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PVO DEVELOPMENT INITIATIVES PROJECT

(677-0051)

AGENCY FOR INTERNATIONAL DEVELOPMENT

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FORMATIVE EVALUATION

USAID/CHAD PVO DEVELOPMENT INITIATIVES PROJECT

(677-0051)

U.S. Agency for International Development

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## I. EXECUTIVE SUMMARY

A. Project Background. USAID/Chad's PVO Development Initiatives Project (677-0051) is a four year, \$12.725 million activity aimed at assisting small farmer food production and supportive private sector activities having demonstration and institutional development effects in the Sahelian zone of Chad. The intent was to support four or five sub-projects lasting two to four years and designed, implemented and monitored by U.S. PVOs. This would yield experience with a range of different technical interventions in different regions, while minimizing the management burden on the USAID Mission. The project was designed in early 1985, was authorized June 7, 1985, and has a PACD of September 30, 1989. The goal of the project is "to increase Chad's production of food and its availability to the deprived, and lay groundwork for more profound agricultural development." The project's purpose is "to assist small farmer production and supportive private sector activities having demonstration and institutional development (primarily local cooperation) effects." This objective was to be accomplished broadly and quickly enough to (a) improve welfare of Chadians hitherto subject to famine and reliant on food aid,; and (b) demonstrate approaches to developing small farmer and private sector food production systems which successor, longer-term projects could adopt or otherwise support.

B. The PVO Sub-Projects. Four sub-project proposals were approved and are in implementation; a fifth one failed to receive AID and Government of Chad (GOC) approval.

1. The CARE Irrigated Agriculture Development Project, funded for \$3.98 million, grew out of previous disaster relief activities. It comprises agronomic, water management and agroforestry activities in three diverse areas: internally drained wadis around Nokou in northern Kanem, externally drained wadis around Cheddra in eastern Kanem, and irrigated perimeters along the Chari and Logone Rivers in Mayo-Kebbi and Chari-Baguirmi Prefectures. Although the sub-project proposal was of marginal quality, CARE has done an excellent job of implementation. Provision of inputs has been timely and of high quality; the technical assistance, in particular, has been strong. The major problem has been over-extension of sub-project management across three project zones which are 750 kms apart and which pose considerably different technical problems. Progress has generally been more satisfactory in the Cheddra wadis and in the southern irrigated perimeters, due mostly to the relatively more favorable conditions in those zones; agronomic and water management interventions have also yielded better results than agroforestry. CARE is planning to focus future efforts in promising the best success. CARE's relations with GOC

counterpart agencies have been mixed. It has worked out a contract with the Ministry of Agriculture that is a model for other PVOs, but has had some problems with the Water and Forest Service.

2. Africare's Ouaddai Rural Development Sub-Project, funded at \$2.84 million, is also the continuation of a previous effort that combined disaster relief with development initiatives. Its aim is to bolster rural production in Ouaddai Prefecture through a range of agronomic, water management, forestry and other interventions. Nearly 18 months were required for the sub-project design, although the final product was of satisfactory quality. Inputs provided to date have generally been of good quality. Exceptions are the inability to recruit the expatriate engineering adviser, under-estimation of the vehicle operations budget, and poor quality of garage and shop tools procured from Nigeria. Substantial progress has been made towards achieving outputs: Africare has continued construction of wadi water catchments; drought resistant varieties of millet and cowpeas are being introduced; the dalou, an animal traction waterlifting system, is being tested; and support to reforestation has continued. However, Africare needs to make a more systematic effort to collect and analyze data relating to its interventions. Relations with the GOC are good, although better with the ONDR (national agricultural extension office) than the Water and Forest Service.

3. The Organization for Rehabilitation through Training (ORT) has received \$2.593 million for the Lake Chad Agricultural Development and Farmer Training Sub-Project. This activity's objectives are to increase wadi food production in Ngouri Subprefecture while maintaining or improving soil fertility, and to identify replicable models for increased food production in similar wadi conditions. ORT's proposal was the most professional under the umbrella project, but, as the only PVO with no previous operational base in Chad, it suffered delays in providing inputs. Office and residential construction in Ngouri and establishment of a radio link with N'Djamena have yet to be completed. On the other hand, the entire long-term technical assistance team is in the field. A major constraint has been the poor state of relations between ORT and SODELAC, the rural development agency for Lac Prefecture which is the GOC counterpart. ORT's agronomic component has been its strongest, with a number of new interventions tested by the agronomist and rural works engineer having already been adopted by wadi farmers. The pump component, however, has so far produced less promising results, as its activities have been dispersed. The forestry activity has also had problems, due to the inability to develop a working relationship with the Water and Forest Service.

4. VITA's Private Enterprise Promotion in Chad Sub-Project, funded for \$1.2 million, is aimed at (1) providing urban and rural small/medium enterprises with credit, management and other direct technical assistance and market information, and (2) incorporating this program into the Chadian financial system. VITA has successfully marshalled the required inputs. However, progress towards attaining sub-project outputs and purpose has been mixed. Reduced demand for SME credit and low repayment rates from existing clients raise serious doubts as to the viability of supervised credit in Chad. One reason for this is poor economic conditions, although it remains to be determined whether other factors have played a role. A VITA initiative that shows far more promise is export marketing activity, which could potentially replace supervised credit as its raison d'être in Chad. A sub-project funded marketing consultant identified export markets for in Chadian produce, and recommended specific actions for penetrating them. VITA hopes to create a "VITA Export Association" to take advantage of this opportunity by providing local farmers needed inputs, technical advice and a guaranteed price for their crops.

5. International Human Assistance Programs (IHAP) submitted a \$2.1 million proposal for the Chari Irrigated Perimeters Sub-Project. This failed to receive GOC or USAID approval because (a) the GOC felt the proposed intervention zone to be already saturated with donor activities and (b) there was an inadequate commitment of non-AID resources.

#### C. Technical Issues

1. Water management and engineering has been a component of three of the sub-projects, with the goal of overcoming the effects of insufficient and irregular rainfall. Africare has developed two promising technologies. The first is the construction of water catchments across wadi beds to catch and retain seasonal flows; these have good potential, but at their current scale will require more capital investment and GOC supervision than would be sustainable at the village level. The second is the dalou animal traction waterlifting system, which is being adapted to the Ouaddai region and seems to be both affordable and replicable at farmer level. ORT's approach has been more diffuse and experimental, but two useful interventions are being developed: a tube well waterlifting system which combines a below-ground piston device with above-ground rocker mechanisms of the traditional shadouf; and a method for tapping regional confined aquifers with tube wells. Scheduled tests of motor pumps in the wadis will likely prove the non-adaptation of this advanced technology. Finally, CARE's major success in this area has been with expanded agricultural production in the southern perimeters, and with refinement of irrigation plots and canal lining techniques to maximize the efficiency of water use.

2. Agricultural production figures is a component in all four sub-projects. CARE has concentrated its agronomic activities in the Bahr-el-Ghazal, where it has set up an experimental farm for varietal trials as well as training of extension agents and farmers, and in the Chari-Logone irrigated perimeters, where the focus has been on-farm trials as well as farmer training. CARE's thorough data collection activities will likely yield well conceived and adaptable improvements in cropping techniques. It has also been careful not to promote new packages to the exclusion of traditional techniques, lest a disaster impair participating villagers' ability to feed themselves. In the Ngouri wadis, ORT is undertaking agronomic experiments on the fields of volunteer farmers, with promising results. The technologies tested have involved no radical changes in inputs or techniques and, as such, have been readily adopted by farmers. Socioeconomic and agronomic data are being collected to determine the impact of this activity. Africare's agronomic activities in Ouaddai have focussed on the water catchments, where cool season recessional cropping has been practiced. Drought resistant varieties of rainfed staple crops are also being introduced. Greater efforts need to be made, however, on data collection and analysis. Finally, VITA has a large portfolio of agricultural production loans and provides regular agronomic advice, largely in the domain of irrigation techniques, to these clients. Its "Export Project" promises to expand this role considerably.

3. Agroforestry has been incorporated into the CARE, Africare and ORT sub-projects. All three PVOs have had similar successes and failures here. The most successful interventions are fruit tree production and nursery development. The least successful has been dune stabilization. Tree planting in northern Kanem, where tree ownership has significant land tenure implications, has proven to be a difficult and cost-ineffective activity relative to agricultural production. It has also not proven particularly effective in Ouaddai, where efforts continue to be plagued by lack of water even for the central nursery. In no instance have any of the PVOs developed hard data on acreage affected by agroforestry interventions, on mortality/survivability, on number of farmers affected, or on replicability and sustainability of the interventions. Moreover, relations between the PVOs and the Water and Forest Service are unusually poor. The common elements of the successful elements appear to be clear economic benefits and ownership (i.e., fruit trees), or strength of the existing GOC institution (i.e., nursery establishment).

4. Credit and markets. Three of the four PVO sub-projects have credit components, and in all four the condition of markets for farm inputs and agricultural production is key to their success. Adoption of improved technology will not be possible in many cases unless markets

can provide necessary inputs (e.g., building materials for improved wells), and will not be worthwhile unless markets can provide outlets for increased production. Credit components are particularly sensitive to changes in market conditions. Unexpected increases in borrowers' production costs or decreases in their revenues can undermine repayment rates and hence a credit program's viability. Market studies and market development are recommended as an integral part of any agricultural production or small business credit program in Chad.

D. USAID/Chad Role. The Mission has done a good job to date in managing this project. The five sub-project proposals that were submitted received thorough technical and administrative scrutiny, and the Mission has provided excellent backstopping to the PVOs' implementation efforts. A problem, however, is that the direct-hire Project Officer has only been able to devote half of her time to this activity. Recruiting a full-time contract Project Manager would allow closer technical monitoring and support of the PVOs.

E. Government of Chad Role. The GOC has had a variety of roles in the project. The Ministry of Planning and Cooperation is the official liaison with AID and the PVOs, and was actively involved in the sub-project approval process; since then, it has not had the time or resources for an active role. Over the course of implementation the PVOs have developed working relationships with the Ministry of Agriculture and the Ministry of Tourism and the Environment (Water and Forest Service). The experience with Agriculture has varied from the fruitful relationship of the extension office (ONDR) with CARE and Africare, to the misunderstandings that have developed between ORT and SODELAC. All PVOs have had strained relations with the Water and Forest Service, in large part due to different conceptions of the purpose of forestry activities.

F. Relevance to USAID and GOC Development Strategies. Both USAID/Chad and the GOC are in the process of designing medium-term development strategies to replace the disaster relief oriented efforts of recent years. The range of technical and geographic experiences gained through this umbrella project will be of great use to both in these exercises.

