

The transfer of animal traction technology: some lessons from Sierra Leone

by

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Abstract

Animal traction was introduced in the West African country of Sierra Leone in the 1920s but it did not spread beyond the initial areas of introduction. In the 1950s, a successful animal traction scheme was abandoned due to lack of official interest in the technology. In the 1970s an attempt was made to transfer an Asian system of draft animal power without adapting it to local conditions. Uptake was minimal, partly because a subsidised tractor hire scheme was promoted simultaneously. Animal traction technology was revived in the 1980s by the Work Oxen Project (subsequently Programme) of the Ministry of Agriculture. Through various project initiatives numbers of working animals increased significantly from just 100 in 1980 to over 3000 in 1992. National animal power use is still low. N'Dama oxen are mainly employed in the north of the country for plowing for rice and groundnut cultivation. The use of weeders, ridgers and ox carts is very limited.

Low produce prices, limited farm profitability, weak rural infrastructure, crime, patronage, war, uncertain land tenure and project attitudes restrict many aspects of agricultural development. Specific constraints to draft animal adoption include unstumped farms, unfamiliarity with cattle husbandry, the high cost and low availability of oxen and disease risks. Two other important constraints, lack of suitable equipment and official scorn of the technology, have been largely overcome.

The on-station and village-level research and development activities of the Work Oxen Project provided many useful lessons. Comparative on-station field trials produced little scientific information but proved invaluable for obtaining support from national decision makers and aid agencies. Socioeconomic surveys based on mass data collection were found less valuable than more personal and subjective methods. Farmer testing of implements proved more useful than on-station evaluation, and changed the project's definitions of excellence. Local manufacture of implements posed many problems, and may not have been justified, particularly as the multipurpose toolbars have been used mainly as plows.

The overall approach of coordinated, multi-disciplinary, multi-donor, multi-organisation activities that have combined research, development and extension have provided a stable foundation for further animal traction development. External liaison has been valuable but there were problems in assessing the significance and worth of documents from other countries. The national plowing competitions proved important in making animal traction an accepted element of national development strategy.

Introduction

Objectives

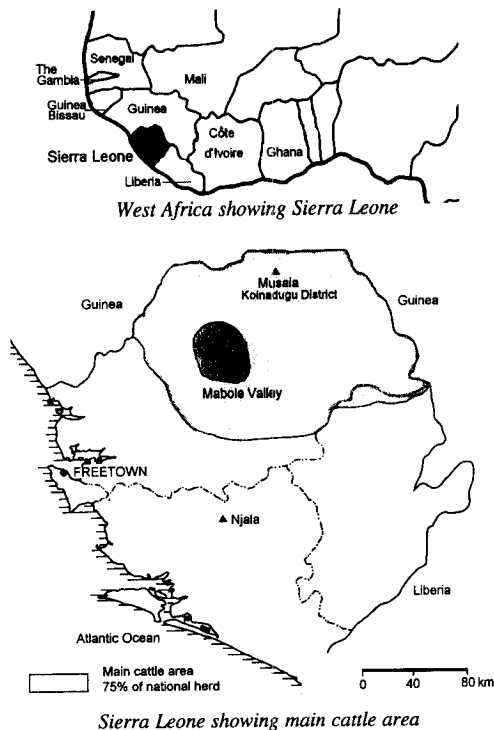
The aim of this case history is to provide an overview of the efforts within one West African country to introduce draft animal power, and highlight features relating to the transfer of animal traction technology. Although some of the observations will inevitably be country-specific, it is hoped that some of the lessons learned in Sierra Leone will prove to be of interest to animal traction programmes in eastern and southern Africa.

This paper is not a comprehensive review of animal traction technology in Sierra Leone but more of an interpretive analysis relating primarily to institutional aspects of technology transfer. It therefore complements other published reports on the subject, including those of Starkey (1981; 1982), Allagnat and Koroma (1984), Corbel (1986), Starkey and Kanu (1986), Bangura (1988; 1990), Gboku (1988), Kanu (1988; 1990), Leaman (1988) and Bah (1990). Although the paper is intended to be objective, the presentation of material is inevitably influenced by the fact that the author worked in Sierra Leone from 1978 to 1985 during which time he was responsible for initiating the Work Oxen Project.

The agricultural context

Sierra Leone is a small West African country (73 000 km²) with Guinea Savannah ecology in the north, where rainfall is 1800 mm, and rainforest in the south, where rainfall exceeds 2500 mm. The staple food of the population of four million people is rice. Upland rice dominates the rain fed intercropping of the traditional bush-fallow agricultural system which accounts for most of the cultivated area of the country. Swamp rice is also widely grown in numerous inland valleys.

The whole country is considered to be of medium trypanosomiasis risk, and the national herd of 333 000 cattle are all of the N'Dama trypanotolerant taurine type. Most (88%) of the cattle are found in the north of the country, where natural pasture is



available for most of the year, with dry season growth being stimulated by fire. Cattle ownership is concentrated in 5% of the farming population, notably within the Fula and Madingo ethnic groups. Cattle obtain all their feed from grazing natural pasture, but a traditional mineral supplement of leaves, salt and termite hill soil is provided two or three times a year. Cattle are the only important draft animal species: the few horses are seldom used, being maintained for reasons of social enhancement. Imported donkeys have not thrived.

