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New Approaches to Animal Traction in Niger

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PART I

DESCRIPTION OF THE FEED PROJECT

The PID for the Farm Equipment Enterprises Development (FEED) Project was prepared by AID/Niger in August 1982 and subsequently approved by AID/Washington. In the approval message, a number of key issues were identified as requiring further analysis during the final design. Based on this analysis, it has been determined that the project as proposed in the project identification document (PID) is not economically feasible under present conditions in Niger. This report explains why it would be inappropriate to finance and implement the FEED project and proposes several interventions that can effectively address the same concerns in the context of existing AID-financed projects.

The basic justification for the FEED project was to satisfy the need for animal traction equipment in Niamey Department. The analysis in the PID indicated a potential demand for this equipment that was considerably beyond the existing production capacity in the country. The requirements for animal traction units (ATUs) in Niamey Department were estimated to be 44,000 in rainfed areas, 12,000 in non-irrigated areas along the Niger River, and 1,000 in the irrigated areas being developed by ONAHA. It was further estimated that, once certain problems of equipment design were resolved, there would be an additional demand for 130,000 units of donkey traction equipment in the northern areas.

To meet this demand, the PID proposed that a network of metal-working enterprises be established in the private sector. In fact, the basic thrust was to use the demand for animal traction equipment as the basis for an efficient and financially sustainable metal-working industry, first in Niamey Department and later in other parts of Niger.

The project's specific objective was to create the capacity to produce 3,600 ATUs per year. The proposed system comprised four levels of production:

- A manufacturing plant at the department level to produce parts requiring relatively sophisticated machinery. This shop would require an investment of about $300,000 and employ about 20 persons;
- Two fabricating shops at the arrondissement level to cut and drill metal parts, and assemble equipment. Each of these shops would require an investment of about $55,000 and employ about 10 persons;
- Six assembly shops to weld and form certain parts. These shops would assemble ATUs and produce certain spare parts. Each shop would require an investment of about $20,000 and employ three to five workers; and
- Thirty-six blacksmiths trained and equipped to repair equipment and produce spare parts not requiring welding or heavy machinery. Each blacksmith would be required to invest about $6,000 in equipment and raw materials.

The FEED project consisted of five activities to achieve the above objective:

- Technical training for each level of production, including in-country vocational training and higher level training abroad;
- Two credit funds, one to finance the initial investments in the private metal-working enterprises and the other to finance the sale of animal traction equipment to farmers;
- Technical assistance to advise firms on marketing programs and to carry out market studies for metal products other than animal traction equipment;
- Technical assistance to provide management training for larger enterprises; and
- An applied research program aimed at improving the design of the animal traction equipment to adapt it better to the needs of farmers in the different agro-climatic zones of Niger.

These activities were to have been implemented by four institutions: OPEN, for the vocational and management training and the marketing assistance; BDRN, for credit to small enterprises; CNCA, for credit to farmers; and INRAN, for applied research. Excluding inflation and contingencies, the project costs were estimated to be $3 million for technical assistance, $2 million for credit, and $1 million for training.

PART II

FINDINGS OF THE PROJECT PAPER TEAM

EXCESS MANUFACTURING CAPACITY

The first two levels of production, the manufacturing plant and the fabricating shops, were based on the assumption that there was insufficient production capacity in Niger to meet the needs of Niamey Department. At present, three production units are operated by UNCC. Table 1 presents their production capacity, according to UNCC sources. The figures, however, are based on one shift working six months per year, and therefore grossly underestimate actual capacity. In fact, CDARMA in Dosso produced 1,900 donkey and 2,300 ox carts in 1983, while operating less than six months. This indicates that, even for a six-month period, the above figures may be underestimates.

The demand for animal traction equipment nationwide is more difficult to estimate. Table 2 presents actual deliveries by type of equipment since 1976-1977. These figures, however, are of limited use in estimating demand for several reasons:

- The quantities produced and distributed are determined to a large extent by the availability of subsidy funding from the Government of Niger (GON). The funds allotted by the GON for subsidies set the upper limit on what is produced and delivered to the Centrale d'Approvisionnement (CA).
- What eventually is sold to farmers depends largely on whether credit funds are available and on the effectiveness of productivite projects in distributing the equipment to the cooperative and village levels. There is a strong correlation between the sale of equipment and the existence of productivite projects.

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TABLE 1

ANNUAL PRODUCTION CAPACITY - UNCC WORKSHOPS

	CDARMA (Dosso)	ACREMA (Tahoua)	UCOMA (Zinder)	TOTAL
Multipurpose tool bars	-	3,000	3,000	6,000
Plows	-	3,000	500	3,500
Cultivators	-	3,000	3,000	6,000
Ridgers	-	3,000	500	3,500
Weeders	-	3,000	3,000	6,000
Donkey plows	500	-	1,000	1,500
Planters	-	-	2,000	2,000
Ox carts	1,000	1,500	3,000	5,500
Donkey carts	1,000	1,500	1,000	3,500

Source: Warren Enger, Report on Animal Traction, Table 3. 1983.

TABLE 2

UNCC SALES OF AGRICULTURAL EQUIPMENT

Equipment	76/77	77/78	78/79	79/80	80/81	81/82	82/83(A)
Tool bars	1,096	2,549	3,882	3,405	4,500	6,827 (50)	2,596 (5)
Plows	683	1,949	2,060	1,777	1,980	2,684 (50)	872(12)
Cultivators, 3 teeth	701	1,233	2,562	1,295	1,238	2,462 (50)	746(25)
Cultivators, 5 teeth	113	1,426	362	498	2,053	2,107 (50)	1,127(53)
Ridgers	408	1,179	844	431	760	856 (50)	231 (0)
Weeders	348	2,664	2,033	824	2,854	3,634 (50)	1,383 (0)
Donkey plows	105	1,069	129	434	912	542 (50)	227 (6)
Planters	4	1,482	864	35	457	1,740(127)	546 (4)
Ox carts	887	2,285	2,816	3,056	3,631(44)	5,366 (19)	2,171(13)
Donkey carts	361	1,408	1,686	1,869	2,092(61)	2,999 (45)	820(12)

Source: UNCC/Centrale d'Approvisionnement

Note: Numbers in parentheses represent percentage added.

(A) Period: October 1, 1982 - August 30, 1983 (11 months).

- Most of the animal traction equipment is heavily subsidized, generally at about 66 percent. There were no changes in subsidy rates between 1973 and 1981. Prices were increased substantially in 1981 and again in 1982, when deliveries experienced a sharp decline. However, these price increases coincided with sharp reductions in the availability of credit so that it is not possible to determine the extent to which the reduced deliveries resulted from price increases or credit reductions. Given that subsidies remain high, it is likely that most of the drop is due to the non-availability of credit.

- The figures in Table 2 represent deliveries from the CA, not actual sales to farmers. Stocks in cooperative warehouses grew in 1982 and 1983; thus sales in the 1981 and 1982 seasons were almost certainly less than is implied by Table 2.

The dominant factor affecting this situation at present is the likelihood of continued and probably substantial declines in subsidies. The GON is experiencing severe budgetary problems as a result of reduced uranium earnings. Enger estimates that if subsidies were entirely eliminated, demand for all equipment except carts would virtually disappear.[1] This assessment requires further study. It is clear, however, that there will not be a shortage of production capacity for animal traction equipment in Niger in the foreseeable future.

The main implication for the FEED project is that the proposed manufacturing plant and two fabricating shops cannot be justified. If these enterprises were to be established in the private sector, they would not be financially viable. A cursory examination of the metal-working industry in Niamey by the industrial engineer on the project paper design team indicated that this would be the case even if these enterprises were to produce a wider range of metal products to meet the needs of manufacturers, builders, and consumers in Niamey and other areas.

NON-VIABILITY OF ANIMAL TRACTION EQUIPMENT

Although animal traction is considered to be an integral part of the improved technical package in Niger, few farmers have adopted it. Even in Maradi Department, which has the best rain-fed agricultural conditions, the largest production of cash crops, and the largest agricultural extension program, only 8 percent of the farmers use animal traction. In general, farmers consider the cart to be a good investment but will not purchase the production-related equipment unless it is heavily subsidized.

Although the reasons for this lack of willingness to adopt animal traction are not well understood, several studies prepared for AID during the past two years have provided important insights into some of the key issues. These studies include the Niamey Department Development Project (NDD) survey of 1980 and 1981 farmer training center (CPT) graduates; the farming systems analysis carried out by Dr. F. Steir for the FEED PID in 1982; Warren Enger's report on the supply and demand for animal traction equipment in Niger; NDD agronomic research conducted on CPT fields by Mary Abrams, with an economic analysis of the results by Douglas Barnett; NDD on-farm research conducted by Michael Wybo; and the recently completed study of the improved technical package by consultants from Ithaca International, Ltd. This section is based largely on information contained in those reports.

Agronomic Assessment

Animal traction provides the most benefits in heavy soils mainly because of labor savings and yield increases related to land preparation. Other benefits include labor savings from mechanized weeding and, in the case of groundnuts and cowpeas, planting with an animal-drawn seeder. Surveys and project experience in Gambia, southern Mali, and southern Upper Volta

show substantial increases in area and yields from animal traction, as well as relatively widespread adoption by farmers. In addition to the relatively heavy soils in these areas, factors favoring the use of animal traction include:

- Higher and more regular rainfall, which reduces the risk of poor crops and results in higher benefits from animal traction in absolute terms; and
- Widespread production of cash crops (including the commercial production of millet and sorghum), which are an essential prerequisite to the successful incorporation of animal traction into traditional or improved farming systems.

In light soils, which predominate in Niamey Department, the benefits from animal traction are less clear. In most areas, deep plowing offers no benefits. The recommended land preparation is to scarify the soil. This requires much less labor per hectare. In soils that are pure sand, even scarifying is unnecessary and can in fact have a negative impact because the practice results in increased wind erosion.

In Niamey Department, most soils have a slight clay content. This causes a crust, which should be broken by scarifying the surface to improve moisture penetration and absorption of nutrients. Animal traction reduces the labor requirement for this activity, but the main benefit is related to weeding. Labor availability for weeding is the principal factor limiting the area that can be cultivated in the light soils of the Sahel. By breaking this blockage, animal traction can result not only in increased area cultivated, but also in increased yields. Some evidence exists that delays of even one week in weeding can reduce yields by over 10 percent.