## II. CONCLUSIONS

### GENERAL

1. The individual PVOs need to continue and expand their collaboration with each other. Specifically, CARE and ORT could profit substantially by testing and extension of the dalou water-lifting system currently being used by Africare; CARE could profit from ORT's data collection activities in the areas of soil and water chemistry, agronomy and hydrology in the Lac and Kanem Prefectures; and ORT could profit from agronomic and forestry lessons learned by CARE to date in Kanem. It is essential that this occur within the next few months, since at that time certain of the CARE long-term TA team with the greatest experience in the Kanem area will begin to cycle out of the project.

2. In terms of a general strategy for food crop self-sufficiency in western Chad, future efforts should concentrate on maximizing irrigated agricultural production on the floodplains and terraces of the Logone and Chari rivers.

3. A second area of concentration should be on development of commercial agricultural production in specific high potential Sahelian/Saharan environments such as the externally drained Bahr-el-Ghazal. In addition to the direct benefits of increased production, development of these environments will ultimately serve indirectly to draw in populations, especially during periods of extended drought, from high risk environments like northern Kanem.

4. While the forestry activities of the PVOs are commendable and should be continued at some scale, given project funding levels and limited impact, they should be prepared for phaseover in their entirety to GOC personnel by the PACD. Forestry activities under the umbrella project have in any case become ancillary to more immediately important agronomic and water management interventions. Future forestry sector interventions should be carefully evaluated prior to implementation, and should probably be undertaken only on a forestry specific project basis.

### CARE -- IRRIGATED AGRICULTURE SUB-PROJECT

5. CARE is far overextended geographically. The sub-project's scope should be reduced by eliminating areas and activities showing the least promise of replicability and sustainability and least benefit for the cost.

6. The internally drained wadis of northern Kanem are an extremely high risk agricultural environment which probably can never be made to sustain more than a small population of

subsistence farmers. CARE is unlikely ever to develop a significant and sustainable commercial agricultural capacity in the Nokou area because of the area's extreme environmental, infrastructural and demographic limitations. These limitations are not likely to be resolved in the mid run.

7. The best current development hope for the Nokou region is maximization of subsistence agricultural production with a view towards minimizing the food relief which has and will probably continue to be required there periodically. Assuring a greater degree of food self-sufficiency would be a significant accomplishment. While CARE appears to have made some limited progress towards this goal, however, it should be deemphasized through the PACD. Higher returns in terms of increased agricultural production are available from development investments made elsewhere.

8. Agriculture in the Cheddra wadis, in contrast to Nokou, has two considerable advantages: easy access to the N'Djamena market and a considerable surplus of land for extensifying production. There remain, however, serious economic obstacles to development of sustainable commercial agricultural production, including the existence of a transport cartel in the region, and a current inability to market crops at a more financially favorable season. CARE has nonetheless made good progress at Cheddra and should therefore concentrate its Kanem efforts in the Bahr-el-Ghazal.

9. Irrigated agriculture along the Chari and Logone Rivers offers a far greater hope for increasing sustainable food production than the Kanem. Indeed, the interriverine lands between the two rivers could, under appropriate technical and economic management, become the rice bowl of Chad. CARE has done an outstanding job of developing an appropriate technical package for small scale, commercial, irrigated agriculture here. While constraints remain, CARE should concentrate the bulk of its efforts through the PACD on refining and extending this package in this zone.

#### AFRICARE -- OUADDAI RURAL DEVELOPMENT SUB-PROJECT

10. In recent years, rainfall in northern and central Ouaddai has been too sparse and irregular to allow significant production of rainfed food crops. Testing, development and extension of new water management technologies are essential if this region is to achieve food self-sufficiency. In this regard, Africare's work on wadi water catchment structures and the dalou animal traction system for drawing well water holds considerable promise. Introduction of short-cycle, drought resistant varieties of millet and cow peas, as planned by ORDP for the 1988 season, is another useful intervention, with potential impact across the Sahelian zone.

11. Even if food self-sufficiency can be attained, Ouaddai's isolation and the small size of its internal markets make commercialization of surplus a doubtful proposition. Introduction or extension of cash crops (e.g., onions or tomatoes) on a large scale may therefore not be feasible in the near to medium term.

12. Agronomic and socioeconomic data on the Ouaddai region are limited, which constrains the planning and implementation of successful interventions. This lacuna needs to be addressed immediately, with ORT's data collection in Ngouri a useful model.

#### ORT -- LAKE CHAD AGRICULTURAL DEVELOPMENT AND FARMER TRAINING SUB-PROJECT

12 The internally drained wadis of the Ngouri area are another high risk agricultural environment. As such, they probably can never be made to sustain more than a small population of subsistence farmers. They nonetheless have certain advantages over the wadis of the Nokou region to the north, including slightly better soil and water resources, a lower population, greater availability of land, and somewhat better commercialization potential. ORT should concentrate on maximization of subsistence agricultural production and limited market production in the internally drained systems, and on developing agronomic and water management technologies which have applicability to both those and the polder systems. Assuring a greater degree of self-sufficiency for the wadi farmers should be the primary goal of ORT through the PACD; if realized, it would be a significant accomplishment.

14. Misunderstandings between ORT and the principal GOC counterpart agency, SODELAC, have significantly impeded sub-project progress. Immediate steps need to be taken to correct them.

#### VITA -- PRIVATE ENTERPRISE PROMOTION IN CHAD SUB-PROJECT

14. Despite timely provision of AID-financed and other inputs, the supervised credit program is facing serious trouble. Only one-third of scheduled loan repayments are being made; loan demand is far down from the the 1984-1987 first phase activity; and overhead costs are running at four times the rate of loan disbursements. Chad's prolonged economic slump appears to be a principal cause for this poor performance, although other factors need to be investigated.

15. VITA has begun a promising effort to develop export markets in France and elsewhere for Chadian agricultural products. This offers a high intrinsic value, as well as the potential for turning around the environment in which the

supervised credit program is being implemented. The relationship between the export activity and the existing supervised credit program needs to be developed.

### III. RECOMMENDATIONS

Sub-project specific recommendations are found in the individual sub-project annexes. The following recommendations reflect the consensus of the evaluation team regarding the USAID/Chad PVO Development Initiatives Project as a whole.

1. The PACD should be extended for two more years, until 30 September 1991.
2. The PVOs should shift their focus from an emphasis on "experimentation" to a more results oriented process of technology identification, adaptation and extension, with the specific goal of maximizing agricultural production in their respective regions of influence. They need to concentrate on interventions which are most likely to work and be extendable during the next two years.
3. The PVOs should concentrate on activities which do not and will not require the continued presence of GOC or outside donor inputs after the PACD. However, during the life of the project the PVOs should make a stronger effort to develop Chadian extension staffs to diffuse and encourage adoption of PVO developed technologies.
4. The PVOs need to extend available interventions which are sustainable and replicable now. Examples of such interventions include 1) improved canal layouts; 2) clay canal linings; 3) furrow planting techniques; 4) crop spacing arrangements; 5) improved plant population densities; 6) improved use of manure; 7) confined aquifer tapping to improve well recharge; and 8) the dalou water lifting system.
5. The PVOs should continue to look for opportunities to establish linkages with commercial farmers and other private sector entrepreneurs.
6. The PVOs should continue to concentrate on water management and agronomic interventions relative to other, ancillary activities.
7. The PVOs should quantify and document the agronomic, environmental and other impacts of their interventions, both successful and unsuccessful; keep permanent documentary records on those interventions; and submit those records annually to USAID/Chad.

8. The PVOs need to considerably improve communications and technology exchange with each other, especially regarding interventions and technical data with potential applicability to their own and other PVO target regions.

9. USAID/Chad has done a good job of managing this activity, but the project needs a full time project manager through the end of the PACD. A portion of the money remaining in the budget should be used to contract for the services of a full time project manager for a period of two years.

10. The rest of the budget should be allocated in FY 1989 to specific PVO activities based on demonstrated and quantified agricultural impact resulting from extended technologies. Activities which currently appear to have high potential include: 1) CARE's irrigated perimeter package along the Chari and Logone Rivers;; 2) Africare's water catchment and water harvesting activities; 3) CARE's agronomic and water management activities at Cheddra; and 4) VITA's efforts to develop export markets for Chadian fruits and vegetables.

12. USAID/Chad should concentrate future agricultural project activities in Chad in areas with the greatest production potential.

#### IV. LESSONS LEARNED

1. The PVO umbrella mechanism was and remains a useful approach to identification of interventions with good follow-up potential, particularly in countries with a strong history of PVO involvement.

2. In an umbrella project of this nature, preparation and approval of acceptable sub-project proposals will be as lengthy as the usual AID project design cycle. However, the PVOs' ability to develop proposals which satisfy all AID project development requirements is limited. No PVO was able to produce an approved sub-project document until at least 15 months after the project authorization, including those with considerable experience in proposal preparation and in development work in Chad. The delays were exacerbated by the need to translate documents into French and obtain GOC approval. Despite the considerable frustration of all parties, the process seems to have worked -- as evidenced by the implementation of four well-designed sub-projects.

3. Those PVOs with the greatest experience in a given country will not always produce the best project proposals, but they will generally produce the best results. Conversely, PVOs which are relatively new to the local PVO scene may produce excellent project proposals but they will also typically experience the greatest implementation problems.

4. Experience with certain types of specialized interventions is not always transferable, even in similar types of environments. VITA's considerably reduced effectiveness in obtaining loan paybacks, e.g., is in stark contrast to its experiences under a predecessor activity in Chad.

5. PVOs, and projects in general, need to focus their efforts on doing a very limited number of things and doing them right. Superfluous or ancillary activities consume time, money and administrative effort and typically do not contribute significantly to the impact observed at the PACD.

6. Collection of hard data on direct and indirect impacts of project interventions must be undertaken if projects are to be evaluated objectively.

7. Financial support to PVOs by a range of donors is a substantial advantage from the perspective of flexibility during project implementation, particularly where activities restricted by one donor can be funded by a different one. Disadvantages, however, include the substantially increased reporting and liaison requirements.

8. The transition from prolonged disaster relief to development activities can be difficult. Beneficiaries sometimes come to equate the PVO presence with Food-for-Work rations and "gifts". This produces a passiveness on their part which impedes the implantation of a development dynamic.

9. Credit programs cannot succeed under unfavorable market conditions. In a country with as small an internal market as Chad's, promotion of exports and development of internal markets is essential for credit programs to be sustainable. This applies to credit programs aimed at farmers in remote areas as well as those around major cities.

## V. PROJECT BACKGROUND

The USAID/Chad PVO Development Initiatives Project (677-0051) is a four year, \$12.725 million activity designed to assist small farmer food production and supportive private sector activities having demonstration and institutional development effects in the Sahelian zone of Chad. The project was designed in early 1985, was authorized June 7, 1985, and has a PACD of September 30, 1989.

The development climate of Chad at the time of project design was unusually difficult. One of the poorest countries in the world, Chad had been wracked by 15 years of recurrent war and drought. While increased food production was clearly the principal development priority, the Government of Chad (GOC) at that time was incapable of reaching the hardest hit populations

in the Sahelian zone. USAID/Chad, however, had two years of positive experience with U.S. private voluntary organizations (PVOs) in its relief and rehabilitation activities and had found them to be efficient vehicles for assistance in both rural development and private sector promotion.