The early years: 1928–1954

The first introduction

The use of animal power in Sierra Leone can be traced back to the 19th century when horses were used for both transport and recreation in Freetown, the capital city and major port. In 1856, a devastating outbreak of disease, now assumed to have been trypanosomiasis, eliminated most of the horses (Dorward and Payne, 1975). Since this time the presence of tsetse flies and trypanosomiasis has effectively prevented the use of horses for work in Sierra Leone. The indigenous trypanotolerant N'Dama cattle never replaced horses as a major source of urban transport, although in the 1920s oxen were used by the Department of Health to pull the Freetown refuse carts (Growcott, 1977).

The use of draft oxen for agricultural purposes dates from 1928. At this time the administration of the country made it illegal to continue a traditional practice of domestic slavery. The Madingo farmers most affected by this ruling complained that without their traditional labour force, they could no longer farm effectively. Tractors had not seemed a feasible option; the first tractor had been imported in 1922 and considerable problems had been experienced in keeping it in working order. However, reports had reached Sierra Leone that in neighbouring Guinea, a scheme had been started in 1919 to introduce draft animals for cotton production. The number of Guinean farmers using work oxen had increased from 24 in 1919 to over 4000 in 1928.

Consequently, in an early example of regional cooperation, three Sierra Leoneans were sent to the farmer training school at Kankan in Guinea where 80 farmers each year were being trained.

The visit to Guinea was successful, and in 1928 oxen were trained in three areas of Sierra Leone, and were used to plow over 30 ha around Karina in the Mabole Valley. There followed five years of gradual expansion of use of work animals, and the assessment of British and French plows and harrows.

In 1933 an agricultural officer from Sierra Leone (who was British) was sent to southern India and Sri Lanka to study rice production systems and the use of draft animals. In a comprehensive report he recommended that long-beamed pole plows and triangular spike-tooth harrows be evaluated in Sierra Leone, and noted that although the Ransome *Victory* plow was of excellent quality, it was expensive, and a cheaper plow would be more appropriate for the small farmers (Granville, 1933). Few, if any, of the recommendations were acted on, and the official reports of the 1930s and 1940s contain the recurrent themes of lack of equipment, lack of spare parts, insufficient time for investigations and general economic stringencies. Fewer than 100 plows had been imported into Sierra Leone by 1945. The rate of expansion was in marked contrast to the more

Farmers in the Mabole Valley using Victory plows bought in one of the early animal traction schemes. These plows have been in use for over 30 years

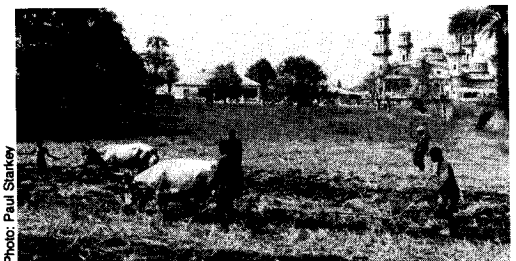


Photo: Paul Stankey



Photo: Paul Starkey

A survey in 1979 of farmers in Koinadugu that had continued to use work oxen since the 1950s although animal traction had officially "died out"

successful Guinean initiative that was stimulated by an export crop.

The Koinadugu and Mabole Valley schemes

In the 1950s there were two modest attempts to promote work oxen. In the Koinadugu District in the north of the country, 72 oxen were trained at the Musaia livestock station between 1950 and 1960, and farmers were able to purchase *Victory* plows. This initiative lasted about 10 years after which the numbers of plows in use slowly declined. The reason given by many farmers for stopping their use of animals was that their oxen, bought in the 1950s, had eventually died. The training had been entirely based at the official agricultural station. Farmers had never been taught how to train their own animals in their villages. A few had managed to train animals themselves, through contacts with farmers in Guinea, but many had simply stored their plows until the official training service reopened. This illustrates the danger of basing animal training in centres, rather than locating it in the villages.

In the north-central part of the country, the Mabole Valley Ox-plowing Scheme of 1950–53 had provided loans to 70 farmers for the purchase of plows and oxen. Although this scheme was abandoned by the government, it had a remarkable, long-term impact. While there had been no

Four people in the Mabole Valley in 1980 working with a 30-year-old Victory plow for upland rice production



Photo: Paul Starkey

expansion of animal traction in Mabole Valley after 1954 (there had been no further credit and no plows available for purchase), the technology had been extremely persistent. In 1980, 30 years after the end of the scheme, well over half the original plows bought in 1950 were still in regular use. Most importantly, the technology had been sustained without any government support since 1960, and had passed from one generation to the next. Few other agricultural projects in Sierra Leone have ever had such a long-term impact. The project had not "failed" for lack of farmer enthusiasm, but because it had been forgotten by the authorities. The clear difference between the official perception of the scheme and its value to farmers is very noteworthy.