Several other factors can affect the overall impact of animal traction on production under the conditions that prevail in Niamey Department. For example, there is a potential conflict between using animal traction for weeding and the intercropping of millet and cowpeas -- a traditional practice that provides

substantial benefits to farmers. Under the traditional system, weeding is carried out after the cowpeas have been planted between the millet rows, thereby making mechanized weeding impossible. However, the recommendation for millet fields is a first weeding one week after planting and a second weeding three weeks after planting. This recommendation would be consistent with the present practice of planting cowpeas four weeks after the millet has been planted. Another possible approach would be to do the first weeding immediately prior to planting cowpeas, and the second weeding by hand.

One technical recommendation for millet production in Niger is to use a tracer to mark the rows prior to planting. This is to ensure the recommended density of 10,000 plants per hectare; it is also to ensure that the rows are straight, a necessary prerequisite for mechanized weeding. There are several problems with this recommendation. Because tracing is time consuming, it delays planting, which can significantly reduce yields. Moreover, plant density can vary considerably without affecting yields, thus eliminating a principal reason for tracing. Farmers with animal traction do need to plant in straight lines, but this can be accomplished in less time-consuming ways.

Other applications of animal traction in light soils include the use of a seeder for planting groundnuts (which is not applicable to Niamey Department, where groundnuts are a minor crop) and of a cart for transporting the crop from the fields to the village. This alone does not justify the cost of a cart but does have a labor-saving value when a cart has already been purchased for other reasons.

Thus, the main on-farm use for animal traction in Niamey Department is for weeding. The production impact of this one use cannot be determined on the basis of research done to date. Animal traction is usually tested as part of a package of recommendations that includes improved seeds, fertilizers, fungicides,

and timely planting and weeding. Attempts to determine production increases attributable specifically to animal traction have been inconclusive. However, the demand for animal traction equipment in the NDD project area is only partly explained by the high subsidies. The factors other than agronomic effects that determine the on-farm use of animal traction equipment are discussed below.

Farm-level Impact of Animal Traction

Three sets of issues determine the impact of animal traction at the farm level. The first is whether the potential impact of animal traction equipment on crop production is sufficient to justify the cost. There is not only the initial investment but also the cost of fodder and the opportunity cost of dry season care of the animals outside of traditional herding.

The main benefit is from weeding, and the impact of this one change on production is unknown. It is fairly certain, however, that in light soils investing in ox traction rather than the much less expensive donkey traction cannot be justified agronomically. The difference in labor savings between the two packages is unlikely to cover the difference in cost. However, the use of donkey traction may result in sufficient increases in area and yields to justify the investment, but this possibility requires further study.

The second issue concerning the farm-level impact of animal traction is whether a significant difference will result on farmers' fields. The experience of other projects, such as the Eastern ORD project in Upper Volta, is that few farmers use animal traction for weeding; thus, overall, farmers adopting animal traction experience no discernible increase in yields and, on average, about a 10 percent increase in area.

Aside from the technical limitations of animal traction in light soils, there are two main reasons for the lack of impact:

1. The learning curve associated with animal traction. The experience of projects that include animal traction has consistently been that the more experience a farmer has with animal traction the more he uses it. This is especially true of weeding, which requires the most skill on the part of both the farmer and the animal. In the Eastern ORD project, for example, only one-third of the farmers with animal traction equipment had a weeder and of these only one-third used it. Of the farmers with ox traction, only 10 percent of those with less than two years of experience used their animals for weeding. This percentage increased to 36 percent after three years and 56 percent after seven years. In the Maradi Productivite Project, a survey of animal traction users showed the following relationship between years of experience and area farmed using animal traction:

Year of Purchase	Area (ha.)
1980	5.7
1979	7.5
1978	8.2
1977	9.5

Thus, the documented experience of most projects tends to understate the potential impact of animal traction on production. Most projects do not allow sufficient time for farmers to become fully adept at using what for them is a radically different technology.

2. The lack of support services. Studies of most animal traction projects have found low-quality extension, poorly trained animals, inadequate animal health care, inappropriately designed equipment, and inadequate equipment repair services. Even in Niamey Department, where the agronomic

potential of animal traction does not appear to be great, some farmers would use the equipment if the supporting services were adequate.

The third set of issues that determines the farm-level impact of animal traction concerns the additional benefits that can accrue, including:

- Revenues from cart transport;
- Increased value of oxen;
- Use of animal traction equipment on neighbors' fields; and
- Off-farm employment made possible by labor savings.

The least is known about the last two activities. Their importance will depend on demand and on the farmers' perception of whether these activities are remunerative enough to allocate labor time. Revenues from carts are known to be very important. In fact, this activity is now the most profitable use of animal traction in Niger.

Economic Analysis of the Farm-level Impact of Animal Traction in Niamey Department

The report on the agricultural technical packages in Niger by Ithaca International, Ltd. contains a detailed economic analysis of the use of animal traction in Niamey Department. The findings of that analysis are summarized in this section. The methodology included synthesized enterprise budgets for individual crops, as well as whole farm budgets that encompassed the production of several crops; off-farm income; and total costs of the farm enterprise, including the opportunity costs of labor and capital. Calculations were performed at financial prices (subsidized inputs and official crop prices) and at economic (uncontrolled market) prices. Budgets were prepared for high and low rainfall zones (higher and lower than 400 mm per

year). Within each zone, assumptions were made concerning level of technology adopted and farm size. While every effort was made to establish realistic magnitudes, these budgets are not derived from surveys of actual farm operations.

The findings as they relate to millet, which accounts for 80 percent of agricultural production in Niamey Department, are summarized below.

1. When farmers adopt all of the technical recommendations except animal traction, the financial analysis indicates increases of at least 20 percent in returns to labor, with higher increases in the south, where there is more rainfall. Although the farmer must sell a higher percentage of his crop to meet cash expenses, he is still able to keep more for home consumption than under the traditional system. This is due to a substantial increase in total production, which is attributable largely to increased yields from chemical fertilizers. When the budgets are calculated at economic prices (that is, when costs are calculated at unsubsidized prices), however, all income benefits from the improved package, excluding animal traction, are eliminated, and farmers experience negative returns, especially in the north. When the subsidies are removed, the cost of the recommended technical package, excluding anaimal traction, exceeds the value of the resulting increase in production.

2. The analysis of the impact of the total package, including animal traction, is intentionally based on somewhat optimistic assumptions concerning animal traction. Specifically, it assumes no losses in work time due to the feeding and caring of the animals; income from the off-farm use of the cart for 75 days per year; and a 20 percent increase in yields resulting specifically from animal traction (claimed but definitely not proved). The financial analysis (using subsidized prices) shows posi-

tive returns to the use of the improved technical packages with animal traction in both the north and the south. In the north, the highest return to farm-family labor is obtained from the improved package using donkey traction; in the south, ox traction provides the highest returns.

However, as in the case of the technical package without animal traction, the analysis at economic prices negates all benefits. The full package shows negative returns for both low and high rainfall zones and all farm sizes, although considerably less negative for donkey traction. At economic prices, the traditional system offers the highest return to labor in the north, and the donkey traction package offers the highest returns in the south, but only by a small margin. Given the optimistic assumptions with respect to animal traction mentioned above, the traditional system is probably also the most remunerative in the south at economic prices. In the northern areas, the improved technology with animal traction is less remunerative than the improved technology without animal traction. In the southern areas, adding donkey traction increases returns to labor, but adding ox traction reduces returns.

The analysis of whole farm budgets (production of subsistence and cash crops plus off-farm income) provides a slightly more positive picture of agriculture in the Niamey Department; the returns to labor from the production of certain cash crops substantially increase the profitability of the overall farm enterprise. However, the conclusions with respect to the returns to the complete improved package relative to the traditional system remain the same. Perhaps the most important finding with respect to animal traction is that in almost all cases farmers will not be able to pay all of their production costs and meet

their other needs without earning cash income from the use of the cart. This means that strictly in terms of the impact on crop production the improved technical package with animal traction is not economically viable at the farm level.

Conclusion

Animal traction is only one element of a recommended technical package that includes:

- Soil preparation to improve water and nutrient absorption;
- Improved seed varieties, better seed selection, and fungicide treatment of seeds;
- Timely planting;
- Optimal plant densities;
- Timely weeding; and
- Use of manure and chemical fertilizers.

The combined effect of the technical recommendations under research station conditions can more than double yields, although the net effect on farmer incomes is usually much less. The key issue is to determine what the contribution of animal traction is to the overall impact of this package, and whether it is worth the cost. In Niamey Department, animal traction is involved at the weeding stage and, to a lesser extent, in soil preparation. Experience has shown that the impact of animal traction in Niamey Department on production is minimal and on income is negative.

In addition, the most difficult decision the farmer must make with respect to the improved package is whether to adopt animal traction.

- The animal traction package is expensive and for most farmers involves going deeply in debt.

- Farming with animal traction is much riskier than traditional farming, which involves almost no cash outlays. The farmer stands to incur substantial losses if the rains fail or if other unforeseen problems occur.

- Investment in animal traction for crop production can succeed only with a cash crop. For most farmers in Niamey Department, this is a major departure from traditional farming practices.

- A positive return on a farmer's investment usually depends on the ability to earn off-farm income, which further complicates the decision.

- There is a long learning curve, which means that benefits are usually a long time in coming.

In short, the decision to adopt animal traction involves a major and drastic reorientation of the typical farm enterprise.

Available data on costs and benefits are limited. Although, on average, the data indicate marginal or negative returns to animal traction, they are highly variable. Within the averages are instances of significant yield and area increases as well as increased off-farm income and total income. Furthermore, farmer interviews in the NDD project area indicate a demand for animal traction under certain conditions.

These conflicting signals indicate the need to:

- Proceed cautiously in recommending animal traction;

- Change the orientation of the animal traction program, especially away from twin ox traction toward donkey traction; and

- Carry out further on-farm studies of production impact.

The subjects to be studied and alternative approaches are discussed in Part IV.

LIMITED DEMAND FOR METAL-WORKING SERVICES IN RURAL AREAS

The PID proposed the creation of six assembly shops, which would finish about 1,200 ATUs annually and perform other work and repairs as ordered. This structure closely follows the model implemented by the other ATU production projects in Dosso (CDARMA), Tahoua (ACREMA), and Zinder (UCOMA). In the case of CDARMA, there is a central assembly shop in Dosso and three satellite assembly shops in Tibiri, Malgorou, and Tara. As a result of this decentralization, the central unit has to maintain close links with its satellites for the following reasons:

- The supply of raw material;
- Quality control of the production process;
- Maintenance of machinery and equipment; and
- Transportation of the final product.