The project was originally designed to support four to five sub-projects having durations of two to four years, each of which in turn would be designed, implemented and monitored by U.S. PVOs. The Project Paper (PP) envisioned sub-project assistance to settled populations to achieve food self sufficiency through technical assistance (TA), commodities, food for work (FFW) and construction, and to small entrepreneurs to start food production related businesses through provision of TA and loan capital out of a revolving fund. This "umbrella" structure also envisioned minimization of the management burden on the USAID Mission and the GOC.

The goal of the project is "to increase Chad's production of food and its availability to the deprived, and lay groundwork for more profound agricultural development." The project purpose is "to assist small farmer production and supportive private sector activities having demonstration and institutional development (primarily local cooperation) effects." The PP notes that the "objective of the project was to accomplish this broadly and quickly enough to a) make a significant contribution to the welfare of Chadians hitherto subject to famine and the recipients of food aid, including settled displaced persons; and b) to demonstrate approaches to developing small farmer and private sector food production systems which successor, longer-term projects can adopt or otherwise support."

Five PVOs originally developed sub-project proposals, of which four were approved:

-- the CARE Irrigated Agriculture Development activity, budgeted at \$3.98 million, was authorized September 9, 1986;

-- the ORT Lake Chad Agricultural Development and Farmer Training activity, budgeted at \$2.593 million was authorized December 12, 1986;

-- the VITA Private Enterprise Promotion in Chad activity, budgeted at \$1.2 million was authorized February 24, 1987; and

-- the Africare Ouaddai Rural Development activity, budgeted at \$2.84 million was authorized April 6, 1987.

The fifth proposal, from International Human Assistance Programs (IHAP) for a \$2.1 million Chari Irrigated Perimeters sub-project, failed to receive GOC or USAID approval because (a) the GOC felt the proposed intervention zone to be already saturated with donor activities and (b) there was an inadequate commitment of non-AID resources. The funds that were provisionally set aside for IHAP remain available for other use.

The assumptions made during the design of the project proved to be largely valid. There was sufficient PVO absorptive capacity and field effectiveness to achieve project inputs as evidenced by PVO submission and USAID approval of four sub-projects and the PVOs' implementation reports. The assumption that necessary inputs would continue to have access to Chad was also valid, as shown by the satisfactory provision of inputs to the sub-projects to date. The validity of assumptions for achievement of outputs was also solid. Target populations have for the most part been ready and willing to participate in sub-project activities, although there have been clear successes in some areas (e.g., irrigated perimeters in the Mayo-Kebbi region) and a few failures in participatory willingness without such external incentives as FFW in others (e.g., dune stabilization in the Kanem). GOC agencies have also been generally willing to cooperate locally. Again, there have been significant successes (e.g., relationship between Africare and the ONDR in Ouaddai) and some failures (e.g., the Water and Forest Service in the northern Kanem). The ability to collect needed data has also proved for the most part to be a valid assumption, although data collection by all PVOs could be improved.

The validity of assumptions for achievement of the project purpose has to date been somewhat less solid. While access to the Sahel has remained largely unimpeded by external factors (i.e., armed conflict) since 1985, access remains poor in most places because of dismal road conditions or the lack of roads altogether. The business climate has apparently improved to some extent as a result of relative stability, but there remain very significant constraints to business in Chad which have seriously undermined VITA's supervised credit program. The assumption that "water potential is realizable" was not valid given technological, economic and sociological realities in certain locations (most notably Kanem), although it was clearly realizable in Mayo-Kebbi and appears to be realizable in Ouaddai. This assumption should probably have been modified to read "significant improvements in sustainable water delivery" and been listed as an output of the project.

Finally, the validity of assumptions for achievement of project goals has also been for the most part solid. There have been no overt national disasters, although "disaster" in Chad is a relative term. Rainfall, however, has been extremely poor in

some areas (e.g., 90 mm in Nokou, 140 mm in Cheddra and 145 mm in Abeche in 1987). Flooding ruined many crops in Cheddra's Bahr-el-Ghazal and washed out some of Africare's water catchments in Ouaddai. Also, political stability has improved at the same time that GOC agricultural policy has not changed to the detriment of the project framework.

There is an implicit assumption in the PP that the activities initiated will be sustainable without some degree of institutional support on the part of the GOC. The validity of this assumption clearly depends on the specific activity undertaken. The assumption is not valid with respect to construction and maintenance of larger water catchment structures in Ouaddai, dune stabilization in Kanem, or certain agronomic practices such as provision of new genetic stock. The assumption does appear valid, however, with respect to other water management, agronomic and forestry interventions, most notably with CARE's irrigated perimeter package in Mayo-Kebbi.

The institutional capacity of the GOC to continue field extension of new farming practices will ultimately be a critical factor in determining the range of new techniques available to farmers and the impact of the technologies developed. However, some of those technologies will remain available, sustainable and reproducible even in the absence of continued GOC support. At the same time that the PVOs work to increase GOC participation and effectiveness in their individual sub-project activities, therefore, they should also be concentrating on development and dissemination of interventions which will ultimately be replicable and sustainable even in the absence of such GOC support.

## VI. PVO DESIGN AND IMPLEMENTATION ABILITY

### A. CARE

The CARE Irrigated Agriculture Development Project, approved in September 1986, grew out of a series of disaster relief activities with which CARE was involved in Chad prior to conception of the umbrella project. It is composed of agronomic, water management and agroforestry activities in three ecologically different and widely separated geographical locations: the internally drained wadis of the Sahelian Nokou region, the externally drained Bahr-el-Ghazal and associated wadis of the Sahelian Cheddra region, and the riverine terraces of the Logone and Chari rivers in the Sahelo-Sudanian regions of Mayo-Kebbi and Chari-Baguirmi Prefectures.

Although CARE's original project proposal was of marginal quality and experienced considerable delays in obtaining approval, CARE has fielded an extremely strong long-term TA

team and done a generally outstanding job of implementation. Inputs have been of generally high quality and been provided with timeliness: about 75% of all long term TA provisions have been met; delivered short-term TA has been of good quality if significantly modified from the CA provisions; extensive training has been conducted; most commodities have arrived and are operational; other local costs have been appropriately expended; CARE inputs have been provided; GOC inputs, although modified significantly, have been provided to an extent greater than originally foreseen; and some FFW funds have been expended although FFW has been terminated. Approximately 40% of all USAID funds had been expended as of a point about 51% of the way into the project. Project outputs to date are also consistent with the provisions of the CA.

To some extent the purpose of the project has been realized, although greater progress has been realized in the southern perimeters and in the Cheddra area than in the Nokou area. The goal of the project, however, "to establish an indefinitely sustainable increase in food production," has not yet been met. It is unlikely that the goal can be reached in the Nokou region, possible that it can be reached to a significant extent in the Cheddra region, and very possible that it can be reached to a very significant extent in the southern perimeters.

CARE has shouldered a far larger load of donor responsibilities and commitments than other PVOs under the project. This has resulted in considerable implementational flexibility, but it has also increased its administrative and reporting burden.

Relations between CARE and the GOC Ministry of Agriculture are generally good, but relations with the Water and Forest Service are poor. The latter relationship derives in part from a preexisting problem with CARE forestry work in the Kanem in the early 1980's. This relationship appears to be improving.

#### B. AFRICARE

Like the CARE sub-project, Africare's Ouaddai Rural Development Project is the continuation of a previous effort (the Apeche Rural Development Project) that combined disaster relief with development initiatives. Thus, even during the design phase, Africare had offices in both N'Djamena and the Ouaddai region, as well as existing relationships with GOC officials and villagers.

Sub-project design commenced in early 1986, with the proposal first submitted to USAID/Chad in May 1986. The need for extensive revisions suggested by the Mission delayed approval of it until April 1987. The Cooperative Agreement between AID and Africare was signed on August 27, 1987, and made effective from May 1, 1987. Sub-project activities did not really get

under way, however, until the arrival of the bulk of the technical assistance team in November 1987 -- two and a half years after authorization of the umbrella project and eighteen months after submission of the first draft of the Africare proposal.

In the six months of effective sub-project implementation, provision of inputs by Africare, the GOC and other parties has generally been satisfactory. The long-term and short-term technical assistance personnel have been suited to their positions and have been assigned GOC counterparts from ONDR and the Water and Forest Service. Commodity procurement, construction and local support activities have generally been of good quality. Villagers continue to receive Food-for-Work rations from the World Food Program in return for labor contributed to the forestry and water catchment construction components. The major problems encountered in provision of inputs have been: (1) Africare's inability to recruit an experienced engineer for the Project Engineer position; (2) under-estimation of the budget for vehicle maintenance and operations; and (3) poor quality garage and shop tools procured from Nigeria.

Progress towards achieving sub-project outputs has generally been satisfactory. The construction of water catchment structures designed to retain flow from seasonal flooding in wadis has been impressive, but planning and impact assessment would be enhanced by the timely recruitment of the expatriate engineer. Other, less visible interventions have potential impact equivalent to the water catchments. Africare has begun testing and demonstrating the dalou, a simple and inexpensive animal traction system for drawing well water, with which TA team members had worked in Niger. Another example is the testing of drought resistant, early maturing varieties of millet and cowpeas from Niger, for rainfed cropping in the dunes. The forestry and agroforestry component is supporting the Water and Forest Service's efforts to establish satellite nurseries to teach farmers the principles of tree production and nursery management, as well as investigating the potential of gum arabic production as a cash crop. The credit component, although still in the design stage, may suffer from not being based on a solid enough understanding of socioeconomic structures.

With the activity only six months into effective implementation, it is somewhat premature to judge progress towards meeting its purpose (to increase agricultural production, combat deforestation and bolster the rural economy in the Ouaddai region) and goal (to contribute to increased food security in the Ouaddai region).

### C. ORT

The ORT sub-project is a three year activity signed eighteen months after authorization of the PP. The sector goal is to increase the dependability of food production in Chad. The activity has a dual purpose: to increase wadi food production in Ngouri Subprefecture while maintaining or improving soil fertility, and to identify models for increased food production which will be replicable under similar wadi conditions. The GOC implementing agency for the project is the Ministry of Agriculture's Societe de Developpement du Lac (SODELAC).

ORT produced the most professional proposal of all of the PVOs, but had no operational base in Chad prior to the signing of the project agreement with USAID. There were, consequently, delays in providing some of the inputs. This in turn resulted in a slow rate of output accomplishment for the first year. The construction of an office complex and a residence in Ngouri have yet to be finished, and as of yet there is no radio contact established between the N'Djamena head office and Ngouri. On the other hand, three of the long-term TA staff have been in Chad since Summer 1987; the rural works engineer arrived in October 1987; and short-term TA provided to date has been of good quality.