Neglect of animal traction: 1954–74

During the period 1954 to 1974 animal traction was increasingly forgotten by the agricultural authorities. In 1954 "tractors replaced animal power" at the Ministry of Agriculture's headquarters at Njala. Small government tractor hire schemes were started in most districts, and despite chronic problems of maintaining widely dispersed tractors, these schemes were considered the backbone of the agricultural development strategies. Emphasis on tractorisation increased in the 1960s with independence providing great optimism that rapid agricultural development based on tractor power would be possible.

The establishment of Njala University College with assistance from the United States led to a whole generation of Sierra Leonean agricultural graduates being trained by lecturers who considered that animal traction was an outdated technology. Animal traction did not appear anywhere in the agricultural syllabuses of the university or of the schools.

By the early 1970s there was no official policy relating to animal traction. No one in a senior position within the Ministry of Agriculture, or the university, was aware that ox plowing was still in regular use in parts of the country. There was a general assumption that draft animals were of historical interest only. Even those people who recommended revitalising animal traction gave the impression that ox plowing had largely died out (Kamara, 1974; Growcott, 1977; Starkey, 1979).

Renewed interest: 1974–79

Chinese rice stations

In 1974 a network of rice production and extension centres was established in Sierra Leone, as a result of Chinese technical cooperation. It was envisaged that several technology options would be used and promoted: four-wheel tractors, power tillers, draft

animals and hand cultivation. Chinese technicians trained oxen, bulls and cows to work in rice swamps. The animals were harnessed singly, with imported Chinese withers yokes, and pulled wooden plows with cast-iron shares. The equipment, techniques and even command language were those used with buffaloes and large breeds of cattle in China. There seems to have been no attempt to build on local experiences, for example using paired animals or a vernacular language for commands.

The plows were 25 cm wide and required a tractive effort of around 900 N, equivalent to 40% of the weight of a four-year-old N'Dama ox. There was no depth wheel, so that pitch control was difficult, and peak loads of 1.3 kN occurred (65% of the weight of a single ox). There was no attempt to modify the plows in order to reduce the draft to a level appropriate to the N'Dama breed.

The centres attempted to promote the use of draft animals in the same areas in which they were also providing highly subsidised plowing services with tractors and power tillers. Not surprisingly, farmers were not interested in investing in draft animals when they could obtain tractor plowing for a cost that only covered the fuel. By the time the tractors had all broken down, people had forgotten that there had ever been an animal traction component of the project. While animal traction and tractor power can be complementary rather than competitive, there seems little point in trying to transfer animal traction technology at the same time as providing subsidised mechanical cultivation services.

Proposals to develop animal traction

During the 1970s there were several proposals to develop animal traction in Sierra Leone. Kamara (1974) suggested that animal traction would be an ideal technology for the smaller farmers. A budget was included in the Koinadugu Integrated Agricultural Development Project in the north of the country to enable it to develop an ox training programme, and the Ministry of Agriculture accepted, in principle, a proposal to set up two ox training centres (Growcott, 1977).

In 1978, a pilot research programme was started at Njala University College (NUC), and a proposal was prepared for a project designed to investigate the feasibility of developing a national draft animal programme (Starkey, 1979). The project was intended to be a multidisciplinary study, based initially on equipment evaluation and replicated trials at NUC and the collection of documents and information from a wide variety of sources. It was envisaged that a well-documented research programme was justified even if it was decided that

animal traction was not a viable technology in Sierra Leone. Much of the project proposal was devoted to highlighting the probable constraints to the development of animal traction that would have to be addressed. Several academic staff of Njala University College considered animal traction a topic unworthy of research and criticised the programme as a "U-turn back to the stone age".

Sierra Leone Work Oxen Project

The Sierra Leone Work Oxen Project started in 1979 with a small budget provided by the Ministry of Agriculture. It was charged with promoting animal traction through adaptive research, extension and training. The project had its headquarters at Njala University College but initially there were no full-time staff and no budget for salaries. French and British volunteers were recruited to carry out programmes of experimental research, equipment evaluation and a socioeconomic survey on the potential use of draft animals. As funds became available to pay salaries, graduate research assistants were recruited locally, and after appropriate training they took over responsibility for the project.

All staff started their work by training a pair of animals themselves at Njala University College. Graduate staff expressed mild resentment of this at first, arguing they had not been recruited to work as ox handlers. However, the confidence that this experience gave them greatly assisted in their subsequent work. As the project developed this practice became standard, and although the *initial* resentment was always noticeable, project officers (Sierra Leonean, French and British) invariably concluded their experience had been invaluable.

On-station research at Njala University College

Initial work at NUC in 1979 included the training of animals, the testing of different equipment designs, and a study of the literature from past animal traction initiatives within Sierra Leone and

Use of a single ox to weed cowpeas during on-station trials at Njala University College



Photo: Paul Starkey

neighbouring countries. Field visits were made to find out the experiences of farmers who had used animal traction before, and at this point the strong persistence of the use of draft animals during previous decades became apparent. It was estimated that about 50 pairs of oxen were still in use in the country. Since farmers who had continued to use work oxen for many years were satisfied with their yoking system, head/horn yokes from the villages were copied for use at NUC.