Since these ATUs are not sold directly to the local population, there is little economic justification for this decentralization.

To staff its assembly plants and upgrade the skills of blacksmiths to service and maintain the ATUs, CDARMA has trained 63 local blacksmiths and provided them with the necessary equipment. Unfortunately, these blacksmiths have found it more lucrative to work in the assembly shops, where they earned an average of 320,000 CFA each in 1983 during the five-month production season, than to repair and service ATUs at the village level.

The CDARMA staff are well aware of their program's shortcomings and at present are trying to reorient it radically. First, they propose to concentrate assembly in Dosso and replace the blacksmiths who are paid per unit completed with salaried workers who will be employed year round. It is estimated that this change could cut production costs by up to 26,000 CFA, an

average of 5,850 CFA per cart. Second, the satellite shops will no longer be involved in assembly work. Instead, they will concentrate on providing assistance and support to blacksmiths at the village level through technical follow up, supply of raw materials and spare parts, and access to welding equipment.[2]

The ACREMA experience in Tahoua appears to be similar. The basic idea in 1979 was to have a central assembly shop with village-level workshops to maintain animal traction equipment as well as satisfy demand for other metal products. To this end, expensive equipment was bought, including two large generators. Nineteen villagers were trained, only three of whom were traditional blacksmiths. The principal criterion for selection was literacy. Because these village-level workshops were overequipped and the workers trained were uninterested in village-level blacksmithing, three of these workshops were upgraded to satellite assembly shops to justify their existence.[3] They generated some additional income by providing welding services for local villagers. According to a recent survey, ACREMA now has two functioning village-level workshops in addition to the three satellite assembly shops. These workshops are reputedly involved in both assembly and maintenance of animal traction equipment.[4]

Certain lessons can be drawn from these experiences, which are applicable to the PID proposal concerning the creation of assembly shops. As the Dosso case has shown, assembly shops are not efficient unless they produce specifically to satisfy local demand on a year-round basis. At present, increasing assembly capacity cannot be justified -- whether at the level of the arrondissement, the department, or the capital. The three production and assembly plants work only on a seasonal basis of five to six months per year. Furthermore, effective demand for animal traction equipment is decreasing, a result primarily of the credit constraint, as indicated in Table 2. The figures for

1983 cover only 11 months; the figures for each year refer only to the total number of ATUs actually distributed, not to the number sold.

The official figures on the productive capacity of the three UNCC workshops are open to question. For example, the annual productive capacity of CDARMA at Dosso is said to be 1,000 donkey carts and 1,000 ox carts. Nevertheless, Dosso managed to produce 4,200 carts in less than six months during 1983. In December, there were 1,900 donkey carts in the CDARMA yard that UNCC was unable to purchase. CDARMA wanted to sell these carts in the open market, if UNCC would give its authorization.

In general, however, the present UNCC production and distribution system is extremely inefficient and makes little sense economically. For example, CDARMA, which is located relatively close to Niamey, produces only carts. Any other animal traction equipment for Niamey Department comes from either Tahoua or Zinder -- with UNCC paying to have the necessary inputs transported there and the finished products, back. In practice, this means that transportation costs add an average of 26.3 percent to the price of the finished product, as shown in the Table 3.

If the production system is rationalized in the future, particularly in terms of modifying existing equipment and production lines or even producing new equipment designed for specific ecological zones, then there may be some justification for introducing assembly shops at the arrondissement level. At present, however, the establishment of assembly shops cannot be justified. Once the equipment assembly requirement is dropped, the major justification for creating metal-working shops with welding capacity at the arrondissement level withers away. It is highly unlikely that a new shop could survive economically solely from the repair of animal traction equipment and the production of simple metal goods.

TABLE 3

DISTRIBUTION COSTS OF ATA VERSUS PERCENTAGE OF PRODUCTION COSTS IN 1982

	Producer Price (CFA)	Consumer Price (CFA)	Distribution Costs (CFA)	Percentage Added
Bati de base	14,824	18,726.5	3,902.5	26.3
Charrue 10"	15,805	19,965.8	4,160.8	26.3
Cultivateur 5 dents	21,595	28,095.7	6,500.7	30.1
Cultivateur 3 dents	13,265	16,757.1	3,492.1	26.3
Buttoir	8,720	11,015.6	2,295.6	26.3
Sercleuse	8,137	10,279.2	2,142.2	26.3
Houes asine	16,890	21,336.4	4,446.4	26.3
Semoir monorang	54,796	69,221.8	14,425.8	26.3
Charrette bovine	77,538	97,950.6	20,412.6	26.3
Charrette asine	65,400	82,617.8	17,217.8	26.3

Source: UNCC/Centrale d'Approvisionnement.

Field trips to visit blacksmiths and villagers in Koni-Beri (Niamey), Tabala and Chatt (Filingue), Makalondi (Say), and Namari-Goungo (Tillaberi) indicated that the one service these shops could provide is welding. If villagers need metal products not produced by the local blacksmith, such as beds, doors, chairs, rakes, and watering cans, they generally prefer to buy them in Niamey, usually in the Bukoki market. The more capable blacksmiths contend that they could perform simple repairs on animal traction equipment and produce some spare parts. They would have a problem only if welding were required or some part that could be found only in Niamey had to be replaced.

Nevertheless, the present lack of welding capacity does not appear to be a serious constraint to the repair and maintenance of animal traction equipment. For example, blacksmiths repair ox-cart draw-bars. Because these are already welded, they are prone to break. Instead of repairing the break by soldering, the blacksmiths interviewed can rivet plates on either side of the break, thereby creating a stronger joint than would otherwise be the case.

The most appropriate means of strengthening the capacity of blacksmith to meet village-level needs are:

- Short-term training, both technical (upgrading present skills and teaching new skills) and managerial (specifically simple accounting procedures); and
- Credit for raw materials and selected space parts for animal traction equipment.[5]

NOTES

1 Warren Enger, Report on Animal Traction (draft), November 1983, p. 44.

2 The information on CDARMA was provided by the staff. Additional information can be found in "Propositions pour la re-organisation des structures et de gestion du Centre DARMA Dosso" by C. Hondus, Assistant Technique, Dosso, March 1983.

3 Ph. Belhomme, 1981. Developpement du machinisme agricole et de l'artisanat rural: Niger: Etude du cadre institutionnel de l'ACREMA et des ateliers decentralises et analyse economiques des options de decentralisation du processus de production. PNUD/BIT, pp. 19-25.

4 CEEMAT, 1982. Etude de Factibilite du Projet Regional de Machinisme Agricole dans les Pays du Conseil de l'Entente. Antony, France, pp. 99-100.

5 Some of these points have already been made by NDD. See "Formation des artisans ruraux Makalondi 25/4 au 14/5/83," Jean-Louis Marolleau, Niamey, June 1983.

PART III

A PROGRAM TO IMPROVE BLACKSMITH CAPABILITIES IN THE NDD AREA

THE EXISTING SITUATION

Need for Repair and Production of Animal Traction Equipment

The animal traction package should be adapted to meet the requirements of the differing ecological zones within Niamey Department. The demand for the ATU and its specific components varies considerably by arrondissement. UNCC makes little allowance for this local variation, and a farmer is usually obliged to accept a combination of three or more of the following:

- Multicultivator body;
- Plow (10");
- Five-tooth Canadian;
- Lifter-weeder blades;
- Donkey-drawn cultivator;
- Ox-cart; and
- Row tracer.

Concerning the multilcultivator, the most common repair problems center on the riveting that joins the handle shaft to the main frame, and on the small wheel at the front when sand gets in the axle. Concerning the plow, the lower part of the blade wears out and has to be replaced on a regular basis, generally every other year. The same is true for the blades on the weeder, the donkey-drawn cultivator, and the Canadian.

The ox-cart, by far the most popular component of the ATU, is riddled with maintenance problems. The most common concerns are:

- The tires and wheel bearings -- replacements for these are often in short supply;
- The draw-bar to which the oxen are yoked -- it often arrives already welded and therefore is prone to break;
- The metal supports between the axle and the platform -- they are often weak; and
- The welded attachments on the platform through which the sides of the cart are slotted -- they are often weak and too small to provide adequate support.

Furthermore, the platform on these carts is made of wooden slats that wear out easily and do not facilitate the transportation of loose materials such as sand and manure. In contrast, the UNCC donkey cart is sturdier and better built but also has a slated platform. In Makalondi, a donkey cart has been produced with a platform made of steel that is enclosed on all four sides by steel panels. This cart is widely used there.

Need for Other Blacksmithing Services

There is still a need for the production and repair of the traditional hand-tools used in agriculture. In villages in which there are both traditional and NDD-trained blacksmiths, the former are involved primarily with the production of these hand-tools.

The other needs expressed by villagers varied according to ethnic group, ecological zone, and potential buying power and included:

- Small seats;
- Chairs;
- Doors;
- Windows (in both wood and metal); and

- Tools for horticulture, particularly rakes, watering cans, and two-pronged hand hoes.

Blacksmith Capacity to Meet these Needs

At present, the blacksmiths trained by NDD can perform most of the services requested of them -- with the possible exception of the production of tools for horticultural production and welding that cannot be replaced by riveting. In the case of the multicultivator, the blacksmiths can replace the necessary rivets, realign the holes, and repair the front wheel. They can do the same for the teeth for the Canadian and blades for the plow, weeder, and donkey-drawn cultivator.

Repairing the ox-cart is more difficult. Often tires as well as bearings have to be replaced. If the main shaft breaks, it either has to be replaced, something the blacksmith can do, or welded, a task for which he does not have the necessary equipment. However, the blacksmiths can repair much of what was usually welded just as effectively with rivets.

In the case of the row tracer, blacksmiths can replace the frame, sometimes in steel rather than wood, as well as the teeth. It should be mentioned that the usefulness of the row tracer has been strongly criticized. A recent report concludes that it is probably the most time consuming and least cost-effective of all of the recommended ATU practices and suggests that there are less onerous ways of ensuring planting density and aligning rows to permit cultilvation in both directions.[1]

The trained blacksmiths can also produce new equipment, including the donkey-drawn cultivator. While there is increasing interest in its utilization, dissatisfaction has been expressed concerning the standard model supplied by UNCC. During the recent NDD project training program, blacksmiths learned how to produce a lighter donkey-drawn cultivator made from scrap metal and riveted, rather than welded. In Chatt, one of these

blacksmiths has received orders for five, which he proposes to sell at 5,000 CFA each -- compared with the subsidized price for the UNCC model of 12,665 CFA. The same blacksmith also produces oxen yokes that sell at 3,500 CFA. These same yokes, less sturdily made, cost 5,000 CFA in Niamey.