The scheduled training of ten SODELAC agents has not yet taken place. This is in part due to ORT's early difficult relationship with SODELAC and the problems involved in identifying candidates. The ORT-SODELAC relationship has yet to be fully defined, but it seems likely that five or so SODELAC agents, including the two currently assigned to Ngouri, will be sent to Senegal for training as initially planned. In general, ORT needs to reexamine and redefine the participant training component of its project in light of its first year's experience.

ORT's agronomic activity is strong, with a number of new interventions tested by the agronomist having been adopted by local farmers. Certain other experiments, such as insertion of a sand lens in the wadi soils, have shown interesting technical results, but do not appear to be replicable due to cost. The rural works engineer's efforts have been of high quality. One intervention he has worked on in particular, tapping the confined regional aquifer to increase well water quantity, has demonstrated excellent, sustainable and replicable results at very low cost.

The pump program, however, has so far produced less promising results. No new pump technology acceptable to the target farmers has been developed. Experimental introduction of motor pumps is proceeding as projected in the ORT proposal, although

the ultimate economic viability of this technology seems doubtful.

The forestry program has also faced problems, although the Peace Corps forester has done a fine job with the limited resources at his disposal. The biggest constraint to this activity is ORT's inability to develop a relationship with SODELAC and the Water and Forest Service which spells out agroforestry responsibilities, can ensure continued competent management of the central nursery, and can result in development of an effective extension cadre for forestry interventions. Without such an agreement, the viability of the entire agroforestry component of the project appears questionable.

In general, land is not a constraint in ORT's area. There is evidence, however, that local groundwater levels have been decreasing in a statistically linear fashion since about 1963; in areas with a shallower water table, there have been problems with recharge of wells. The implications are that land will gradually be removed from potential production given the present limitations of shadouf waterlifting technology unless (i) waterlifting technologies can be improved, (ii) better water conserving technologies can be adopted, and/or (iii) the lower regional aquifer can be more effectively tapped to improve water quantity in the wadi wells.

ORT is currently working on all three fronts. Its activities have not yet brought any new land into production, however. Instead, they have focussed on improvement and intensification of agricultural production. Nonetheless, in the mid to long run improved agronomic and water management practices may result in cropping of additional acreage in existing wadis. Moreover, the actual payoff of their activities in terms of agricultural productivity will likely occur in the next two years as they expand significantly into new wadis. In order to effectively accomplish such increases, however, ORT will need to (i) increase the number and improve the quality of the interventions available for extension and (ii) develop an effective service vehicle for accomplishing that extension.

#### D. VITA

The Private Enterprise Promotion in Chad sub-project, authorized for the period February 24, 1987, through February 23, 1989, is the continuation of the "Private Enterprise Project" implemented by VITA between March 1984 and February 1987. It has a dual purpose: (1) to provide both urban and rural small and medium enterprises (SME) with credit, management and other direct technical assistance and market information, and (2) to incorporate the established supervised credit program into the Chadian financial system through the

selection and implementation of an appropriate turnover mechanism.

The first phase activity, which received \$2.051 million in AID funds, set up all of the basic structure of a supervised credit program: procedures for evaluating credit applications and monitoring loans; recruitment and training of local staff; and recruitment of the two long-term advisers retained for the current sub-project. In mid-1986, the supervised credit program seemed an outstanding success: the repayment rate was 75%, and administrative costs were only \$1.60 for each \$1.00 lent out. Private Enterprise Promotion was designed against this background, with the expectation of continued expansion and improvement from an impressive base.

Since approval of the sub-project proposal and signature of the Cooperative Agreement, VITA has successfully marshalled the required inputs. However, progress towards attaining sub-project outputs and purpose has been mixed. Although VITA prepared a thoughtful proposal for institutionalizing the program through creation of a Chadian credit PVO, reduced demand for SME credit and low repayment rates (36% in 1st Quarter 1988) from existing clients raise serious doubts as to the viability of supervised credit in Chad. One of the reasons for this is that sub-project design assumptions as to continued economic growth and hence demand for SME credit proved to be false. It remains to be determined whether other factors have played a role in this disappointing performance.

In the face of the crisis threatening the core activity of its sub-project proposal, VITA has shown admirable flexibility. It has identified an export marketing activity that could potentially replace supervised credit as its raison d'être in Chad. A sub-project funded marketing consultant identified French wholesalers who might be interested in Chadian produce and also recommended specific agronomic and commercial actions for penetrating this market. VITA proposes the creation of a "VITA Export Association" to take advantage of this opportunity by providing local farmers needed inputs, technical advice and a guaranteed price for their crops. The activity would contribute to attainment of the sub-project purpose's by providing rural SMEs with technical assistance and market information. At the same time it could strengthen the supervised credit program by enhancing loan repayment rates, increasing demand for new credit and covering administrative overhead.

## VII. TECHNICAL PROGRESS TO DATE

### A. WATER MANAGEMENT AND ENGINEERING

The PVOs have invested impressive amounts of energy in development of improved water lifting and water management technology, and have successfully focussed on technologies which offer great promise. Considering the short time that the teams have been working, and the diversity of the needs of the various regions, the effort to date has been commendable.

1. Africare began building water catchments under a food for work program in an attempt to ameliorate the persistent inability of famine refugees in Ouaddai Prefecture to help themselves. Africare knows how to build water catchments which can harvest wadi water in the most efficient possible manner. It has also demonstrated the advantages of the dalou animal traction waterlifting device and how to combine it with a temporary holding reservoir tank for maximum irrigation efficiency.

Mistakes have been made, however, including unrealistic completion targets, inappropriate equipment purchases, and unreasonable project siting. Africare has nevertheless advanced on the learning curve and now knows what it takes to harvest water efficiently and effectively in the Ouaddai. To streamline the work the team needs a sheeps foot roller, a tracked two cubic meter front end loader, and another dump truck. They also need to work more closely with the newly restaffed Ouaddai regional office of the Rural Engineering Service (Genie Rural). The expatriate engineering position has not been filled, which hurt the project when management made some inappropriate technical decisions and equipment selection.

Ouaddaiens have historically made use of small-scale water retention structures. "Diguettes" and stock watering ponds to harvest water should be promoted at appropriate sites throughout the region. It would be impossible to have too many of these. Erosion control structures made of brush and rock should also be introduced and encouraged. Gabions are useful but may not have an acceptable payback unless used in conjunction with these other structures. Concentrating improvements on a single water course was considered but abandoned as politically unworkable.

2. Despite the short time since ORT resumed operations in Chad, it has met with some water management success. The ORT team has conceived a tube well water lifting device which combines modern below ground technology with the traditional shadouf above ground rocker mechanism. The technology for tapping regional confined aquifers with tube wells has been developed further. Although testing continues,

it is safe to say that advances in this area can add measurably to wadi farmer water production at least in the short term.

ORT has invested heavily, however, in its search for technology to replace the traditional shadouf. The project's targets in this area were, unfortunately, ill defined and unrealistic; this has caused dispersal of team effort. The team needs to focus on provision of improved waterlifting technology. Efficiency and economic comparisons of modern technology with the shadouf need to be oriented to the needs of wadi farmers. ORT's staff must report what has no potential, develop what shows promise, and adopt and extend what works. This should be done by minimizing wasted effort. The project goal of increasing agricultural production can only be achieved when farmers obtain improved water technology.

3. CARE's major success in water management improvement to date has been with expanded irrigated agricultural production in the southern perimeters. CARE has also refined the layout of irrigation plots to maximize the efficiency of water use and is developing canal and channel lining techniques. The Jenkins treadle pump has also been improved, and offers an inexpensive and sustainable alternative to the shadouf.

CARE has needed technical assistance in its well lining program, however. Also, the sub-project Hydrologist/Groundwater Specialist should focus on groundwater hydrology in the Bahr-el-Ghazal. CARE's slowness in filling this slot has caused the water management program to show little in the way of results outside of the southern irrigated perimeters except some good ideas.

4. General comments. The umbrella project PVOs must avoid duplication of effort and must share proven developments so that benefits under the project can reach those who need them as quickly as possible. Good communication is often the most difficult item to achieve on a development project, but is the most vital need. More effort must be made by project management in this area. Efforts must also focus on results. It is not the person but the function performed by that person that should be managed. The manager must also be sure that adequate and appropriate inputs are received in a timely manner -- which is a challenge given the remoteness of the project sites.

The water management goals of these activities must continually remain in focus, milestones towards those goals identified, and progress towards them tracked. If the goal is unrealistic, it should be revised using procedures acceptable to the USAID Mission. Better records, better systems of record keeping, and better result reporting systems are needed in each component of this umbrella project. The amount of manpower, machinery and

materials employed or used must be carefully recorded in one location daily. The efforts of other donor agencies should be monitored and assistance coordinated so that regional concerns are addressed while duplication of effort is avoided. As an example, GTZ (German Aid) may be able to supply a borehole to the forest nursery at Abeche.

Team building activities both internal to the PVOs and within the various sets of development-oriented assistance agencies and the GOC are another necessary and ongoing management activity. Responsibilities should be assigned so that each person knows what contribution he is expected to make and by what date that contribution is needed. Finally, positive and negative impacts of project activities as well as successes and failures need to be carefully documented.

It would be useful for both AID and the PVOs for the USAID Mission Engineer to review and approve building and other construction plans prior to the start of construction. The grease pit at the Africare garage in Abeche, for example, is essentially a fire trap from which escape in the event of a flash fire would be impossible. It should either be dug out and fitted with a ramp on one end or replaced altogether. Mission engineering review could identify potential hazards or mistakes of this nature.

## B. AGRICULTURAL PRODUCTION

Part of the umbrella project's statement of purpose was "to assist small-farmer food production". All four sub-projects also have increased agricultural production within their purposes.

1. CARE identified "increased food production in each target area" (Nokou, Bahr-El-Ghazal, Chari-Logone perimeters) as the first output in its proposal. It was hoped that 85 ha of new land would be brought into production (extensification), with 400 ha of existing cropland showing up to 10% increases in yield (intensification). Progress towards these targets has been difficult to measure due to a lack of baseline data, particularly in Kanem.

Agricultural activities at Nokou are less significant than elsewhere. The focus here has been on attaining food self-sufficiency by (1) stimulating traditional wadi farmers to intensify and improve their agricultural practices and (2) developing wadi-based production strategies for traditional pastoralists whose herds had been decimated by the drought of the early 1980s. Development of sustainable commercial agricultural capacity in the Nokou region is unlikely because of economic (poor transportation links and limited markets), ecological (low fertility and rainfall), and sociological constraints.

CARE's agricultural activities in the Bahr-El-Ghazal, centered at Cheddra, have considerable potential, because of relatively easy access to markets and wide availability of agriculturally useful land. Farmers here grow onions, tomatoes, okra, garlic and wheat under irrigation, and rainfed millet in the dunes. CARE is setting up an experimental farm near Cheddra where varietal trials as well as training for extension agents and farmers will take place. On-farm trials will consist of testing newly released varieties from the research center at Gourom as well as locally collected seeds. Currently, an employee of the Ministry of Agriculture coordinates farmer and staff training at Cheddra. This GOC employee appears qualified and should be of great value to CARE in its efforts to make Cheddra one of the most viable agricultural regions in the Sahelian portion of the country.