In 1980 a series of comparative on-station field trials was undertaken to establish whether the use of draft animals was both technically and economically viable. Rice, maize, groundnuts and cowpeas were grown in replicated plots using hand cultivation, tractor cultivation and a range of different animal-drawn implements. Details were recorded of the labour inputs, the tractive efforts, the weed infestation and the eventual yields. These were analysed for statistical significance and the economic implications were discussed (Starkey and Verhaeghe, 1982; Starkey, 1981).

In retrospect these replicated trials conducted in a research station environment produced little scientific information of relevance to the farming systems of Sierra Leone. They established that good seedbed preparation with animal-drawn mouldboard plows could control weeds effectively, but this was already known to farmers both within and outside Sierra Leone. They also showed that while work oxen appeared economically attractive compared with either manual labour or tractors, crop farming in Sierra Leone was of very low profitability and any technological investments were hard to justify. Farmers knew this already.

Demonstration value of research plots

Despite their lack of realism, the experimental trials had important benefits for the animal traction programme in Sierra Leone. First, the trials built up the confidence of the project staff. Second, they provided comparative figures relating to the use of draft animals which, although derived from artificial farming systems, were essential for presenting the case to funding agencies for further work on the use of work oxen in Sierra Leone. Third, they provided valuable demonstrations to university staff and visitors that animal traction was a viable option.

At this time the most eloquent arguments in favour of developing animal traction could have been heard from the farmers of the Mabole Valley, but decision makers seldom, if ever, travelled there. Had the project spent all its efforts in the early years undertaking farming systems research in the villages of Koinadugu and the Mabole Valley, this would

have led to much greater understanding of the needs of small farmers. However, it is ironical that such understanding probably would not have changed national policies nearly as much as did the few unrealistic, on-station trials at the university.

The people with power to decide whether to support animal traction development in the country were senior ministry officials, heads of non-governmental organisations (NGOs), diplomats, representatives of donors and aid agency consultants. Such people spent most of their time in offices in the capital city, but occasionally they would visit Njala University College. Thus, in retrospect, the main value of the research plots had been to give animal traction crucial visibility and accessibility that stimulated discussion and enabled busy decision makers to quickly grasp a few points, that could later influence policies and budgets.

Attempts to make the formal trials more relevant by repeating them at several locations within the country overstretched the available staff. The large amount of variation produced within the multilocation trials meant that statistical analyses could not distinguish treatment effects from other variance. Replicated experimental trials were then dropped from the Work Oxen Project programme as requiring an unjustified amount of management time.

Instead more subjective comparative demonstrations were undertaken on farmers' fields. These were not sufficiently replicated to allow statistical analyses, and so, released from the need for uniformity, they could be modified during the course of a season in accordance with farmers' ideas. The results were not suitable for academic publication, but the lessons could immediately be discussed by the project and the farmers and by the farmers' neighbours. These trials paved the way for the more subjective, collaborative research and development that became an integral part of project strategy and philosophy.

On-farm demonstration of use of Pecotool to weed upland rice in the Mabole Valley



Photo: Paul Starkey

Search for information and contacts

From its inception, the Sierra Leone Work Oxen Project requested information concerning animal traction from several international, bilateral and NGO aid agencies. Many documents were received describing experiences in other countries, but in the early stages, it was very difficult to distinguish between hard experience and "nice ideas". Over half of the documents received had been produced by "appropriate technology" enthusiasts and had been published or disseminated by organisations such as the Intermediate Technology Development Group (ITDG) and Volunteers in Technical Assistance (VITA). Reports were almost invariably optimistic, yet there was no way of knowing whether the technologies had been successfully transferred to farmers, or rejected. For example, well-produced documents describing "successful" wheeled toolcarriers nearly diverted valuable project time to a technology that had never actually been accepted by farmers (Starkey, 1988a).

Several publications relating to a nearby country, The Gambia, strongly influenced project thinking during the next few years. These advocated the use of multipurpose toolbars that could be used for weeding as well as plowing (Matthews and Pullen, 1975; Metrick, 1978). It is likely that these reports led the Work Oxen Project to place excessive emphasis on multipurpose implements; at that stage all the farmers wanted were cheap and simple plows.

As the Work Oxen Project developed its networking approach to information exchange, it participated in study visits and workshops in several neighbouring countries. Direct contact with other seasoned field workers and, more importantly, visits to farmers in other countries, provided the project with much experience and many insights to actual problems that could never have come from the optimistic literature received. In 1986, the project hosted an international workshop on Animal Power in Farming Systems (Starkey and Ndiame, 1988).

Equipment evaluation

An early objective of the project had been to identify appropriate designs of animal-drawn implements. The only plows in the country were Chinese wooden ones which were insufficiently robust for upland soils and required excessive tractive effort in swamps. Several designs of multipurpose toolbar were imported including the *Houe Sine* from Senegal, and the *Anglebar* and *Pecotool* from the UK. Lightweight plows informally imported by traders from Guinea were also obtained.