In Makalondi, the blacksmith has produced 30 of these donkey-down cultivators, 23 of which he has sold for 15,000 CFA each, some under contract to the Centre Miniaba and some to private clients. This artisan had also received training in Togo and Upper Volta.

In Namari-Goungou, a blacksmith produces five different models of plows -- a different model for each crop cultivated. The most popular model is priced at 22,500 CFA. Not only are his plows lighter than the standard UNCC model, but on each of his models the draw chain is also attached in a different place to allow for the numerous turns required when plowing with oxen in small, irrigated fields. In contrast to the rainfed agriculture of the NDD project area, irrigated agriculture is practiced at Namari-Goungou, where the demand for and utilization of the ATU is much greater. The buying power of the local farmers is also greater. In the local markets, merchants reputedly sell plows for 35,000-40,000 CFA each.

Although the NDD-trained blacksmiths can make such non-agricultural metal products as beds, doors, and windows, the demand for these products and the prices the villagers would pay for them are unknown. Nevertheless, some illustrations of potential demand can be given. In Koni-Beri, the blacksmith has orders for eight metal beds. He calculates the cost of his materials at 6,400 CFA and then negotiates the price of his labor with the client. In Makalondi, the blacksmith claims that he can produce metal beds more cheaply than those fabricated by a colleague with welding equipment. The latter sells a 90-cm bed for 10,000 CFA and a 1.40-m bed for 13,000 CFA, approximately

2,000 CFA less than beds purchased in Niamey once transportation costs are included. The NDD-trained blacksmith believes that he could produce the same beds for 6,500 CFA and 10,000 CFA respectively and sell them at the same price as his colleague. He is uncertain about the demand but feels that people would prefer to buy from him since his workshop is so near them.

According to villagers, metal beds are more popular because they:

- Are more durable;
- Are insect free;
- Attract little dust; and
- Are more comfortable.

Although many people expressed interest in doors and windows with metal frames, the demand for these commodities depends to a certain extent on the presence of termites and type of house construction, as well as the extent to which villagers have had personal experience of these innovations.

Nevertheless, there is a need not only to train additional blacksmiths (10 proposed in 1984 with perhaps an additional 20 in 1985), but also to upgrade the skills of those already trained. Although course content will differ for the groups, the training should focus on:

- Demonstrating the procedures involved in repairing existing animal traction equipment;
- Constructing modified equipment (particularly carts and plows); and
- Producing metal products for which a local demand exists.

Tools and techniques that correspond to existing blacksmith skills should be used in all three areas.

The major constraint on the productive capacity of both the traditional and trained blacksmiths is the shortage of raw materials. Typically, a client will ask the blacksmith to do a piece of work. Since the blacksmith has little working capital, the client will provide him with an advance. The blacksmith then travels to Niamey, buys the material, and returns -- a costly and time-consuming process. The most successful blacksmiths interviewed had ready access to raw materials, in the form of credit in kind: in Namari-Goungo, informally through the project; in Makalondi, through the Centre Miniaba, but only for the production of donkey-drawn cultivators.

The trained blacksmiths would benefit from training in simple accounting procedures. One blacksmith interviewed in Tabala had little idea of even how to begin costing out the inputs and labor necessary to produce a metal bed. The blacksmith in Chatt had orders for five donkey cultivators, which he produced to sell at 5,000 CFA each, a price that may be too low. The two other models presently available, although somewhat heavier, cost considerably more. The subsidized UNCC model costs 12,665 CFA (in 1982 the real price was 21,336 CFA), and the model produced by the blacksmith in Makalondi sells for 15,000 CFA.

Blacksmiths trained by NDD have had to wait more than two years for any follow-up support from the project. This support has been introduced only recently. M. Mainassara Gagara of NDD, who participated in the May training program, has provided follow-up support since that time.[2] Blacksmiths interviewed expressed interest in assistance -- particularly to help them resolve technical problems in repair and production, but also to assist them with the supply of inputs and the search for new markets.

The above observations concerning present blacksmith capability to satisfy local needs refer only to NDD-trained blacksmiths. Of the original 28 trained in 1980, perhaps 15 are working and can perform the services demanded of them. Although these are not the only blacksmiths who can meet the needs of the NDD area, well-trained blacksmiths are in short supply -- particularly when one bears in mind that NDD has already provided approximately 400 CPT graduates with ATUs and will supply an additional 200 graduates with the same package on an annual basis for at least the next two years. Thus, the demand for more trained blacksmiths should be met by upgrading the traditional, village-level blacksmiths.

Present capacity to satisfy local demand for blacksmith services can be improved by providing:

- Credit for raw materials;
- Training in simple accounting procedures;
- A strengthened follow-up and support system; and
- Additional technical training -- both for traditional blacksmiths and for those already trained.[3]

In the short term, these support activities will increase the capability of local blacksmiths to:

- Maintain existing animal traction equipment;
- Produce modified animal traction equipment adopted to local conditions; and
- Produce a variety of metal products.

In the long term, expansion of blacksmith activities will depend to a large extent on the applied research on animal traction equipment, specifically, the degree to which it can develop modified prototypes. If prototypes are developed, local blacksmiths will be needed to make these modifications. If they are acceptable to the local population, the possibility is raised

of the blacksmiths' producing parts and assembling this modified equipment on a small scale. If this occurs, USAID, the GON, and NDD should seriously consider assembling some of this modified equipment locally -- as the Centre Opérational Régional pour la Méchanisation Agricole (COREMA) has done in Upper Volta. It supplies the various components to the local blacksmiths. One COREMA shop operates at the village level and is run by the local community. However, 250 ATUs must be assembled per year to break even.[4]

LESSONS LEARNED FROM BLACKSMITH PROGRAMS

Selection Process

From the three programs visited, CDARMA in Dosso, Namari-Goungou, and NDD, and a fourth on which some literature is available, ACREMA in Tahoua, several conclusions can be drawn. The most important of these concerns the selection of candidates for blacksmith training. In the cases of both CDARMA and ACREMA, the selection process was complicated by the fact that the emphasis was more on the assembly of animal traction equipment than on its repair and maintenance at the village level. At Namari-Goungou, of the 11 participants trained and supplied with tools, only one presently works as a blacksmith.

In NDD, the selection process was sloppy and those finally selected were not necessarily the best technically or the most motivated. However, the following conclusions can be drawn on the better NDD-trained blacksmiths:

- They are technically very proficient;
- Their villages support them; and
- There is a steady demand for their services.

All three conditions are important. For example, in Fada, a village near Koni-Beri, there is a trained blacksmith who is both technically proficient and enjoys the support of his village. Because the villagers have shown little interest in obtaining animal traction equipment, however, there is a little demand for his services and his considerable talent is wasted.

Type and Duration of Training

In Niger, training tends to be long, and blacksmith training is no exception. For example, the blacksmith retraining presently under way at CDARMA will last five months. The training at Namari-Goungou lasted six months. If the selection process is effective, the candidates chosen should already be technically proficient. The training should upgrade existing skills and teach a few, selected new ones. This process will not take six months.

The recent NDD training program provides a good model. The trainer visited the blacksmiths in their villages to learn their existing skill levels and determine their training needs. He then designed a three-week training program.

Integration into an Ongoing Development Project

In the case of Namari-Goungou, the follow-up support for the one trained blacksmith is informal. In the case of CDARMA, it has been virtually nonexistent. In Maradi, where 90 blacksmiths have been trained over a five-year period, the follow-up support has left much to be desired in terms of financial, material, and technical assistance.[5]

In the case of NDD, the follow-up and integration into the project are only now beginning. Example of ways blacksmiths may be effectively integrated are provided by the Compagnie Malienne

de Développement de Textiles (CMDT) project in Mali, where blacksmiths receive the same type of back-up support as farmers. Candidates for blacksmith training must:

- Live in an area in which animal traction equipment is heavily concentrated;
- Agree to construct a workshop according to the trainer's instructions; and
- Be willing to pay 25 percent down for the tools and equipment they receive at the end of the training course.

Once the training is completed and the workshop constructed, the blacksmith receives regular visits to determine the number and type of services performed (an indicator of the effectiveness of the training program) as well as the income generated (an indicator of his technical proficiency and his productivity). The credit, which is repayable over a three-year period, is collected monthly. Thus, the blacksmith has to be gainfully employed on a year-round basis. In addition, the blacksmiths trained have formed an association to buy raw materials, both used and new, on a wholesale basis.[6]

While this type of integrated program can provide some suggestions for NDD, it is expensive and perhaps more appropriate for areas with much greater agricultural potential than the rainfed areas of Niamey Department.[7] The important lesson is that NDD-trained blacksmiths should receive the same type of assistance and support as NDD-trained farm couples. Although NDD has been severely criticized in the past for its lack of this type of support, even for its own CPT graduates, it is now making a determined effort to upgrade this "service d'appui." It is to be hoped that, in time, the present "agents de suivi" will also support the blacksmiths trained by the project.

Several cases have been reported of CPT graduates waiting for the project to repair their animal traction equipment. They argue that since the project provided the equipment the project is responsible for repairing it. By providing the necessary support to blacksmiths, the project can help break the farmers' dependence on government services.

PROPOSED PROGRAM

Training

Overview

Based on observations of village blacksmith operations and training sites and on review of West African training experiences described in literature, the recommended training process for blacksmiths consists of the following:

- A rigorous recruitment and selection process conducted by NDD staff at the village level, with the full participation of traditional village authorities and village cooperative officials;
- A basic training program for small groups of new trainees (8-12) that will use existing manual skills and focus on the procedures used to construct commodities that can be easily marketed at the village level (metal doors and windows, beds, chairs, and rakes, for example) and the repair or modification of animal traction equipment using procedures proved at the village level;
- A strong and consistent process of follow-up and support conducted by the NDD blacksmith trainer with assistance from relevant field personnel. This activity should be clearly linked to the timely provision of credit and raw materials;
- Periodic short-term recycling programs to:
  - -- Support the trainee's professional development and ability to provide necessary services in the village using the network established for this project,
  - -- Reinforce abilities developed in preceding programs, and

-- Expand trainee capacity by demonstrating procedures for the repair or modification of agricultural equipment and for producing additional commodities that will be marketable in the local economy.