CARE's most promising agricultural intervention is its management of eight irrigated perimeters along the Chari and Logone Rivers in Mayo-Kebbi and Chari-Baguirmi Prefectures. On-farm trials are being conducted to determine the suitability of different techniques and their usefulness in improving production. For example, one experiment will determine the efficiency of water uptake between two rice varieties under rainfed as well as irrigated conditions. At the end of the growing season, fields will be evaluated to determine output as a consequence of different varieties, spacing arrangements, watering regimes and fertilization status. CARE will also collect data on agricultural activities outside of the irrigated perimeters. This will permit quantification of the villagers' non-farm activities, thereby allowing better design and implementation of project interventions. CARE has been careful to take an approach to extension of their irrigated perimeter package which does not discourage villagers from rainfed agriculture. This is because of the still experimental nature and uncertain sustainability of the irrigation package and the desire to ensure that under worst case conditions (e.g., total loss of the irrigated rice crop due to pump breakdown) the villagers' ability to feed themselves using traditional means would not be compromised for even a single season.

2. In Ngouri, ORT is undertaking agronomic experiments with volunteer farmers in the five sub-project wadis, with promising results to date. Although there have been problems in selecting prototype pumps for testing with the volunteer framers, the Agronomist has conducted a series of on-farm trials. These covered plot size, spacing arrangements, manure application, dates of planting, and improvement and expansion of varieties of crops grown in the wadis. On all accounts, there have been significantly higher yields in the demonstration plots than on farmer plots. Following the demonstrations, farmers adopted the innovations without much

difficulty. None of these technologies involved any radical changes in inputs or techniques and, as such, they were more easily adopted than advanced technologies would have been. The Agronomist is also collecting data on socioeconomic activities to determine the proportion of income secured from these changes in cropping techniques and their impact on the well-being of individual farmers.

At this point, ORT's activities have not yet brought any new land into production, as these efforts have focused on improvement and intensification of production on existing cropland. In the medium to long term, however, improved agronomic and water management packages may result in cropping of new acreage at the edge of existing wadis.

3. The focus of Africare's agronomic interventions has been the areas behind the water catchment structures, which have good potential for increasing production. Two cropping regimes have been made possible by these structures. Under "recessional" cropping, water accumulated behind a catchment during the rainy season recedes and leaves behind land on which farmers plant their crops. During the 1987/88 season at the Mattar catchment farmers grew tomatoes, peanuts, millet and sesame. Limited yield data indicate that about 2.26 tons/ha of dried tomatoes were obtained. Under cool season cropping at Mattar, berbere, a variety of sorghum, was grown. Here, farmers establish a nursery at the beginning of September, transplant the seedlings some 30 to 40 days afterwards, and harvest in mid-January. Because this crop survives on moisture accumulated over the course of the rainy season, farmers traditionally construct small terraces around each plot to retain water from irrigation at the time of transplanting. The water catchment structure allowed farmers to secure a better crop because more water was harvested and conserved for a longer period. Yields from the 1987/88 season at Mattar are estimated at 1.62 tons/ha. At present, production made possible by the water catchments cannot be estimated as a percentage of total farming activities. The 1988/89 growing season should provide data to evaluate this. In addition, data on market conditions and the moisture content the nutritional capabilities of the soil need to be gathered and analyzed for future crop selection in these areas.

Africare has also paid attention to rainfed cropping in the dunes, the traditional source of staple grains. As a solution to the problem of low rainfall (144 mm in Abeche in 1987) Africare will procure two tons of millet seeds and two and a half tons of cowpea seeds from Niger for the 1988 rainfed cropping season. These are early maturing varieties with much lower water requirements (as low as 100 mm) than the traditional local varieties. Given the inadequate and irregular rainfall in the project zone, the introduction of

early maturing varieties should lead to much greater production. The drought resistance of these newly introduced varieties should give them a better survival rate during periods of critical moisture availability.

4. At present, about half of VITA's loan portfolio is in the agricultural production sector, in the regions of N'Djamena and Bongor. VITA also has a "Service Agronomique et Technique", which evaluates the technical aspects of agricultural loan applications and then visits clients on a monthly basis to provide agronomic advice. This advice focuses on ensuring routine maintenance of motor-pumps used by clients with irrigated production, as well as recommending improved technical packages such as improved seeds and fertilizer use.

If the "Export Project" for shipping winter crops to Europe takes off, VITA's agricultural role will increase dramatically. For this to succeed, VITA will have to work very closely with the farmers -- from provision of seeds to advising on harvest methods -- to ensure production of export quality fruits and vegetables.

### C. AGROFORESTRY

Three of the four PVOs -- CARE, Africare and ORT -- are involved in agroforestry activities.

1. CARE has concentrated to date on nursery establishment, fruit and fodder production, soil nutrient replenishment, windbreak establishment, dune stabilization and salt extraction experiments. CARE's efforts so far have generally been the most successful of all of the PVOs. About 38 community and central nurseries and 1,018 individual nurseries had been established as of February 1988; some 530,000 seedlings had been distributed although data on survival were lacking; and about 40% of the total project participants were either planting, maintaining or harvesting tree products.

2. ORT has concentrated on establishment of nurseries, germination and dissemination of fruit trees, windbreak establishment and dune fixation. Due to the presence of only a single expatriate adviser with little national support, ORT's progress to date has been considerably more limited than CARE's. Ten village nurseries and one central nursery have been established, with fewer than 10,000 trees disseminated. Again, solid mortality data are lacking. Dune stabilization efforts have not yet begun to a significant extent; ORT could profit substantially by discussions with CARE technical personnel regarding this type of intervention. The need for dune stabilization also appears less pressing in Ngouri than in Nokou.

3. Africare's activities are essentially an extension of its previous agroforestry interventions in Ouaddai over the last several years. There is a focus on nursery establishment, with Africare and the Water and Forest Service collaborating on development of a central nursery to supply regional satellite centers with planting materials. The biggest constraint remains the lack of sufficient water at the central nursery to keep even the central stocks alive. This constraint should be relieved by either drilling of a borehole or significantly deepening the existing open well. Another problem in Ouaddai, consistent with PVO experience in other parts of Chad under this project, is that farmer participation has generally been minimal. Several village nurseries have been established with FFW encouragement from the World Food Program, but this type of activity does not appear to be sustainable. Again, the PVOs could all significantly benefit from better communication with each other on lessons learned in their respective zones of intervention.

4. General comments. The most successful types of PVO forestry interventions are fruit tree production and nursery development. The least successful intervention has been dune stabilization. Tree planting in northern Kanem, where tree ownership has significant land tenure implications, has proven to be a difficult and cost-ineffective activity relative to agricultural production. It has also not proven particularly effective in Ouaddai, where efforts continue to be plagued by lack of water even for the central nursery. In no instance have any of the PVOs developed hard data on number of hectares actually affected by agroforestry interventions, on mortality/survivability under different types of scenarios, on number of farmers affected, or on replicability and sustainability of the interventions. Moreover, relations between the PVOs and the GOC Water and Forest Service are unusually poor.

One of two elements seems to be present in the successful forestry interventions. The first is that individuals perceive clear economic benefits and ownership rights accruing from their work. An example of this is farmers' planting of fruit trees in their plots. The other element relies on existing technical and administrative capabilities within the Water and Forest Service -- e.g., establishment and maintenance of central nurseries.

While the forestry efforts of the PVOs are commendable and should probably continue at some scale, given the reality of limited project funds they should also be considered ancillary activities to the more central and immediately important water management and agronomic interventions. Responsibility for forestry activities should be prepared for gradual turnover to Chadian personnel at the time of the PACD.

#### D. CREDIT AND MARKETS

Three of the four PVO sub-projects have credit components, and in all four the condition of markets for farm inputs and agricultural production is key to their success. Adoption of improved technology will not be possible in many cases unless markets can provide necessary inputs (e.g., building materials for improved wells), and will not be worthwhile unless markets can provide outlets for increased production. Credit components are particularly sensitive to changes in market conditions. Unexpected increases in borrowers' production costs or decreases in their revenues can undermine repayment rates and hence a credit program's viability. Market studies and market development are recommended as an integral part of any agricultural production or small business credit program in Chad.

1. VITA's Private Enterprise Promotion in Chad sub-project is the continuation of a 1984-1987 project which created a credit organization with an effective Chadian staff and established procedures for loan administration. In the first phase, both demand for loans and repayment rates were encouragingly high. Clients included small/medium sized enterprises (SME) and agricultural producers in and around N'Djamena. However, since 1987 both new loan volume and repayment revenues have tumbled; in the first quarter of 1988, only five new loans, for a total of 10.9 million CFAF (\$38,000), were made, while only 36% of due payments were received. At the same time, overhead costs, which cover both banking operations and advisory services to clients, have slightly increased, so that it costs VITA about \$4.00 to lend \$1.00. These problems may in large part be due to general economic stagnation in Chad, which has also affected the operations of the local commercial banks. However, lack of knowledge about the economy and the markets faced by VITA's clients makes it difficult to pinpoint the cause.

VITA has recognized the importance of markets for its clients and has begun a promising initiative to develop export markets for Chadian fruits and vegetables. A marketing consultant identified French wholesalers potentially interested in Chadian produce and recommended steps for penetrating this market. VITA has proposed the creation of a "VITA Export Association" to take advantage of this opportunity, by providing participating farmers the needed inputs, technical advice and a guaranteed price and market for their crops. If the promise of the export market holds true while the problems with the supervised credit program continue, the overall thrust of VITA's sub-project could shift from credit to market development.

2. ORT initially proposed establishing two credit programs: one to enable entrepreneurs to manufacture pumps, and the second to support agricultural production by wadi farmers in Ngouri.

The credit program for pump manufacture is in abeyance. The sub-project has neither developed an acceptable pump prototype nor identified Chadian entrepreneurs interested in manufacturing pumps.

Support for the agricultural production credit program has been requested in the form of a \$130,000 grant from Band Aid/Live Aid. This program would establish in each sub-project wadi an approximately 500,000 CFAF (\$1,750) revolving fund managed by a committee selected from the wadi farmers. Loans would be made to individual farmers for purchase of agricultural production inputs such as seeds and well construction materials. An expatriate credit consultant would develop procedures to ensure the solvency of individual revolving funds, as well as equitable distribution of credit. Because of the lead time required for Band Aid/Live Aid funding, ORT has submitted this request before analyzing the available socioeconomic data collected in the wadis. As such it relies on some large assumptions and could, once in implementation, prove uneconomic. Of particular concern are the results from tests of water management technology (will there be improved inputs worth borrowing for?) and analysis of marketing data (can increased production be profitably sold and permit loan repayment?). The farmers' attitude towards credit (i.e., their willingness to repay) must also be established.