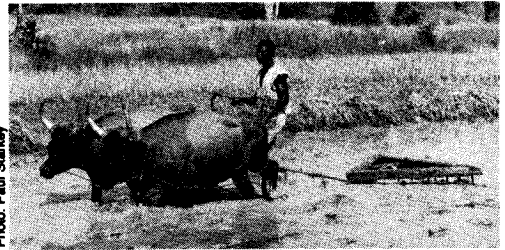


Photo: Paul Starkey

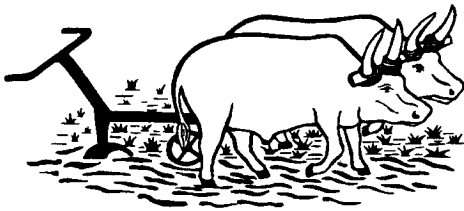
On-station testing of a triangular harrow for swamp rice production at Njala University College

All proved satisfactory during on-station trials. They were then tested by farmers in 15 isolated villages around the country. Maintaining these implements in good condition throughout a plowing season provided unforgettable lessons for the project. A broken bolt, stripped thread or cracked weld that could have been repaired in minutes at the project headquarters, required a great deal of time and effort, including long motorcycle journeys hampered by the weight and bulk of replacement steel components. The project learned through uncomfortable experience and farmer reaction that reliability and ease of repair were generally more important than technical excellence. If equipment could be continuously used by farmers in remote villages in different parts of a country for at least one season it passed one major test relating to reliability and suitability.

At the end of the season, farmers were asked to return the equipment lent for evaluation. If it was readily returned, the equipment had probably failed the test of farmer acceptance (perhaps it had been difficult to use). When equipment had been really useful, the farmers would suggest numerous reasons why it should not be returned. Farmers who found equipment economically useful were generally ready to buy it for a realistic second-hand price.

Equipment production

An early objective of the project had been to have a facility for fabricating equipment. The main justification was not economic but was to allow standardisation and to allow designs to be rapidly changed in accordance with local demand. Various proposals were prepared and a donor agreed to fund a project to rehabilitate a Ministry of Agriculture workshop. An equipment designer from the UK worked with local staff to produce the jigs necessary to manufacture *Pecotool* multipurpose toolbars, using imported steel and components. Local manufacture posed many problems for the project, and the time and money spent trying to produce equipment locally may not have been justified.



The logo of the Work Oxen Project

Constraints to local production included the problems of maintaining isolated workshop services, obtaining spare parts for machines, theft and corruption, and obtaining a balance between excessive management supervision and ensuring quality control. There was also the problem of the parallel ("black") market. Goods, including steel or ready-manufactured implements, could be imported by the project at the low official exchange rate, and could be costed at this rate. On the other hand, most goods and services purchased in local currency, such as welding rods, diesel fuel and bottled gas, were based on prevailing black market prices. As a result it was cheaper (in terms of official exchange rates) to import fully manufactured implements than to make them locally. At the same time, inflation rose dramatically as the local currency was devalued by about 2000% in seven years. In such circumstances, the project should have started to increase its equipment prices frequently and charge on the basis of *replacement* costs (rather than actual purchase cost). However, in the interests of good relationships with farmers, implement prices were fixed every season. Thus a sustainable revolving fund could not be built up, and workshop funds were rapidly eroded by inflation.

Although the project invested its time, resources and reputation in selecting and fabricating a good quality multipurpose toolbar, single-purpose plows could have been made more strongly and more cheaply. Ready-manufactured plows could have been imported from Asia for a fraction of the cost. Had

there not been a local supply of plows, the various development projects in Sierra Leone would have had to order implements from other countries in accordance with the regulations of their supporting aid agency. This would have led to greater equipment diversity, but many more problems in providing spare parts and continuity of supply.

The project manufactured ox carts for sale, but relatively few have been sold. Two alternative designs were made. The first type used imported axles, with roller bearings and pneumatic tyres. This was considered of good quality but it was expensive and the tyres meant risk of punctures and theft (stolen for use on motor vehicles). The alternative "Wananchi" cart had metal wheels and wooden block bearings. This used locally-available materials but had a heavier weight and draft. Constraints to cart adoption included their high cost, hilly terrain and the very limited numbers of roads and wide tracks in rural areas.

Local blacksmiths have been instrumental in keeping plows working for over 30 years. The project tried to contact blacksmiths in all areas in which it has operated and identify their constraints. It has assisted blacksmiths with the supply of materials, tools and training (Kanu, 1990).

National coordination and catalytic role

To ensure adequate liaison, a national work oxen coordinating committee was established, comprising representatives of the Ministry of Agriculture, the university, all the main agricultural development projects with animal traction components, NGOs interested in animal traction and representatives of relevant aid agencies. The coordinating committee met twice a year and served several purposes: it allowed the sharing of ideas and experiences, restricted the unnecessary duplication of efforts, established communication channels and reduced jealousies and rivalries that might have existed (unofficially) between programmes.

From the outset the Work Oxen Project was designed to be catalytic, providing technical advice and training services to other agricultural development projects and organisations to enable them to develop their own animal traction components. The catalytic role was decided for pragmatic as well as methodological reasons: since the project had no significant funds of its own, its only option was to advise organisations that had resources to achieve the desired ends.