- The specific repair procedures and modifications to existing equipment that are most appropriate for use at the local level and thus for inclusion in the courses will vary and be based on the observations of participants and staff. For example, one blacksmith had modified the draw-bar attachment to the oxen to make it more maneuverable. Another had replaced the centers of wheel hubs with wood, which gives better service in sand. At another site, the wheels (roulettes) had been locally constructed using only rivets. These types of site-appropriate repairs and modifications should be consistently sought after and studied as potential training tasks during both recycling programs and core courses;

- The introduction of workshop management methods presented during basic blacksmith courses and recycling programs with reinforcement and expansion of the pertinent management principles provided during follow-up visits;

- The use of an NDD staff blacksmith trainer as the principal source of program organization and support, assisted by an outside, short-term blacksmith training expert as principal trainer in the core and recycling courses. The NDD trainer must receive prior formal instruction in training techniques and in performing village-level blacksmith procedures (such as simple construction using rivets rather mass production using welding). The short-term expert must possess thorough knowledge of simple and practical construction techniques emphasizing riveting in product assembly and be capable and willing to perform extensive hands-on demonstrations.

Recruitment and Selection

The success of the blacksmith training effort will depend in large part on the ability to recruit trainees with good manual skills and interest in working at the village level. The prospective trainee must be well integrated into village life, and supported and viewed by village and cooperative authorities as a responsible and capable craftsman. Since one program objective is to place competent and responsible blacksmiths in villages to ensure the timely and economical repair of animal

traction equipment and to make other useful products, the villages themselves should be the focal point of the recruitment and selection process.

The blacksmiths who were successful after training were not only capable artisans but were also well integrated into village activities through their own work and personal interest. Moreover, they enjoyed productive relationships with such village authorities as the chief and cooperative representatives. Since integration of the successful blacksmiths in the villages and cooperatives is so important, the potential for similar well-integrated relationships must exist before blacksmiths are included in the training program. Village authorities and cooperative members should therefore be consulted during the selection period, and they should fully understand the training objectives and their subsequent roles.

Field interviews with blacksmiths and village authorities indicated that those living in the villages should participate in the trainee selection process and in later project activities. This desire stems from their strong interest in obtaining a village-level capacity to repair agricultural equipment and fabricate useful commodities. According to the villagers, their interest in local services and goods is due to their desire to:

- Eliminate transportation costs (500-2,000 CFA) associated with repairs and purchases;
- Eliminate lost travel time, particularly during the planting and harvest seasons;
- Obtain items responsive to their specific needs; and
- Work with an artisan in the village to purchase, repair, and modify equipment and other blacksmith products.

The NDD blacksmith trainer should tour Niamey Department to determine where significant markets exist for the repair of animal traction equipment and the production of blacksmith goods.

With the assistance of local authorities, the trainer should identify approximately 20 potential trainees working within these areas. The list of potential trainees should be developed from local sources who identify blacksmiths who are highly regarded for their skills, positive relationships within the village structure, and integration with the local cooperative.

The trainer should then visit the villages identified and discuss the training program with the blacksmith and determine his interest in it. When the blacksmith displays a strong interest in participating in the program, the trainer should confer with village authorities and cooperative officials to determine their level of confidence in the blacksmith and the willingness of the village to support his work. The support during training might consist of a meal allowance for the trainee or some similar gesture of village commitment to the training process. It is extremely important that both the blacksmith and the village hierarchy understand the details of the program (such as length of training, tools provided, capabilities developed, raw materials, and credit). In particular, they should understand that the trainee will not become a government employee or work in a shop but will return to the village to furnish local residents with needed repair services and commodities.

The NDD trainer should then select 8-12 trainees from the original list. Only blacksmiths who have displayed strong personal interest in the program once all of the details have been explained should be included. If the NDD trainer has not been able to identify at least eight solid candidates, he should continue his search until a minimum class size is obtained.

Basic Training Course

The basic training course for blacksmiths should focus on:

- Demonstrating the procedures involved in repairing or constructing (with practical modifications) agricultural equipment; and

- Producing useful metal goods that are marketable in the village using techniques and tools that correspond to current blacksmith skills.

The focus on teaching only techniques that can be shown to be useful at the village level is important to project success, as costs and time in training for procedures not necessarily applicable to the village situation can be eliminated. Training activities and follow-up support can therefore concentrate on procedures that will directly benefit both blacksmiths and village residents. Since the program will recruit only those candidates who are already working as blacksmiths, albeit in a traditional capacity, its emphasis will be on upgrading skills.

The content of the basic course should be determined by discussions between NDD staff, other technical experts, village blacksmiths, and residents. These discussions should identify the equipment repair techniques and modifications in the construction of agricultural equipment that are practical and marketable at the village level. The work should require only the use of basic hand-tools, which the trainees can construct themselves.

Although further discussions regarding course content should be conducted, most of the basic course elements have already been identified from the recent NDD blacksmith recycling program, visits to village blacksmiths, and other training programs. For example, basic hand-tools were constructed by trainees during the recent NDD recycling program at Miniaba. During this program, a modified donkey plow was constructed that is lighter, less expensive, and easier to handle than other models available in Niger; it has been used successfully in the villages. Of particular interest is the method of constructing the hoe's wheel, which contains a longer lasting wood insert at the hub

rather than a metal insert that deteriorates rapidly when used in sandy soils. Furthermore, this model is constructed entirely with rivets and can therefore be completely assembled in the villages as welding is not required.

At Namari-Goungou, an ox-drawn plow is being produced that is lighter, less expensive, and more durable than other models currently available. In addition, the blacksmith has modified the point at which the oxen are attached to the plow to make it more manueverable when turning frequently in restricted areas. Blacksmith shops in the Makalondi area have built an an improved version of the donkey cart, with a continuous bottom and sides that permit hauling of sand for house construction and transport of natural fertilizer to the fields. At other sites, riveted metal beds and village-produced metal window and door frames as well as gardening equipment have been fabricated. The construction of these products, plus selected repair and refabrication processes (for plows, blades, and cultivators, for example), should become the focus of the basic course, which should be modified over time to reflect accumulated project experience.

The course's length will depend on the specific procedures to be introduced. However, considering that the traditional milieu of the blacksmiths negates the introduction of extensive new procedures and products in a short time span, and the fact that the blacksmiths trained will already be competent artisans, the course duration in the proposed NDD context should be much shorter than the five or six months often established in past programs. Two months would be more appropriate. This would allow for teaching procedures that are currently useful and marketable at the village level without overwhelming the artisans with extensive new material. A shorter training time would also lessen the effects of separating the blacksmith from his village and family.

In two months, new trainees could learn to construct and repair the plows and carts that have been shown to be most appropriate in the various villages. During this period, they could also learn to produce metal beds, chairs, rakes, watering cans, window and door frames, as well as basic atelier management methods. The focus should be spread the accumulated knowledge of what is actually useful in the villages among the trainees, who can then put this knowledge to immediate use upon return to their homes.

The course should be given shortly after the end of the harvest season (November-December) at a rural location as central as possible to the trainees' villages. A CPT would be an ideal site to install a temporary covered area and forges for practical work. Training results from the first group of 10 trainees should be thoroughly examined and should provide the basis for the next year's program.

Assuming that the results are satisfactory and that conditions and markets warrant training more blacksmiths, two courses of 10 trainees each should be planned for the second year. With the 15 blacksmiths already trained and working, this additional training will provide 45 trained personnel in Niamey Department at the end of the second year. Further plans for training should be made at that time, using the experience gained as the basis for planning or modifying any further courses.

Follow-up

Follow-up support to the trainees should serve two purposes. First, it should provide technical guidance and attitudinal support for the trainees' practical work. Second, it should provide assistance in integrating the blacksmith and his new procedures into traditional village life, while assisting with market expansion. The NDD trainer will play the principal role in the process. He should be responsible for:

- Organizing the follow-up process;
- Arranging visits to blacksmiths, cooperatives, and villages;
- Identifying and providing required interpersonal and technical support to blacksmiths and cooperatives;
- Communicating the results of his work to other project-related staff, seeking outside assistance when necessary;
- Maintaining productive relationships with blacksmiths, cooperatives, and village authorities; and
- Assisting with the procurement of materials.

Cooperative organizations will also play a key role in project success. They must support the blacksmith with materials, credit, encouragement, and assistance with the integration of his work into the community. The cooperative will also be the focal point of local-level communication between the blacksmiths and the project staff in Niamey. As part of its current efforts to strengthen the cooperatives, NDD should develop the capacity to fulfill the requirements of the follow-up process as well as the provision of credit to blacksmiths.

The blacksmiths should be fully informed about the follow-up work during training. They should be prepared to communicate their needs in a clear and timely fashion and work effectively with the cooperatives and NDD project staff.

The village residents should also play an informal role in the process. They should be consulted during each visit, and their observations and suggestions should be included in project activities. Their participation in the blacksmiths' work should be encouraged by the NDD trainer during his visits and by the cooperative on an ongoing basis.

If the current capabilities of the local agents de suivi can be strenthened, the NDD project staff should consider involving them in the follow-up process. These agents could assist with

communications; marketing, by identifying potentially useful commodities; and the overall effort to ensure the viable integration of the blacksmith's products into the local network.

The follow-up process should begin two weeks after the blacksmiths have returned to their villages. The NDD trainer should visit each trainee and discuss the training process. He should also assist with the identification and resolution of problems associated with the process of re-integration, new work procedures, raw materials, tools, and credit. Village cooperative representatives should also participate in these discussions. Although the NDD trainer will organize and coordinate the follow-up, the village cooperative must provide the on-site support necessary to integrate the new products and procedures with the traditional expectations of the village blacksmith's role. The cooperative is the first link of contact with the provision of credit, and any obstacles or uncertainties in this process must be dealt with early.

Subsequent follow-up visits should be conducted by the NDD trainer twice during the first four months following training to ensure a sound beginning for the blacksmith's expanded role. These visits can help to identify and solve problems at the village level.

The intensive follow-up effort will be time consuming and costly in its early stages. Experience with similar projects in other countries indicates that this type of intensive effort is necessary. The follow-up process can be conducted less frequently after the first four months. However, when staff members are informed of a problem, they should respond immediately. The specific frequency of follow-up visits after the first four months should be determined by the NDD staff, based on observations and contributions from the field. However, given

the importance of follow-up to trainee success and to the development of future recycling and training, trainees should be visited at least twice a year for two years after completing the core course.

Trainees completing recycling programs should also be provided with follow-up assistance. In this case, however, follow-up can be less intensive. One visit conducted one month after the completion of the recycling program is appropriate. In both the core and the recycling courses, the follow-up process should be clearly established and the roles and expectations of all parties thoroughly defined and understood.