3. Africare plans to begin implementation of an in-kind farm credit program in the second year of its sub-project, following collection of relevant data and design of the program over the course of the first year. To date, however, there has been no serious effort to collect socioeconomic or agricultural production data on target populations. Current plans for the credit program itself are couched in general terms. Fifteen sets of animal traction equipment are to be distributed to "pre-cooperative groups" around Kiledji village and three more in the areas around the water catchments. If poor crops make repayment impossible, the equipment will be returned at no charge. Africare does not yet seem to have the detailed understanding of markets and other economic factors necessary for a successful credit program. It is essential that this lacuna be corrected well in advance of actual implementation.

4. CARE is the only one of the four PVOs whose sub-project has no credit component. Market conditions, however, are key to success in its three zones of intervention. In the Nokou region of northern Kanem, isolation

and the lack of market outlets is as serious a constraint on increased wadi production as the area's difficult physical environment. The Bahr-el-Ghazal region of southeastern Kanem has potentially good links with the markets of N'Djamena and Massakory, but farmers' revenues have been limited to date by the presence of a cartel of wholesalers and transporters. Finally, the irrigated perimeters along the Chari and Logone Rivers, which have the best physical production possibilities, have also faced problems in finding markets for their rice and other crops.

#### E. ENVIRONMENTAL MONITORING

The Initial Environmental Examination (IEE) for the PVO umbrella project, as amended in March 1987, required that certain specific monitoring and mitigation measures be undertaken by CARE, ORT and VITA in specific regions.

1. In Kanem and Ngouri, ORT and CARE were required to monitor soil salinization throughout the life of the project and to technically evaluate methods of managing soil salinization in the internally drained wadis. These provisions were included in the CA for ORT, which has monitored soil chemistry and is making a good faith effort to evaluate salinization management. Other restrictions became inapplicable because of ORT's deletion of certain water management activities.

These IEE monitoring and mitigation provisions should have been but were not included in the CARE CA. CARE's efforts to date have been limited to collection of baseline soil and water chemistry data and to limited and indirect evaluation of potential salinization mitigation packages. Monitoring of intervention impacts on soil chemistry in these wadis is critical to determining the sustainability, replicability and economic costs of agricultural production here. CARE needs to ensure that a solid monitoring and evaluation package is in place so that firm conclusions can be drawn by the PACD.

An additional provision of the IEE, as amended, was that AID funds not be expended to encourage traditional pastoralists to give up their nomadic way of life to pursue agriculture in the wadis, or to encourage any person to settle in wadis not currently used for irrigated agricultural production. Neither ORT nor CARE has undertaken such activities.

2. In the irrigated perimeters of the Chari and Logone Rivers, CARE was originally required by the IEE to provide appropriate malaria treatment drugs, or limited funds for the acquisition thereof, to the hospital at Koyom as well as other infirmaries which treat local populations for malaria in the immediate region of the interventions. This provision

was later put on hold under an agreement between the mission and REDSO/WCA until the findings of an in-depth health study were reported. That study, conducted in May-June 1987, failed to visit the irrigated perimeters or to make recommendations regarding potential health impacts. However, the present routine reporting system of the Ministry of Public Health permits identification of sudden increases in the number of cases of fever and hematuria in the health facilities in these areas. This means it will recognize an upsurge in cases of malaria and schistosomiasis and will accordingly channel additional prophylactic medicines to the affected zones.

3. A final provision of the IEE, as amended, was that VITA include a statement on each of its loan agreements that the funds provided would not be expended for the procurement or use of pesticides. Loan agreements reviewed during the course of the evaluation indicate that that statement has not been included in the agreements. VITA is therefore technically in violation of the provisions of 22 CFR 216, although they have specifically refused loans for pesticide acquisition and use during the program. The statement should be put on all agriculturally related loans through the end of the PACD.

#### VIII. USAID ROLE IN THE PROJECT

A. Project administration. The project was designed to place a minimum management burden on the limited direct-hire staff of USAID/Chad. The PVOs were to perform design of the sub-projects and all the usual implementation functions such as commodity procurement and personnel recruitment. Day-to-day management for USAID would be assured by a contract Project Manager, who would have a coordinating role under the supervision of a direct-hire officer.

After the project was authorized, the Mission decided that a full-time contract Project Manager was not necessary, because of the assignment of a General Development Officer who became Project Officer. Funds were initially reprogrammed for the recruitment of an Irrigation Engineer, to coordinate the PVOs' water management activities, but no suitable candidate was identified. In mid-1986, before the withdrawal of the IHAP proposal, when the Mission believed that all project funds were needed for PVO sub-projects, the Irrigation Engineer position was cancelled.

The GDO, with technical support from the Agricultural Development Officer and Engineer, has done an excellent job of ensuring submission by the PVOs of acceptable proposals, negotiating their approval by the Mission and the GOC, and liaising with the PVOs over the course of sub-project implementation. However, her other responsibilities, which

include health and family planning projects, leave only about 40% of her time for management of this project. This has particularly cut into her time available for site visits.

The evaluation team therefore believes it desirable for the Mission to revive the contract Project Manager position. This person would liaise not only between USAID and the PVOs, but also among the PVOs and between the PVOs and the GOC, to ensure sharing of technical progress. The Project Manager could also serve as an arbitrator for difficult PVO/GOC relationships, such as that between ORT and the SODELAC. The person in this role should have both relevant technical skills (e.g., education and experience in agronomy or water management) and experience in project administration in Africa. Proposed terms of reference are Annex E of this evaluation.

3. Technical monitoring. In addition to reinforcing the administrative side of its project management, USAID needs to develop a means to verify the impact of different interventions. Otherwise, it is difficult to draw firm conclusions about their effectiveness, much less objectively plan future activities. USAID/Chad should quantitatively measure the accomplishments and assess the impact of the CARE, Africare and ORT sub-projects by requiring them to periodically submit the information described below. This information should replace a portion of existing reporting requirements rather than add to it.

First, to the extent practicable, a synthesis of known or estimated baseline data on area of cultivation, crop productivity (weight per unit area per year) and target population sizes in the target areas prior to sub-project start-up should be submitted. Second, PVOs should adopt a modified form of CARE's "PIE Discursive" showing specific quantitative information on:

- expansion of production (i.e., number of new hectares put into production);
- intensification of production (i.e., number of hectares affected by farmer adoption of extended technologies); and
- number of farmers actually adopting the developed and extended technologies; and estimates of the impact of those interventions per unit area.

Third, PVOs should submit as part of their annual work plans a rationale based on a summary of the effectiveness of their interventions during the previous year. This should be broken down by intervention type, level of extensification and intensification, and productivity impact.

Models for these reports are attached as Annex J of this report.

## IX. GOC ROLE IN THE PROJECT

It is difficult to generalize about the GOC's role in the project. The GOC has not had the resources for centralized monitoring of the sub-projects within the "umbrella" context, even to the limited extent of USAID. The individual PVOs maintain counterpart relationships at the technical level, of differing degrees of closeness.

### A. MINISTRY OF PLANNING AND COOPERATION.

The Permanent Secretariat for Non-Governmental Organizations (SPONG) of the Ministry of Planning and Cooperation is the GOC counterpart for the overall umbrella project. SPONG was actively involved in the design of the sub-projects, and the Ministry of Planning approved the PVO proposals on behalf of the GOC. It also negotiated project protocols with each individual PVO. An example of its effectiveness in this role was its rejection of the International Human Assistance Program's proposal for the Chari Irrigated Perimeters sub-project. SPONG was concerned (a) that IHAP was relying on oral and hence uncertain commitments from the World Bank for commodity and equipment support, (b) that the proposed intervention zone was already saturated with donors, and (c) that the GOC's role was poorly defined. The USAID Mission concurred in SPONG's analysis.

Since then, SPONG's role has been limited for the most part to receiving and commenting on the PVOs' periodic progress reports. The only instance where it has intervened directly at the sub-project level has been in considering VITA's request to increase its lending rates. Because of its limited resources and pressing work load (i.e., liaison with all PVOs operating in Chad), it is unlikely to be able to assume a more active role.

### B. MINISTRY OF AGRICULTURE.

Although all four sub-projects have important agronomic components, there is only limited central awareness of what has been attempted or accomplished under the project or the sub-projects. This is even true for the CARE sub-project, which signed a technical agreement with the Ministry in January 1987 for the provision of counterpart personnel. In discussion with the evaluation team, for example, the Director General complained about not receiving progress reports from the PVOs. Instead, the PVOs have developed working relationships directly with the technical services. Relationships with the two principal services are described below.

1. The Office National de Developpement Rural (ONDR -- National Agricultural Extension Service) has established good working relationships with two PVOs. The benefits are reciprocal, as the PVOs receive counterparts while ONDR gets training for its staff. ONDR headquarters staff has a good idea of the involvement of its personnel in sub-project activities. On the CARE sub-project, two counterparts have been named to expatriate personnel in both Mayo-Kebbi and Cheddra, and five field extension agents have been seconded to work in all the CARE zones. The relationship with Africare is also very good. An ONDR extension agent has been seconded as the expatriate Agronomist's counterpart, for work on fields around the water catchment structures. In addition, its Regional Chief for Ouaddai also collaborates with Africare in designing and planning sub-project agricultural activities.

2. The Societe de Developpement du Lac (SODELAC -- Lac Development Corporation) is responsible for all rural development activities in Lac Prefecture, and as such is the principal counterpart agency to ORT in Ngouri. The relationship has not been a good one. SODELAC has not provided the counterpart personnel needed by ORT for its work program and, as a consequence, many project activities have yet to be undertaken. There has been considerable misunderstanding as to the level of support to be given SODELAC counterparts by ORT. A formal contract between the two parties, such as the one CARE has negotiated with the Ministry, might help clarify some of these problems.

#### C. MINISTRY OF TOURISM AND ENVIRONMENTAL PROTECTION (WATER AND FOREST SERVICE)

The three PVOs with forestry components have generally had more difficult relations with the Water and Forest Service than with the Ministry of Agriculture. A large part of this may be due to fundamentally different ideas as to the nature of forestry programs. The PVO forestry activities emphasize extension -- i.e., teaching villagers the benefits of trees and techniques for caring for them. The Water and Forest Service, on the other hand, is biased towards enforcement -- i.e., protecting existing stands of trees and fining villagers who cut firewood.

In general, the PVOs provide equipment and the Water and Forest Service provides staff for nursery operations but no counterparts to expatriate advisers. Lack of counterparts seems most serious with ORT's operations in Ngouri and could jeopardize the viability of this forestry component. CARE, because of its larger and stronger organization in Chad, has been able to work around the difficulties in the relationship. Africare seems to have the best relationship with the Water and Forest Service. This is due to the energy and intelligence of the Service's Ouaddai Regional Inspector, who understands the importance of extension in forestry.