Had the Work Oxen Project been initiated in the form of a major project, co-funded by an aid agency, there would not have been the same need to

Pecotool toolbar manufactured in Sierra Leone

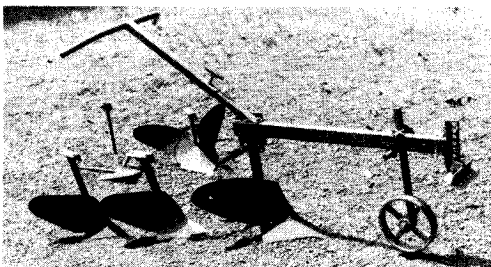


Photo: Paul Starkey

cooperate with other projects. The project could have operated for the period of the external funding largely independent of other projects, possibly with a fleet of vehicles and project headquarters. At the end of the period of external funding, its activities and effectiveness would probably have collapsed. However, as a result of the multi-donor and catalytic approach, by 1986 more than 20 projects and organisations in Sierra Leone had their own draft animal programmes (Kanu, 1988). With such a range of programmes the "risks" were spread, and the outlook for animal traction development became far more stable than if activities were dependent on just one or two budgets influenced by the whims of key individuals within ministries or aid agencies.

Training and technology transfer

The project started from scratch, in a situation where almost no agricultural staff in the country (or in the project) had knowledge of animal traction. This may have been fortuitous, for the project was obliged to learn from experienced farmers and those few agricultural agents who had been involved in the schemes of the 1950s. With information gleaned from farmers, books and old annual reports, the project trained a small team of extension workers. The team gained practical experience in villages that already used animal traction, by assisting with equipment testing by farmers, situation analyses and data collection. The core team went on to train workers of other projects in areas selected for pilot introduction. From the outset, farmer training in areas of introduction was village-based and labour-intensive. Where possible, farmers were taken to see village-based demonstrations (such as plowing competitions) in areas of animal traction use. Demonstration sets of animals were maintained at cooperating institutions in several parts of the country, and these were taken to villages for demonstration purposes (and could be hired out for plowing and transport).

In the more favourable and cattle-rich areas, notably in the north, animal training became less of a problem, as farmers were encouraged to learn from other farmers. As knowledge and skill transfer became mainly farmer-to-farmer, the local projects concentrated more on issues of credit, implement supply and animal health. Elsewhere, particularly in new areas, basic knowledge of animal traction remained a limiting factor and extension agents were still required to demonstrate and teach animal traction skills. This remains the case in many parts of the country.



Photo: Paul Stanley

All staff of the Sierra Leone Work Oxen Project started by training a set of work oxen themselves

Publicity activities and plowing competitions

From the outset, the project placed high priority on publicity. It was a small and generally unknown project operating in a country where there was considerable scepticism on the practicality and desirability of using draft animals. The name "work oxen" was chosen as easier to understand than "draft animal". A project logo of animals plowing was developed and used to convey the objectives of the project. Wooden boards, shaped as silhouettes of oxen, were designed to catch the eye, and the project participated in agricultural shows, displaying equipment, oxen and exhibitions of photographs.

Such static exhibitions could be, and sometimes were, dismissed by planners and aid agency representatives as irrelevant enthusiasm for "appropriate technology". If such people went to the villages where farmers had used work oxen for generations and saw the farmers' own enthusiasm, they might be convinced that the technology was worth investigating. This led to the organisation of national plowing competitions at a village in the Mabole Valley to which senior ("air-conditioned") agriculturalists and decision makers were invited.

The farmers of the Mabole Valley responded with enthusiasm so that visitors saw 60 or more animals plowing at the same time. In addition, farmers came from far away, and the sight and sound of other farmers using draft oxen was far more convincing than any village extension demonstration by project staff could have been. The impact of these annual competitions on visitors was immense, for the spectacle was impressive and provided unique opportunities to see a widely dispersed technology in a concentrated form. As more ministry and university staff and aid agency representatives attended these competitions, the reputation of the project slowly changed. What had been a neglected and scorned technology became an accepted option

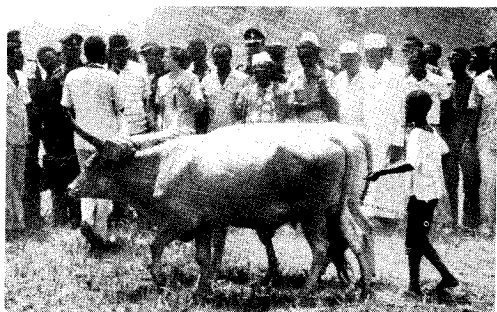


Photo: Sierra Leone Work Oxen Project

Invited guests, including the President of Sierra Leone, viewing an ox plowing competition

for the small farmers. In 1985, the President of Sierra Leone was the guest of honour at the village-based plowing competition.

Socioeconomic surveys

From the outset, the project was anxious to obtain as much information as possible concerning the realities of animal traction use in villages. A socioeconomic survey was planned in 1979 in accordance with the conventional wisdom prevailing at that time, when the large Integrated Agricultural Development Projects, and their supporting donors, favoured mass data-collection for baseline surveys. Enumerators were trained and assigned to each of nine villages in different parts of the country. They stayed in the villages throughout the cropping season, and details were recorded of areas cultivated each day by those farming with animals and those using hand labour. Information was collected on the daily use of the animals, and the time allocated for grazing them. Although some records were lost through sickness and absences, a filing cabinet full of data was built up, and partially analysed.