Recycling Courses

Programs to expand the skills of previous trainees should be presented at least once a year. The content of each program should be based on the needs identified during the follow-up process and also cover any new work procedures or products that are useful and marketable at the village level. As in the basic course, the final decision regarding course content should be based on the contributions of expert consultants, NDD staff, village blacksmiths, local farmers, and cooperative members. The continued input of these parties ensures technical precision, marketability, and the responsiveness to new products or procedures at the village level.

These courses should last only two to three weeks. They should be presented as close to the end of the harvest season as possible, taking into account the time required for staff participation in the long-term course for new trainees, which should receive priority in timing.

Selection of trainees, training sites and materials, and related procedures should follow the same process established for the core course.

Workshop Management Instruction

The core course for new trainees and the recycling programs should include a component to introduce basic methods of workshops management. This component should prepare the blacksmiths to calculate the cost of raw materials and labor. They should learn to calculate stock requirements for the construction of the products in terms of quantities ordered by the villagers, ordering and materials selection, and credit procedures. These elements should be an integral part of the training for each type of product and should be presented when a new product is introduced. For example, the training concerning the construction of a metal bed should include not only the technical procedures involved but also the calculation of the costs of bed materials and labor, materials selection, and ordering procedures. The overall approach should be summarized near the end of the course.

Trainees should be learn to prepare a "petit carnet," which should contain pertinent information in a simple format and be developed as each new procedure or product is introduced. This should be done for both literate and illiterate participants. Even illiterate trainees will find the carnets useful upon return to the village, where they will most likely find a family or cooperative member to assist them.

Program Instructors

Two instructors will be required to conduct the training program efficiently. One should be a permanent member of the NDD staff. The other should be a highly qualified blacksmith training expert with extensive first-hand experience in the Sahel. He should be hired on a short-term basis and may have to be recruited outside Niger.

A promising candidate for the role of the permanent NDD instructor has already been identified. This individual has the prerequisite interest in the work, local language skills, and organizing ability, but will require specific training in blacksmith skills and training techniques.

Concerning the training of the trainer, one program in Mali is similar to the training proposed for the NDD project. The Mali program is conducted by CMDT, under the auspices of the Division du Mechanisme Agricole, Department of Rural Engineering. This program focuses on village-level blacksmith skills rather than factory-type production, and provides raw materials and credit in a process similar to that being proposed for NDD.

The CMDT program can provide training in technical skills and training methods to NDD's staff trainer. NDD project management should contact the CMDT program to investigate the requirements for participation, while they explore options in other countries. In Mali, the training will require four consecutive months to cover technical skills and training methods.

The NDD trainer's role should focus on course organization and management, follow-up support and assistance to trainees, recruitment and selection of trainees, contacts with village co-operatives and "agents de suivi," the assembling of tools and raw materials for courses, and the managing of blacksmith requirements for raw materials at the NDD project level.

Since the NDD trainer is not a master blacksmith, an expert short-term instructor should be hired as principal trainer for the core and recycling courses and should assist in analyzing and identifying procedures appropriate for village-level work. The expert instructor must be fluent in French (and, if possible, speak Hausa or Djerma) and have experience working in Sahelian conditions similar to those of the Niamey Department. This expert should be a creative hands-on individual, rather than a classroom instructor. He should be capable of and willing to conduct extensive demonstrations of the procedures rather than simply discussing them. His work should focus on riveting rather than welding.

During the next two years of the training project, at least 10 months of the expert instructor's time will be required. This includes one month to analyze and identify new procedures and products prior to the beginning of training each year, two months for each of the three core courses, and one month each year for recycling programs.

Additional training input in literacy is recommended for blacksmiths during the course of the project. This activity should be carried out as part of the rural animation process through either the CPTs or the literacy service.

Training Program Costs

The estimated cost for the recommended training is $134,000 over the course of the project. Itemized estimates are:

• Training of NDD trainer	$ 15,000
• Expert instructor (9 mos.)	90,000
• Field vehicle (for follow-up)	10,000
• Fuel and maintenance (2 years)	15,000
• Training materials	
- 3 core courses	3,000
- 3 recycling programs	1,000
	$134,000

Note: The cost of tool sets provided to each of 30 new trainees is $8,000 total. The set has been modified considerably from earlier efforts. This cost is considered under the credit section.

Implementation Plan

The implementation plan provided in Annex A is to be used as a project management tool. Although the timing of the plan may vary, the events themselves should be adhered to and conducted in the recommended order. To facilitate course development, a sample course program is provided in Annex A. The training activities in the sample courses are composed of products and procedures found to be useful and marketable during field visits to village blacksmiths in the Niamey Department.

Credit and Input Supply

This major blockage constrains blacksmith capability and productivity at the village level. The blacksmiths trained by NDD in 1980 received tools worth 140,000 CFA (subsidized at 40 percent), plus raw materials valued on the average at 45,000 CFA, all on credit. As this assistance was provided directly to the blacksmiths, it bypassed the existing cooperative structure. In practice, this meant that the cooperative officials responsible for collecting loan payments were unaware that the blacksmiths had loans outstanding. In the proposed program, 10 new blacksmiths will be trained in 1984; a maximum of 20 more may be trained in 1985. All these trainees will require short-term credit for inputs and long-term credit for tools and equipment.

A low repayment rate has not been confined solely to the blacksmiths. It has also been true for those receiving animal traction equipment. However, a report presented in January 1983 pointed out that the low repayment rate (28.1 percent at the end of 1982) was more the result of shortcomings in the performance of the lending institutions themselves than of the borrowers.[9] Since that time, NDD has made impressive efforts to improve collection procedures and the repayment rate is now 61.8 percent.

Of the 44 loans disbursed to blacksmiths in 1980, there had been no repayment on 20 of them by the end of 1983. At present, the repayment rate is just under 20 percent. Unless strenuous efforts are made to improve this repayment rate, it is pointless to provide additional credit to chronic defaulters.

Interviews with blacksmiths, cooperative officials, and villagers indicated that if credit were to be provided to blacksmiths, it would have to be done through the cooperatives. Ideally, the following types of credit are called for:

- Short-term credit to purchase raw materials and selected spare parts; and

- Long-term credit to purchase tools and equipment for those blacksmiths to be trained by the project over the next two years.

In the first year of this proposed training program to upgrade blacksmith skills, NDD will work with the 15 blacksmiths already trained, plus the 10 additional ones who will be trained before the onset of the agricultural season. Enough raw material will be made available to these 15 to last up to 12 months.

The cash to pay for the blacksmith's products (whether donkey-drawn cultivators or metal beds) is more readily available toward the end of the year once the harvests are in. Thus, a 12-month credit will provide the blacksmith with enough lead time to build up a stock of finished products.

The NDD blacksmith trainer will have to visit all 15 blacksmiths and have them calculate their needs over the coming year. The ceiling should be set at 200,000 CFA per applicant. This amount is intentionally high to encourage the more dynamic and resourceful blacksmiths. Only the best should receive this maximum -- the remaining ones should receive sums based on their needs, potential, and the market for their services and products.

This credit will be furnished in kind -- raw materials (both used and new) for repairs and production as well as a small quantity of selected spare parts that cannot be produced locally, such as wheel bearings, tires, and inner tubes. The amount of credit to be given should also be discussed with the local cooperative officials. Not only is their approval mandatory, but they should also participate in reviewing and encouraging the blacksmith's work and seeing that the credit is used effectively.

The 10 new trainees will be unable to calculate their needs until they have practiced what they have learned and seen what the increased demand is likely to be for their services and products. Accordingly, it is recommended that they be given a

supply of raw materials on credit -- valued at no more than 100,000 CFA -- at the termination of their training. In addition, they will also receive tools and equipment on long-term credit. As some of this equipment will be produced during the training session and the rest bought locally, the total package should cost no more than 100,000 CFA per trainee. Before the final selection of this equipment is made, however, certain modifications should be made, based on the experiences of the first group of graduates. For example, several of them had problems with the drills provided for making holes in metal and wood as well as with the threading equipment crucial for the production of rivets.

All material made available on credit should be provided at its full price. Distribution costs and, if necessary, storage costs should also be included in the price.

If construction activities continue in Niamey, sufficient material should be available the Bukoki market to satisfy the blacksmiths' needs. The suggestion has been made that if there is sufficient demand, containers of scrap metal (such as used truck springs) could be purchased in Europe. This material could also be purchased in Nigeria.

Of the 15 blacksmiths already trained, most have large credits still outstanding. Their debt burden should not be increased unless they are prepared to repay their present debts on a regular, systematic basis. If they are unwilling to do so, then no further credit should be provided. For this reason, it is strongly recommended that the blacksmiths, to the extent possible, pay back their credits on a regular schedule, rather than making one lump payment on the due date. Thus, this upgraded blacksmith program proposes to provide credit to a maximum of 45 blacksmiths over a two-year period: the 15 already trained, 10 in 1984, and 20 in 1985. The amount of credit required over this period is as follows:

• Short-term credit = 45 x 200,000	=	9,000,000	CFA
• Long-term credit = 30 x 100,000	=	3,000,000	CFA
• Contingency fund of 25 percent	=	3,000,000	CFA
Total	=	15,000,000	CFA
		($37,500)	

To implement this credit proposal, NDD should:

- Establish a credit policy for blacksmiths. A decision must be made concerning non-payment of outstanding credits -- both short-term (raw materials) and long-term (tools and equipment). With one exception, none of the short-term credit has been repaid. Does NDD want to write this off or demand payment before any new short-term credit is provided? For the long term, the suggestion has been made that, since a certain percentage of the tools distributed have not been used, NDD recover these tools, redisburse the loans, and establish a realistic time frame for repayment. The minimum and maximum amounts of credit to be provided should also be established and the total amount of credit necessary to finance this blacksmith credit program calculated. A decision should also be made concerning the procedure by which credit recipients are to be followed up.

- Survey the 15 trained blacksmiths, determine what their annual input needs are, and establish repayment schedules for outstanding credits.

- Require individual blacksmiths to submit their applications to the local cooperative.

- Decide whether to buy the necessary materials on an annual basis and store them in the cooperative warehouses or on a quarterly basis. The former would be more efficient but might make the prices unreasonably high.

- Once CNCA gives its approval, NDD should buy the material with the assistance of selected blacksmiths, who will know exactly what sort of material is needed and should be able to obtain the best price.

- Distribute materials to the cooperatives, which in turn distribute them to individual blacksmiths.