#### D. GENERAL COMMENTS.

The PVOs' relationships with GOC agencies have been problematic because of the project's emphasis on developing technologies that are sustainable and replicable at the village level. This implies that they will not be reliant on GOC support, which, given the unpleasant medium term budgetary realities, is an appropriate condition. However, participation in PVO initiatives of GOC agents, with their experience and interest, can facilitate testing, development and extension of the new technologies, without necessarily implying reliance on the government service. Further, training and reinforcement of the GOC services through their participation in the sub-projects is a desirable side-effect. The PVOs have recognized these facts and have incorporated them into their activities.

#### X. RELEVANCE OF THE PROJECT TO USAID AND GOC DEVELOPMENT STRATEGY

##### A. USAID STRATEGY

This evaluation comes at a time when USAID/Chad is reviewing its medium-term development strategy. The Mission wants to shift its focus away from urgent and immediate relief and rehabilitation needs and towards longer-term growth and development. The likely foci of the program will be food production, child survival and health, and road maintenance, although the exact nature of project and non-project interventions remains to be determined.

The PVO Development Initiatives Project is appropriate for this transitional stage in the evolution of USAID/Chad strategy. The experience gained in a variety of agricultural production methods will be invaluable in the orientation of the new strategy as well as the design of future agricultural projects.

If USAID/Chad plans to continue work in remote and difficult zones such as those covered by this project, PVOs should be retained as implementation agents. They have done an excellent overall job from both technical and administrative perspectives, and with considerably less of a management burden on the Mission than other alternatives (consulting firms or universities). In particular, these organizations have done an excellent job of recruiting the right sort of idealistic, adventurous and professionally competent personnel for their activities. They have also experienced very few of the usual delays or setbacks encountered in commodity procurement or provision of other inputs.

**B. GOVERNMENT OF CHAD STRATEGY**

Under the 1987-1990 "Medium-Term Policy Framework" developed by the GOC in collaboration with the World Bank and the International Monetary Fund, the two main thrusts are the rehabilitation of export production by the cotton industry and the livestock sector, and reinforcement of public finances.

Concurrent with this will be the preparation of sectoral policies, including the food production sector. The GOC's likely objective will be to ensure food security by (i) providing incentives for increased food production and (ii) avoid excessive regional price fluctuations and localized food shortages. Both the umbrella project and the PVO sub-projects are contributing to this food security target by providing farmers with improved seeds and cultivation techniques, better water management, and greater credit availability.

ANNEX A

CARE IRRIGATED AGRICULTURE DEVELOPMENT SUBPROJECT

Subproject Review

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## 1.0 SUMMARY AND CONCLUSIONS

The CARE Irrigated Agriculture Development Subproject, a three year US\$ 3.98 million activity which was approved in September 1986, grew out of a series of activities with which CARE was involved in Chad prior to conception of the USAID PVO Umbrella Project. The CARE subproject is composed of agronomic, water management and agroforestry activities in three ecologically different and widely separated geographical locations:

- the internally drained wadis of the sahelian Nokou region,
- the externally drained Bahr-el-Ghazal and associated wadis of the sahelian Cheddra region, and
- the riverine terraces of the Logone and Chari rivers in the Sudanian and Guinean savanna-woodland regions of west-central and southwestern Chad.

CARE has fielded a strong long-term TA team which has done an outstanding job to date. Inputs have been provided with timeliness and are of high quality: about 75% of all long term TA provisions have been met; delivered short-term TA has been of good quality if significantly modified from the provisions of the Cooperative Agreement (CA); extensive training has been conducted; most commodities have arrived and are operational; other local costs have been appropriately expended; CARE inputs have been provided; GOC inputs, although modified significantly, have been provided to an extent greater than originally foreseen; and some Food For Work (FFW) funds have been expended although FFW has been terminated. Project outputs to date are also for the most part consistent with the provisions of the CA.

To some extent the purpose of the project has been realized; i.e., there has been an increase in long term food production capabilities in the Kanem and the southern irrigated perimeters. Greater progress has been realized in the southern perimeters and in the Cheddra area of the Kanem than in the Nokou area of the Kanem. This trend is expected to continue.

The goal of the project, to "establish an indefinitely sustainable increase in food production" in the Kanem and southern perimeters, cannot yet be said to have been met. It is unlikely that this goal can ever be reached in the Nokou region, possible that it can be reached to a significant extent in the Cheddra region, and very possible that it can be reached to a very significant extent in the southern perimeters.

CARE has shouldered a far larger load of donor responsibilities and commitments than have other PVO's under the umbrella project, being answerable to the Mormon Church, Live Aid/Band Aid, the FED, the EEC and the Dutch Government in addition to AID. A significant advantage of this is the implementation flexibility it provides. The concomitant disadvantage is the increased administrative and reporting burden which naturally results.

Relations between CARE and the GOC Ministry of Agriculture are generally good, but relations between CARE and the Water and Forest Service remain poor. The latter relationship derives in part from a preexisting problem with CARE forestry work in the Kanem in the early 1980's, and between the Water and Forest Service and the PVO's in general, but this relationship appears to be improving to some degree. Relationships between CARE and USAID/N'Djamena are good.

In general, agroforestry interventions are considered to be more important in the Kanem than in the Mayo-Kebbi. In both regions CARE should concentrate its efforts on agronomic and water management interventions due to the higher developmental payback realized.

The internally drained wadi environment of the northern Kanem is an extremely high-risk agricultural environment which probably can never be made to sustain more than a small population of subsistence farmers. CARE is unlikely ever to develop a significant and sustainable commercial agricultural capacity in the Nokou region because of the regions' extreme environmental, infrastructural and demographic limitations. These limitations are not likely to be resolved in the mid run, except perhaps temporarily by the introduction of interventions which at the present time are technically, economically and/or socially unacceptable and/or unsustainable. The best current development hope in the Nokou region is for maximization of subsistence agricultural production with a view towards minimizing the amount of food relief which has and will probably continue to be required there periodically. Assuring a greater degree of food self-sufficiency would be a significant accomplishment here. While CARE appears to have made some limited progress in the northern Kanem, however, work in this area should be de-emphasized through the PACD.

Agriculture in the Cheddra wadis, in contrast to Nokou, has two considerable advantages: easy access to the N'Djamena market and a considerable surplus of land for extensifying production. There remain, however, serious economic obstacles to development of sustainable commercial agricultural production here such as the existence of a transport cartel and the current inability to bring crops to market at more financially favorable times of the year. CARE has nonetheless made good

progress at Cheddra and should concentrate and focus its Kanem efforts in this area, particularly in the Bahr-el-Ghazal.

Agriculture in the Mayo-Kebbi and Chari-Baguirmi areas offers by far the greatest hope for attaining sustainable food production in Chad. Indeed, the interriverine lands between the Logone and Chari rivers could, under appropriate technical and economic management, become the rice bowl of the country. CARE has done an outstanding job of developing an appropriate technical package for small scale, commercial, village irrigated agriculture in the Mayo-Kebbi specifically. While constraints remain (e.g., irrigated crops are grown only during the rainy season, when the river is highest), CARE should concentrate the bulk of its umbrella project efforts on extending this package in the Mayo-Kebbi zone.

CARE is far overextended geographically. The subproject's scope should be reduced by eliminating areas and activities showing the least promise of replicability and sustainability and the least benefit for the cost. Because of TA burnout, extreme logistical constraints, highly variable success between the different target regions and areas, the very high costs and very small benefits deriving from work in the Nokou region, and the much lower costs and higher payoffs obtained in the Mayo-Kebbi region, CARE should:

- 1) continue assistance to the Nokou region only through low level funding in support of a skeleton Chadian staff covering the region;
- 2) geographically consolidate and concentrate the bulk of its limited Sahelian resources at Cheddra; and
- 3) focus its major commercial agricultural production efforts in the southern irrigated perimeters.

In terms of a general strategy for agricultural development in western Chad, efforts should concentrate on maximizing commercial irrigated production in the interriverine lands between the higher floodplains and terraces of the Logone and Chari rivers. There is tremendous potential for development here.

As a secondary focus the strategy should concentrate on improving the ability of specific Sahelian/Saharan environments with good near-surface groundwater resources to support increased commercial agricultural production. Examples of such areas include the Bahr-el-Ghazal. Significant development of such isolated but relatively high potential environments cannot help but attract nomadic populations during periods of prolonged drought, in turn drawing down impact from much more high risk Sahelian/Saharan environments like those found in the northern Kanem.

## 2.0 RECOMMENDATIONS

The following recommendations specific to the CARE Irrigated Agriculture Development Subproject in Chad constitute the consensus of the PVO Umbrella Project evaluation team.

### General

1. The PACD for the CARE subactivity should be extended for 15 months, through December 31, 1990. An extension would permit:

- 1) further development and dissemination of technical packages for the Kanem region;
- 2) substantial replication of the irrigated perimeter package in the Mayo-Kebbi region; and
- 3) sufficient time to develop a sustainable, hopefully privatized system for pump maintenance in the Mayo-Kebbi region.

In all target subproject regions, CARE should emphasize agronomic and water management activities through the PACD.

2. CARE is far overextended geographically. It should consolidate its Kanem efforts by reducing support to the Nokou area to a skeleton national staff serving as regional representatives; draw back and focus its Kanem resources on the Cheddra area; and continue to concentrate heavily on commercial and subsistence agricultural production in the Mayo-Kebbi.

### Nokou

3. After departure of the Mao-based expatriate forester, responsibility for implementation of further northern Kanem wadi activities should be transferred to a limited number of CARE-funded nationals stationed at selected regional centers in the Mao-Nokou area. They would be responsible for ongoing liaison with ONDR and for continued extension of promising water management, agronomic and agroforestry interventions developed principally at Cheddra.

### Cheddra

4. Agronomic and economic interventions in the Cheddra region should concentrate on development of additional cash crops as well as market opportunities.

5. CARE should adopt and demonstrate improved water lifting technologies at Cheddra, with a view towards extending those technologies in appropriate locations in the Kanem. The dalou

animal traction system, as well as the improved Jenkins pump and other promising designs, should be among the technologies tested and, if practicable, extended in the Bahr-el-Ghazal. However, evaluation of the costs, benefits and groundwater hydrological impacts associated with the possible expanded use of motor pumps in the Bahr-el-Ghazal should be undertaken prior to any significant extension of motor pump technology in the Kanem.

6. Canal lining and crop plot layout technologies should continue to be tested and extended at Cheddra, but well lining technology should focus on more permanent solutions such as mortar blocks.

7. The Cheddra demonstration farm should employ a high quality gardener responsible for developing a living showcase of crops adaptable to the Cheddra region.

8. The Bahr-el-Ghazal is a water course and as such will be subject to major periodic flooding. Development interventions must therefore be accomplished in such a manner as to minimize or preclude disastrous losses during such flooding.