Unfortunately, the expatriate supervising the survey left prior to the final analysis, and this meant that even fewer lessons were learned from the difficult exercise than might have been the case. The data were never entered into a computer, and this may have been for the good, for statistical analysis may well have given a spurious authority to any conclusions. In practice, much information, including the "objective" measurements of times and areas, would have probably correlated mainly with the personalities and moods of the enumerators. The detailed data sheets and survey codings disguised the fact that the young men with secondary school qualifications seldom actually spent their days with a tape measure in a rice swamp or followed grazing animals with a stop watch. They were intelligent enough to produce imaginative estimates for the data sheets from the comfort of their lodgings.

Thus the first attempt at a socioeconomic survey provided useful (negative) lessons on the value of such exercises, and made the project realise that it did not really need data so much as a thorough understanding of the role that draft animals could play in the farming systems. This led to the development of a more subjective and personal approach to the socioeconomic impact of animal traction (Allagnat, 1984). Subsequent surveys were undertaken mainly by senior staff themselves, and rather than looking at daily work rates, the emphasis was placed on what was achieved during a season, and by whom. These surveys were stratified to allow various economic comparisons between ox-users and non-ox-users in villages where draft animals were maintained, and between ox-hirers and non-ox-hirers in villages where no work oxen were owned (Allagnat, 1984; Allagnat and Koroma, 1984).

Gender and age issues

At the outset the project tended to operate in a male-dominated environment: all project staff were men, as were most Ministry of Agriculture officials, aid donor representatives, traditional chiefs and cattle-owning farmers. Socioeconomic surveys indicated that women did obtain benefits from borrowing or hiring oxen, but at that stage most users of animal traction were men. While there seemed no evidence that women were marginalised by animal traction, it was noted that male children of oxen-owning families seemed slightly less likely to be sent to government-run schools (Allagnat and Koroma, 1984) although they benefited from traditional Islamic education.

In order to stimulate the interest of women in animal traction, the project provided training to members of a women's association near the Maboale Valley. In the short term, the association proved mutually beneficial in clearly demonstrating to organisations and local farmers that women could work with oxen as well as men (the winners of the 1985 national plowing competition were young women). However, almost as quickly as young

Members of a women's association plowing with oxen near the Maboale Valley



Photo: Paul Starkey

women were trained, they were married and became unavailable to the association. After some time, the women hired men to work with their animals. Women are involved with animal traction in several parts of the country, but the great majority of ox users are still men.

Present situation and constraints

In 1987, the Work Oxen Project lost its temporary "project" status, and became a programme of the Ministry of Agriculture and its staff were absorbed into the establishment. Animal traction had thus become a long-term element of national agricultural policy. Much of the programme work continued to be implemented through area-specific, donor-assisted projects that had appropriate resources.

By 1992, about 3000 N'Dama cattle were used for work in the country, mainly for plowing. Most implements in operation were single-purpose plows or multipurpose toolbars used only as plows. While some farmers used wooden or steel harrows, very few weeders, ridgers and ox carts were in operation. The numbers of farmers benefiting from the oxen were much greater than the numbers owning oxen, since ox owners almost invariably plowed for several other farmers in the area.

Two fundamental (institutional) constraints to the development of animal power during the period 1978–85 had been the people's attitudes towards the animal draft technology and the lack of equipment. As these two factors ceased to be limiting, the animal health constraint and overall economic conditions appeared increasingly important in many parts of the country.

Animal health

Animal traction had been well-proven by farmers in the north of the country, and animal power extension programmes could be recommended there with some confidence. Elsewhere, it appeared necessary to proceed with great caution. Pilot technology transfer programmes in the south, the east and the central part of the country had recorded heavy loss of animals due to health problems. The existing veterinary facilities and services had been inadequate to determine the causes of the mortality. Some locally-funded research had been undertaken on traditional means of ensuring the health and husbandry of the animals, and a revolving fund had been established to improve the supply of drugs in remote areas (McKinlay, 1990). Nevertheless, there appeared to be areas of the country where there seemed little point in trying to transfer animal traction technology, unless animal health constraints were also solved.

Economic, political and infrastructural factors

A primary constraint to agricultural development in Sierra Leone in recent years has been low farm profitability. Low prices for farm produce have made it difficult to justify or encourage investment in agricultural technologies. As in many African countries, the influential urban population wants low food prices, and this encourages the government to import cheap food and accept "food aid". The requirement of farmers for assured and high produce prices is difficult to reconcile with this.

The long-standing economic problems have been compounded by more recent political problems, notably rebel incursions. Even outside the areas of unrest, the troubles have had a large psychological and economic impact. Thus, as in many other African countries, many constraints to transferring animal power technology in Sierra Leone have been economic and political rather than technical: large problems of technology transfer are small compared with the major economic and political problems.

Although the infrastructure of the rural areas is very weak, the ability of Sierra Leonean entrepreneurs to overcome such constraints has been convincingly demonstrated in recent years. Small-scale private-enterprise rural transport services (known as "podapodas") and private mining schemes in isolated areas have succeeded in keeping their machines running for prolonged periods despite chronic national shortages of fuel, spare parts and foreign exchange. The implication is that if farming in Sierra Leone was sufficiently profitable, the farmers and entrepreneurs would find ways of sustaining the necessary technologies.