- Establish regular links between the blacksmith trainer, the agents de suivi, cooperative officials, and the blacksmiths to monitor credit repayment, as well as the quality and quantity of services and products provided by the blacksmiths.

- This same process should be followed with the 10 new blacksmiths to be trained in 1984. If this training is to be conducted in the near future, NDD can combine their credit needs with those of the 15 already trained. For these 10, the inputs should be made available immediately after their training is completed.

NOTES

1 Ithaca International, Limited, 1983. Assessment of Agricultural Technical Packages in Niger. Ithaca, N.Y., pp. 23-24.

2 For example, see his "Visite des Artisans Ruraux: Rapport de Tournee," NDD, Niamey, June 1983.

3 Mainassara, op cit.; Marolleau, op cit., p. 3.

4 CEEMAT, op cit., pp. 75-81.

5 Projet de Developpement Rural de Maradi. 1982. Rapport Mission Mali: Formation Forgerons, Installations, Equipements. Maradi, p. 1.

6 Ibid., pp. 8-11.

7 The comments in the text indicate that this is indeed the case:

> "Le soutien logistique important est possible grace a l'appui financier de la CMDT, du FAC, du CCCE."
>
> "Les resultats obtenus sont possibles au sein d'un projet de productivite intensif comme la CMDT: coton-cereales dont mais exigeant une tres forte implantation de material agricoles et des besoins locaux de moutore." Op. cit. p. 11.

8 Thomas M. Painter. 1980. Social Soundness Analysis of the Niamey Department Development Project. Part 1. USAID/Niger, Niamey, p. 13.

9 Thomas Stickley, 1983. Credit Management Specialist's January 17-29, 1983. Consultancy to Niamey Department Development Project. Phase II 683-0240. Development Alternatives, Inc., Washington, D.C., p. 9.

PART IV

APPLIED RESEARCH ON ANIMAL TRACTION

OBJECTIVES

Applied research on animal traction in Niamey Department should have two main objectives:

- To provide a better understanding of how animal traction fits into existing farming systems and what it contributes to the recommended technical package; and
- To adapt animal traction recommendations to different agro-climatic conditions. This is needed to ensure that recommendations concerning animal traction are technically sound and reflect economic realities at the farm level.

Three sets of issues need to be addressed:

- Agronomic: this deals with the potential impact of animal traction on crop production through increased yields and increased area planted. The research should focus on:
  - -- Differences in agro-climatic conditions,
  - -- Different soils,
  - -- Different crops, and
  - -- Differences between the three main types of traction: donkey, one ox, and two oxen.
- Engineering: this concerns equipment design. The major need is for modifications in the donkey-drawn equipment. For Niamey Department, the weeder, a light plow for scarifying, and the cart are of most interest.
- Economic: this deals with the economic viability of animal traction at the farm level. The need is to understand better all of the costs and benefits of animal traction for traditional farmers under the agro-climatic and market conditions that prevail in Niamey Department.

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Research on animal traction at the national level is the responsibility of three divisions within INRAN: the Division of Agronomic Research, the Division of Agricultural Equipment (Machinisme Agricole), and the Division of Rural Economics (Economie Rurale). Although INRAN is not currently conducting any research specifically on animal traction, a major FAO/ILO initiative is about to begin. This project will have three main components: modifying and testing animal traction equipment in Tahoua Department, studying the on-farm production impact of animal traction in Tahoua Department, and coordinating national-level information gathering, analysis, and policy making with respect to animal traction equipment.

The activities proposed in this section focus on Niamey Department, but they should include effective linkages with the FAO/ILO project as well as the agronomy and farming systems sections of INRAN. Studies in Niamey Department should complement rather than duplicate work done elsewhere in Niger, and the findings should be disseminated through INRAN to other regions with similar agro-climatic conditions. The main objective of these applied research activities, however, should be to ensure that the recommendations of the NDD project with respect to animal traction are technically sound and feasible at the farm level.

AGRONOMIC STUDIES

Applied agronomic research on animal traction should focus on:

- Labor savings;
- The impact on area cultivated; and
- The impact on production.

For Niamey Department, this concerns mostly weeding and, to a lesser extent, soil preparation. Not only does weeding require the most labor, but delays can also significantly reduce yields. The labor savings should be assessed in the context of all agricultural activities to determine the extent to which addressing one blockage shifts the labor constraint to another activity. Although the impact of labor savings on area cultivated is the main potential benefit from animal traction in light soils, yields should also be studied. The assumption that using animal traction for soil preparation and for more timely weeding can increase yields by up to 20 percent should be tested in the NDD project area.

The agronomic research should take into account differences in soil conditions, rainfall, and types of draft power. The 10 CPTs are well suited to measure differences in soils and rainfall, and on each CPT, comparisons between types of draft power can be made using the methodology developed by the NDD Applied Research Unit on three CPTs in 1983. To maximize the comparability of results, all animals should be readily available and equally well trained, and the CPT chiefs should be commited to the careful execution of the studies. In addition, the trials should be conducted over several years to take account of variations in rainfall.

Experience with trials in 1983 has shown that measuring the variables that affect the impact of animal traction is extremely expensive and time consuming. In this respect, conducting the research on the CPTs provides important cost savings. The facilities are in place, along with the necessary expertise, support services, and staff for monitoring. The main additional requirement is for adequate supervision by the NDD Applied Research Unit. This will almost certainly not be possible without a counterpart for the applied research adviser. The applied research program itself has several different ongoing

research activities that should be followed. Moreover, there is the additional need for the Applied Rearch Unit and the Monitoring and Evaluation Unit to collaborate on studies at the farm level.

The preparatory steps for carrying out agronomic research in animal traction should to begin as soon as possible. First, the design of the research to be conducted on each CPT should be completed. Second, manpower, logistics, and financial requirements must be determined. Third, a counterpart to the applied research adviser must be recruited. Fourth, all CPT staff who will be involved in the animal traction research should receive the necessary training. Finally, trained draft animals must be obtained for each CPT. These actions will not be implemented unless the applied research adviser is replaced immediately, or a short-term agronomist is brought in by the project until a full-time replacement is found.

EQUIPMENT DESIGN

Niger has probably done less testing and redesign of animal traction equipment than any other country in the Sahel. The obvious first step in any equipment design program should be to visit other countries -- Upper Volta, Mali, and Senegal -- to learn what they have accomplished that can be used as a point of departure for Niger. In addition, the FAO/ILO project will include an equipment design component. This experience should be applied to the needs of Niamey Department as well. In the end, however, equipment design is best done by working closely with the farmers who will be using the equipment. Thus, it is advisable that the NDD project carry out its own research in this area.

The most urgent need in the Niamey Department is for modifications in the donkey equipment. The ox traction package is extremely expensive and is not needed in the light soils that prevail in the area. The equipment testing should focus on:

- Cost;
- Durability;
- Ease of use; and
- Ability to be repaired by local blacksmiths using readily available materials.

Priority attention should be given to the weeder, since it offers the most benefits to farmers in the NDD project area. There is also a need to examine the ability of the donkey cart to work the sandy soils of the NDD project area.

The initial step in an equipment design program for NDD is to employ a short-term consultant to assess the situation and established a plan of action for testing and modifying the equipment. This plan should:

- Identify the specific equipment to be tested and modified;
- Describe how the equipment is to be obtained;
- Design the research methodology; and
- Describe in detail what will need to be done at the farm level to ensure proper technical support and monitoring of results.

Following this first phase, the project has two options. The first is to implement the program using existing staff: obtain improved equipment from other countries or from the Tahoua project, test the equipment on farmers' fields, and recruit a short-term consultant to assess the results periodically. The second option would be to employ a full-time technician for at least two years who would be responsible for equipment design and blacksmith training (see Part III).

The decision on which course to follow should await the findings of the short-term consultant. If it is determined that a full-time adviser is needed, the consultant should be requested to prepare a scope of work for that position.

FARM-LEVEL ECONOMIC STUDIES

These studies address the factors that determine the actual impact of technological changes on farmers' fields. This requires developing an understanding of the context within which farmers make decisions on production and resource allocation (including labor). Some of the issues addressed through farm-level studies are:

- The adoption rate of all or parts of the recommended technical package. Why does the farmer accept or reject certain recommendations? This provides information not only on inappropriate recommendations but also on the lack of supporting services such as extension, animal health care, and equipment repair.

- The actual impact of recommended practices on area, yields, production, and income. Even if all of the recommendations are followed, the impact will vary in different agro-climatic conditions. This information is essential for modifying recommended practices to reflect actual conditions on farmers' fields.

- The use of labor savings on and off the farm. Studies often show that there is little relation between labor savings and area planted. Unless this is better understood, it will be difficult to assess the actual impact of animal traction on crop production.

- The effect of variations in rainfall on the production impact and economic viability of animal traction. Most analyses of the returns to animal traction are based on assumptions of average rainfall. When poor rains one year out of three are hypothetically built into the calculations, the returns are reduced significantly.

- Off-farm use of animal traction. Most analyses of animal traction in Niamey Department show that increased crop production alone cannot pay for it. More needs to be learned about opportunities for and farmer attitudes toward using animal traction equipment, especially the cart, as an off-farm source of income.

- An end result of these on-farm studies should be crop budgets and whole farm budgets similar to those prepared in the Ithaca International Ltd. study of the recommended technical package. These budgets focus on the key issues affecting the farm-level feasibility of the recommended practices. Although they are based on the best information available, they are still hypothetical. Their underlying assumptions need to be tested. In addition, the on-farm studies should include discounted cash flow analyses to measure the financial returns on investments in animal traction and to define better the magnitude of risk involved during the early years of large negative cash flows. The whole farm budgets combined with the discounted cash flow analysis can provide an appropriate set of criteria for judging the farm-level feasibility of alternative animal traction packages.

One approach to addressing these types of issues is traditional farming systems research. This consists of base-line studies to determine the existing situation and studies of farmers adopting improved technologies to determine the farm-level feasibility and impact of the recommendations. The base-line studies aim at defining the major types of farming systems in a given region, taking into account such factors as subsistence crops grown, cash crops grown, farm size, labor availability and use, use of agricultural inputs, and assets of the farm household. Based on this information, the major farm types are defined and a sample of each is selected for further study. This sample of farms receives all or parts of the improved technical package, and the impact of the changes on production and income is measured.

The end result of this research is data on the major constraints to increased agricultural production, the effectiveness of the technical package in addressing those constraints, and the socioeconomic feasibility of the technical package from the standpoint of the entire farm household. Within this context, animal traction can be analyzed in terms of:

- How it fits into traditional farming systems;
- What it contributes to the overall impact of the technical package; and

- What is the overall impact on farm households, including off-farm income and leisure time.

