the total contract performance of all ox owners was provided for women. In comparison to the participation of women in IRDP's agricultural project (around 30%) this means that women's benefits within the Work Oxen Project were clearly neglected until 1989–90, when special promotion measures for female ox owners were initiated.

Considering the average cash crop area of ox owners during the last season before receiving work oxen (1 ha), most (about 80%) of ox owners have been doubling the cash crop area. This upper limit was clearly related to the availability of family labour and to the attractiveness of cash crop farming in 1988–89, which restricted the supply of hired labour for planting and weeding. Only about 20% of the ox owners equipped with loan packages by IRDP have been expanding their cash crop area at the expense of providing plowing services for their fellow farmers in 1988–89 (Löffler, 1989).

As the average plowing charges in both 1986–87 and 1988–89 corresponded to the market value of one bag of maize, it seems that contract services were generally provided without exploitative tendencies.

Final assessment

There have been some problems with IRDP's Work Oxen Project. For example, fellow farmers have complained about the unsatisfactory contract services provided by the ox owners, especially in terms of timeliness of plowing. The main beneficiaries of the introduction of work oxen in the project area have been the ox owners themselves. Moreover, the *de facto* ownership/control of work oxen by women was neglected until the final stage of the project. However, considering the widespread impact that the introduction of work oxen has had in

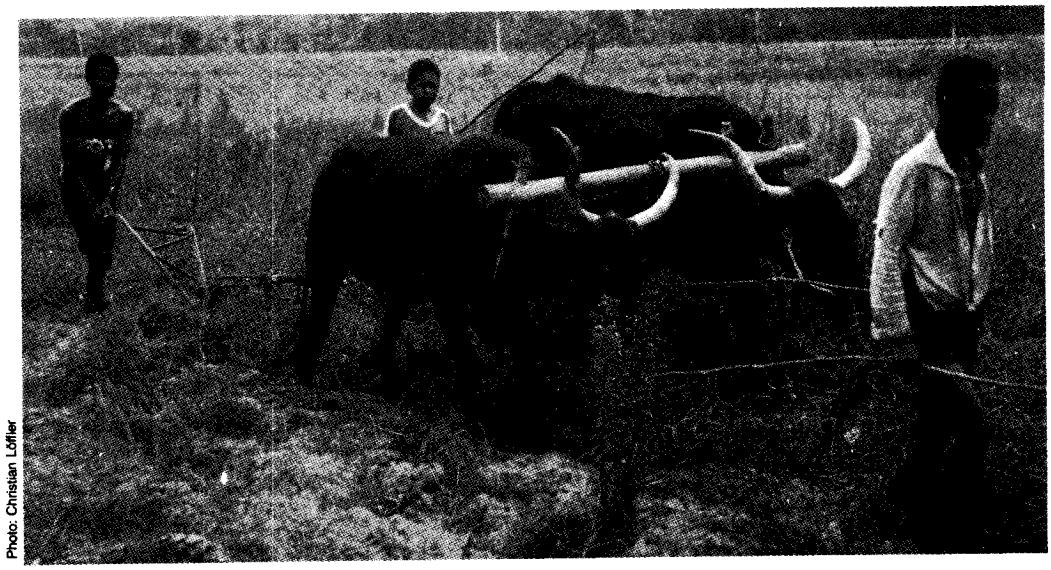

Photo: Christian Löffler

Photo 4: Plowing dambo soil, Chizela District, North Western Province

the project area, IRDP's individual ownership/joint use approach can be regarded as a success. When a wide range of farmers and representatives of the district administration were asked about the sustainable impact of IRDP projects, the general feeling was that the introduction of animal draft power has been the most welcome innovation of the IRDP, but that a work oxen package loan should be available to every farming family.

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