Crime

Theft, corruption and patronage remain major sociological constraints to the development of agriculture in Sierra Leone. Animals can be easily stolen and disposed of as meat, equipment can disappear and crops can be stolen from the fields. Widespread corruption means that crime generally does pay. The combination of crime, corruption, uncertain land tenure and traditional and governmental patronage means that farmers face high risks. Farmers have been reluctant to put their time and money into long-term, high risk farming investments, such as animal traction, particularly when farm profitability has been low. Projects can do little to change such situations, but some interventions, such as the development of recognisable branding systems for work oxen, may increase confidence and/or reduce crime and improve the prospects for draft animals.

Project mentality

For the past thirty years, both the Ministry of Agriculture and the rural economy have been strongly influenced by donor-assisted projects, lasting between two and eight years. These have provided ministry staff with various "perks" and have temporarily provided subsidised services or inputs to farmers. Projects have been able to import equipment free from most of the problems and charges incurred by the private sector. A vicious circle has developed, and as projects have provided more subsidised products and services, the private sector has become less involved in the supply and distribution of comparable inputs. Even village blacksmiths have found it difficult to make a plow share from a car spring for less than the (subsidised) cost of an imported share.

While donors increasingly talk of privatisation of services and sustainable private sector initiatives, no one really expects the formal private sector to bother with something as difficult as animal traction (widely distributed market, high transport costs, seasonal sales and high price sensitivity). With the chronic shortage of steel and manufacturing capacity, any workshop that could make plows, could make more profit by making other items for the urban or transport markets. Thus all involved (government officials, private sector services and farmers) anticipate that if one project supplying inputs "fails", another donor-assisted initiative will follow. In such a situation, the prospects for long-term sustainability of local equipment supply seem poor, but prospects for village level persistence of the technology remain high.

Conclusions

Sierra Leone provides a fascinating case history relating to the transfer of animal traction technology. Despite various attempts at oxenisation and tractorisation, human energy remains the main power source in the dominant bush-fallow farming systems. Cattle are in short supply in much of the country. Apart from the north, the country appears only marginal for successful cattle raising (although climatic changes and increasing bush clearance have made it easier for draft animals to survive). Similar problems (but not identical conditions) relating to an apparently unfavourable combination of climate, disease, scarcity of animals and extensive farming systems based on shifting cultivation are found in many other West and Central African countries including Guinea, Guinea Bissau, Ghana, Togo, Benin, Nigeria, Cameroon, southern Tchad, Central African Republic and Zaire. They are also found in

several parts of eastern and southern Africa: including northern Zambia, north-east Tanzania, northern Mozambique and south-west Uganda. There have been some comparable pilot animal traction schemes within these countries and animal traction is slowly spreading in similar "unfavourable" humid and semi-humid areas.

In Sierra Leone, as in many other areas where animal traction has been largely unknown, lack of farmer knowledge of animal traction has been a limiting factor, requiring extension programmes. Often the whole of the support infrastructure needed for animal traction has been absent, and therefore needed to be supplied (on a temporary basis) from the introducing organisation (eg, provision of implements, spare parts, animals, veterinary services and credit). Once a critical mass of users has developed and the needs have been identified, such services can be provided by other organisations (private sector or governmental). The long-term sustainability of animal traction will depend on the development of such local support services.

Like several other countries in Africa, the economic environment in Sierra Leone has not been conducive to agricultural investment. Comparable problems of high inflation, foreign exchange shortages and/or corruption have been experienced by Angola, Ghana, Guinea, Mozambique, Nigeria, Tanzania, Uganda, Zaire and Zambia. In these and other countries, policies relating to the importation or pricing of staple foods have made profitable farming difficult. Such major macro-economic problems or distortions are likely to influence the success or failure of draft animal power far more than any "project" initiatives which might be suggested.

In common with many other countries in Africa, in Sierra Leone animal traction was scorned for a time, but has recently become an accepted element of national development strategy.

Interaction of the draft animal programmes in Sierra Leone with programmes elsewhere in Africa has been high. This, together with close-knit, inter-disciplinary research-development-extension teams and regular contact with farmers has helped keep morale high; the infectious enthusiasm of staff has probably been a factor in the relative success and durability of the programme. Collaboration between the various national institutions has been close and aid agencies' initiatives have generally complemented each other. Sierra Leone has managed to avoid some of the pitfalls of working in isolation, but in some cases, it may have suffered from giving more weight to ideas from other countries than to the wishes of the local farmers.

Animals have been used mainly for plowing, and early attempts to promote animal-powered weeding have been disappointing. This is similar to experience in other countries: weeding is often accepted several years after plowing. Furthermore, weeding technology is easier to transfer if the main crops are maize, cotton and groundnuts, rather than rice. The low use of animal-drawn carts appears surprising, and this seems an area for investigation.

The Sierra Leone experience should certainly not be taken as a model, but many programmes elsewhere in Africa could benefit from the many positive and negative lessons gained in attempting to transfer animal traction technology in a difficult environment.

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