Because of the large variations between farms and frequent yearly changes in growing conditions, farming systems studies require large samples and several years of data. Otherwise, the findings are not statistically reliable and do not provide an adequate basis for drawing sound conclusions about the technical package or its components. This implies considerable resource requirements, including a multidisciplinary research team, a large number of enumerators along with field supervisors, and data processing equipment and personnel.

The main advantage of this type of research is that, when done well, it provides statistically valid findings on farm-level constraints to increased production and on the farm-level feasibility of improved technologies. These findings make it possible to recommend widely applicable improved technologies with a high degree of confidence. The main disadvantages are that the research is extremely expensive and usually fails to achieve its desired results because of funding shortages and lack of appropriately trained personnel. In the case of the NDD project, it is very unlikely that the necessary personnel could be made available to carry out the research. Furthermore, the NDD project is a relatively small-scale production-oriented activity. A major farming systems research effort would change the nature of the project in a way that is not desired by either USAID or the GON.

An alternative way of addressing the issues discussed earlier is to monitor farmers in the context of an ongoing extension program. The objective of this monitoring is to assess the actual impact of the recommended technical package on crop production and farmer incomes. This involves gathering the same type of information as obtained through farming systems research. However, the data gathering and analysis are oriented more toward understanding the process of technological change in the context

of a particular project, than toward measuring with quantitative precision all of the key factors involved in small farmer decision making. Most of the data gathering concerns farmers who have received extension and other support needed for the adoption of the improved technology.

The NDD project will undertake two types of monitoring activities in 1984. The first will be an evaluation of the impact of CPT training on farmer behavior, production, and income. These evaluations will focus on the extent to which CPT graduates have adopted the recommended technical package and the impact that this has had on production and net income.

The second type of monitoring activity will be in-depth surveys of a small number of CPT graduates using the methodology developed by Michael Wybo in 1983. These surveys will measure as precisely as possible the differences between CPT graduates and neighboring farmers with respect to labor use, area planted, use of animal traction and modern inputs, and crop production. Whereas the impact evaluations will provide information on adoption rates and production levels, the in-depth surveys will generate detailed data on the relationships between the adoption of the recommended techniques and changes in yields, production, and returns to labor.

These studies will deal with the entire technical package, not only animal traction. To obtain a valid assessment of the recommendations with respect to animal traction, the studies should be designed to generate:

- Data on the extent to which animal traction equipment is used and the farmers' reasons for accepting or rejecting recommended practices;
- Data on area planted by CPT graduates before and after receiving animal traction equipment. In the past, NDD data gathering has been largely limited to yields;

- Data on labor use throughout the year with and without animal traction, including time needed to feed and care for the animals;
- Data on off-farm uses of animal traction and income earned from increased value of oxen; and
- Data on variables that are exogenous to the technical package such as climate, insects, and availability of supporting services.

Preparations are already under way in the NDD project for the impact evaluations. The only additional step that should be taken at this time is to review the survey design to ensure that the data needs listed above will be met. In addition, two sites should be selected as soon as possible -- one in the north and one in the south -- to continue the research begun by Michael Wybo. NDD's Applied Research Unit should review the design of both studies to ensure that on-farm agronomic issues are being properly addressed.

RESOURCE REQUIREMENTS FOR APPLIED RESEARCH

The approach recommended in this report has been to study various aspects of animal traction in the context of existing NDD activities. Thus, agronomic research related to animal traction will be incorporated into the ongoing activities of the Applied Research Unit, and the on-farm economic research will be part of the impact evaluations of the Monitoring and Evaluation Unit. Although no additional staff is needed specifically for agronomic and economic research on animal traction, the research recommended in this report cannot be carried out if the Applied Research and monitoring and evaluation units are not fully staffed. This means that the Monitoring and Evaluation Unit needs a full staff of enumerators and field supervisors as well as an assistant to the monitoring and evaluation adviser who will be responsible for overseeing in the day-to-day implementation of the farm-level surveys. In addition, the applied research adviser needs a local counterpart; otherwise it will not be

possible to carry out animal traction research on all 10 CPTs. Finally, both agronomic and economic research will require dependable logistical support, especially transport and data processing. The latter will require the hiring of a full-time data processor. It should be emphasized that these resources are needed for the proper implementation of the overall programs of the Applied Research and Monitoring and Evaluation units, and not specifically for research on animal traction.

The main additional resource requirements are related to the applied research on the design of the ATUs. The activity has not yet been designed in detail, but funding will be needed for:

- An animal traction equipment expert for two years;
- The purchase of equipment prototypes for testing and modification; and
- Travel to Upper Volta and perhaps other countries to observe experiences in adapting equipment to local conditions.

Part of these costs will be attributable to the blacksmith training program, since the animal traction equipment expert could also be responsible for training and blacksmiths could be involved in producing the modified equipment.

ANNEX A

IMPLEMENTATION PLAN FOR BLACKSMITH TRAINING AND CREDIT PROGRAM

ANNEX A

IMPLEMENTATION PLAN FOR BLACKSMITH TRAINING AND CREDIT PROGRAM

1. Establish credit policy.

2. Survey previous trainees. Identify inputs for trainees and arrange repayment of outstanding credits.

3. Canvas Niamey Department. Meet with village authorities and cooperatives to identify potential trainees, and products and procedures marketable at the village level.

4. Identify raw materials needed for the blacksmith project and their qualities and quantities.

5. Review and approve individual loan applications of previous trainee applicants.

6. Purchase raw materials for previous trainees.

7. Establish monitoring system for the credit/cooperative process.

8. Review data gathered in Step #3 and select the 10 best candidates based on their interest, capabilities, markets, level of integration in village life, and village and cooperative support.

9. Establish a preliminary list of blacksmith products and procedures for training courses, based on their appropriateness for village-level work and marketability.

10. Set training dates for basic course and recycling programs.

11. Identify and contract expert trainer for courses.

12. NDD trainer and expert should visit selected trainees, village authorities, and cooperatives. Finalize list of products, procedures, and materials to be used as training activities in courses. Explain project process in detail.

13. Write training program based on outcome of visits.

14. Purchase raw materials for training course.

15. Make arrangements for course (including location, meals, lodging, tools, per diems, transportation, post-course credit for trainees, and training materials).

16. Visit trainees and villages, authorities, and cooperatives to provide full information on course logistics, expectations, objectives, expected outcomes, credit, and follow-up.

17. Present basic course.

18. Facilitate start-up of credit process for successful trainees.

19. Conduct follow-up visits to trainees, villages, authorities, and cooperatives.

20. Visit trainees from earlier courses to prepare for recycling course. Contact village authorities and cooperatives. Discuss project process and procedures in detail.

21. Write training program using information from experience with basic course.

22. Select trainees.

23. Purchase raw materials for the recycling course.

24. Make arrangements for recycling program as in Step #15.

25. Contact trainees for recycling program as in Step #16.

26. Present recycling course.

27. Facilitate start-up of credit process for recycled trainees who are not already participating.

28. Follow-up recycled trainees.

29. Gather information as in Step #1 and analyze for development of next year's programs.

NOTES:

1 The NDD trainer's participation is not shown in the plan. This training should be arranged and completed as early in the process as possible.

2 Work in Steps 2 and 3 may be combined in a single visit wherever possible.

3 Work in Steps 12 and 16 may be combined if work in project is sufficiently advanced.

4 Work in Steps 19 and 20 may be combined in a single field trip wherever locations permit.

5 Overall process should be repeated in accordance with training efforts in subsequent years.

IMPLEMENTATION PLAN
BLACKSMITH TRAINING
NIAMEY DEPARTMENT DEVELOPMENT PROJECT

Activities — Time Lines

Sequence	1984												1985						
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
1.) Establish Credit Policy																			
2.) Survey Previous Trainees Regarding Credit																			
3.) Canvas Niamey Department																			
4.) Identify Raw Materials Needed for Credit																			
5.) Review Loan Applications Regarding Previous Trainees																			
6.) Purchase Materials for Credit																			
7.) Establish Monitoring System																			
8.) Select Trainees																			
9.) Establish List of Products for Training																			
10.) Set Training Dates																			
11.) Contract Expert Trainer																			

Activities — Time Lines

Sequence	1984												1985						
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
12.) Visited Selected Trainees and Villages								—											
13.) Write Training Program								—											
14.) Purchase Raw Materials for Training								—											
15.) Make Course Arrangements									—										
16.) Inform Trainees of Current Logistics, etc.									—	—									
17.) Present Basic Course											—	—							
18.) Assist with Start-up of Credit Process												—	—						
19.) Follow-up Trainees															— On-going —				→
20.) Visit Previous Trainees Regarding Recycling						—	—	—											
21.) Write Recycling Course													—						
22.) Select Previous Trainees for Recycling													—						
23.) Purchase Materials for Recycling Course													—						
24.) Make Arrangements for Recycling Course													—						

Activities

Time Lines

Sequence	1984												1985						
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
25.) Contact Trainees for Recycling														—					
26.) Present Recycling Course														—	—				
27.) Facilitate Start-up of Credit																—			
28.) Follow-up Recycled Trainees																—	—	On-going →	
29.) Begin Development of Next Year's Program																—	—		

BLACKSMITH TRAINING

SAMPLE COURSE OUTLINE

Week 1

Introduction and Orientation
Basic Principles of Atelier Management
Materials and Their Applications
Construction of Hand-Tools

Week 2

Repair Procedures for AnTrac Equipment
(blades, draw-bars, wheels, supports)
Cost and Selection of Materials
Petit Carnet de Gestion d'Atelier

Week 3

Construction of Gardening Equipment
(watering cans, rakes, shovels, hand cultivators)
Cost and Selection of Materials
Petit Carnet de Gestion d'Atelier

Week 4

Construction of Nuts and Bolts
Construction of Harness and Tack (Ox and Donkey)
Cost and Selection of Materials
Petit Carnet de Gestion d'Atelier

Week 5

Construction of Donkey Plow
Construction of Ox Plow
Cost and Selection of Materials
Petit Carnet de Gestion d'Atelier

Week 6

Construction of Donkey Cart

Cost and Selection of Materials

Petit Carnet de Gestion d'Atelier

Week 7

Construction of Ox Cart

Cost and Selection of Materials

Petit Carnet de Gestion d'Atelier

Week 8

Construction of Metal Beds, Chairs, Doors, and Window Frames

Cost and Selection of Materials

Petit Carnet de Gestion d'Atelier