#### Irrigated Perimeters of the Chari and Logone Rivers

9. In the Mayo-Kebbi and Chari-Baguirmi irrigated perimeters, CARE should concentrate on refinement and replication of a viable irrigated perimeter package. In particular, a mechanism must be developed, tested, proven and established prior to the PACD to ensure that timely pump maintenance and repair can be sustained after the project ends. If possible, this mechanism should operate through the private sector.

10. Evaluation of alternative irrigated dry season crops should be a major focus of the irrigated perimeter package.

#### Technical Assistance

11. CARE's long-term TA team is expected to cycle entirely out of the project over a period of 12 months (September 1988-September 1989). Four key personnel (the Chief-of-Party, Agricultural Economist, Agronomist and Agroforester) are scheduled to cycle out over the four month period September-December 1988. It is imperative that CARE refill these positions with experienced and qualified personnel having significant exposure to Sahelian field conditions, and that CARE attempt to maximize the time of overlap between the current principals and their replacements.

12. Assigning centrally located long-term TA personnel to work in both the Kanem and Mayo-Kebbi regions has not worked well. Most of these personnel are exhausted trying to cover the two

different bases, and the end result has still been an overwhelming concentration on the Mayo-Kebbi and an effective slighting of the Kanem. CARE should employ the services of two agronomists, each with responsibility for a single region; concentrate future agricultural economics activities in the Mayo-Kebbi; and concentrate any future forestry activities in the Kanem.

13. The Hydrologist/Groundwater Specialist should evaluate the potential effects of motor pump use on groundwater hydrology in the Bahr-el-Ghazal.

#### GOC Collaboration

14. The Ministry of Agriculture, the Water and Forest Service and CARE should make every reasonable cooperative effort to complete both the contractual arrangements between them and the nomination, provision and acceptance of appropriate remaining counterpart personnel to the project.

#### Data Collection

15. CARE should continue and expand its exchange of technical information on the Kanem with ORT, particularly with respect to agronomic interventions, confined aquifer tapping, and forestry lessons learned. CARE should also use the baseline data already collected as values against which to monitor changes in soil and water chemistry resulting from different types of cropping scenarios during project implementation. The results of those comparative analyses should be submitted to USAID/Chad no later than six months before the PACD. USAID may want to include this in the upcoming amendment of the Cooperative Agreement.

16. The CARE Project Implementation and Evaluation (PIE) charts should be modified to show the direct and indirect outputs of its agricultural production. A sample approach is shown in Tables 1-3 of this annex.

#### Establishment of a Health Component

17. Establishment of a health component for the CARE activity is not recommended. CARE should continue to focus on the principal objectives of water management and increased crop production, and on developing technical packages which are both replicable and sustainable, rather than dilute its efforts by undertaking activities which are important but peripheral to the major thrust of the project.

### 3.0 INPUTS

#### 3.1 Long-Term Technical Assistance (AID)

Long-term technical assistance (TA) specified under the CARE Cooperative Agreement (CA) was designed at 216 person-months, 120 person-months of which should have been delivered as of the time of the evaluation by six long-term TA personnel. A relatively high percentage of this had in fact been delivered, 89 person-months or about 74% of the total (Table 1).

#### Technical Assistance Summary (Person-Months)

	<u>PLANNED</u>		<u>ACTUAL</u>	<u>PERCENT</u>
	<u>EOP</u>	<u>To 5/88</u>		
<u>Personnel</u>				
<u>Long-Term</u>				
Agricultural Engineer	36	20	8	40
Agricultural Economist	36	20	19	95
Agroforester	36	20	18	90
Agronomist	36	20	19	95
Mechanic	36	20	8	40
COP/Coordinator	36	20	17	85
SUBTOTAL	216	120	89	74
<u>Short-Term</u>				
Social Scientist	9		16	178
Groundwater/Wells	10		0	0
Extension Trainer	6		0	0
Evaluation Team	4		0	0
SUBTOTAL	29		16	55

CARE has, in general, fielded a strong long-term TA team. The only weaknesses have been the inability to field a project mechanic and project agricultural engineer until twelve months into the project. This team, however, is for the most part exhausted due to field responsibilities in areas located 700 km apart; it takes approximately 22 hours just to drive from the southernmost to the northernmost project sites, over some of the worst roads (or tracks) and terrain in sub-Saharan Africa. Especially with respect to the Agronomist and Agricultural

Economist, their commitments should not have been split between the Kanem and the Mayo-Kebbi.

CARE's long-term TA team is expected to cycle entirely out of the project over a period of 12 months (September 1988 - September 1989). Four key personnel (the Chief-of-Party, Agricultural Economist, Agronomist and Agroforester) are scheduled to cycle out over the four month period September-December 1988. It is imperative that CARE refill these positions with experienced and qualified personnel having significant exposure to Sahelian field conditions, and that CARE attempt to maximize the time of overlap between the current principals and their replacements.

The general quality of the outputs of the long term TA team are discussed in Section. 4.0.

### 3.2 Short-Term Technical Assistance (AID)

Short-term TA was originally designed to include 9 person-months of Social Science expertise, 10 months of Groundwater/Wells expertise, 6 months of Extension Training expertise, and 4 months of expertise for an evaluation team (Table 1). To date, the Social Science commitment has been exceeded through delivery of about 16 months of service. The quality of this service is considered to have been excellent.

The groundwater/wells expertise is no longer envisioned as necessary by CARE, who has assigned the Agricultural Engineer to undertake those responsibilities. CARE should not, however, preclude acquisition of such short-term TA. Sufficient project funds exist to obtain this expertise and it will be required to assess the projected mid- and long-term impacts of motor pump use on groundwater hydrology in the Bahr-el-Ghazal.

The extension training expertise is also no longer envisioned by CARE as being necessary, due to the acquisition of a CARE intern with specialized expertise in extension training and the ability of the GOC to assume most of the extension training activities. The need for such short-term expertise is expected to depend upon the quality of the intern services obtained, and should not be irrevocably deleted from consideration until that quality has been assessed.

Provision of funding for short-term evaluation TA is expected to occur during the final year of the project.

### 3.3 Training (AID)

Training activities specified in the CA included 4 person-years of long-term training at N'Gala, Nigeria. CARE

has dropped consideration of this component from the project in favor of increased and improved local farmer training which they consider under prevailing circumstances to be far more appropriate. All things considered, the evaluation team believes this to have been an appropriate decision; it should, however, have been cleared in writing with the USAID Mission since it is a significant deviation from the CA which may in fact require a CA amendment.

Approximately 180 person-months of long-term counterpart training were also envisioned under the terms of the CA in the form of counterparts to the six long-term TA personnel. To date, only about five months of such training have materialized due to the considerable delays experienced in signing individual contractual agreements with the GOC. Only three counterparts have actually begun work to date. This situation is discussed in greater detail below under GOC contributions to the project.

About 35 field agents were also expected to be trained under the project; this has already been exceeded through training of eleven low level agents, nine "gestionnaires" (local managers employed by CARE), seven senior "gestionnaires", 13 ONDR agents and nine temporary Water and Forest Service personnel. Two field agents were also expected to have been sent for three months each to France for training, but CARE has deleted this from further consideration in favor of additional on-site field agent training. This decision is also considered to have been appropriate, but again it should also have been cleared in writing with the Mission since it represents a significant deviation from the CA. The quality of the field agent training has not been evaluated due to the inability to interview trainees and assess training impact. However, the generally high quality of the training personnel suggests that this training has likely been appropriate.

A mobile equipment maintenance training component originally envisioned under the terms of the CA has already seen about 12 person-months of training accomplished in the Mayo-Kebbi region. Training of both Mayo-Kebbi and Kanem personnel has and is expected to continue in the future. The general quality of this training to date is considered, based on the quality of the project Mechanic, to have been good although considerable additional training will clearly be required before a pump maintenance and repair system which is fully sustainable can be realized. The project approach to identify one or two talented mechanics in each area where pumps occur, and to train them to a much greater degree than other trainees, is considered a good one. This pump maintenance and repair component is a key to the ultimate sustainability of the irrigated perimeter package developed and extended by CARE to date in the Mayo-Kebbi, and it will require considerable attention in order to ultimately

realize a (hopefully privatized) system which is sustainable after the PACD.

An unspecified number of small farmers were expected to be trained under the project, and a large but unspecified number have been trained to date by field agents working under the aegis of the CARE activity. Again, the quality of this training has not been assessed due to an inability to interview a representative sample of such farmers. Nonetheless, based on the extent of adoption of interventions, especially in the Mayo-Kebbi and to a lesser extent Cheddra regions, farmer training quality appears to have been consistent with the extent and quality of the interventions developed by CARE.

### 3.4 Commodities (USAID)

The CA envisioned commodity acquisition under the project to include one large transport truck, eight light four-wheel drive trucks, pumps and spare parts, agricultural tools and implements, irrigation canal construction materials and training materials. All of these have been acquired and delivered, with the exception of the large transport truck. In lieu of obtaining a new truck, a CARE transport truck used on earlier activities was reconditioned and assigned to the project and has been functioning.

### 3.5 Other Inputs (USAID)

Other inputs to be funded by USAID included the services of a Project Administrator, local salaries of CARE personnel, in-country travel, field allowances and building rental. All of these have been provided.

### 3.6 CARE Inputs

CARE inputs under the project as specified but not quantified in the CA were to include equipment and operational costs, training, administrative support and vehicle operational support costs. All of these inputs have been provided to some extent by CARE to date.

### 3.7 GOC Inputs

GOC inputs were originally designed to include about 180 person-months of counterpart personnel, of which only about five months have been provided to date. The problems in assigning counterparts apparently predate the development of the current project, and involve issues related to both provision of high quality counterpart personnel and the need to provide salaries and vehicles for them.

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To improve upon past experience with counterpart personnel, CARE signed a technical agreement with the Ministry of Agriculture in January 1987. This included the national extension office (ONDR), the agricultural training service (DEFPA) and the rural engineering office (Genie Rural), and specified that the ministry would provide two counterparts, one for the Kanem forester and one for the the southern perimeters, as well as a third high level person in the form of a trainer. Under the terms of the agreement, CARE had the option to accept or reject the nominee, and this contractual approach resulted in significant delays. This delay is of course a major disadvantage of this type of approach, because the absence of counterparts until at least half way through the project reduced CARE's ability to effectively use the GOC to further the goals of the project. It also did not apparently significantly improve CARE's relationship with the GOC.

The delays and other disadvantages were mitigated by the improved quality of personnel assigned to the project and by the fact that the GOC has provided a total personnel package far in excess of that originally envisioned in the sub-project proposal. These include two ONDR counterparts, one Genie Rural counterpart, the DEFPA trainer, a counterpart for the project mechanic, an assistant mechanic, five ONDR field extension agents, seven temporary nurserymen for a period of about seven months each, ad hoc personnel including a temporary farm manager, an interpreter and a statistician, and nursery personnel contributed by the Water and Forest Service. Of these, CARE pays the salaries of only the mechanic's counterpart and the assistant mechanic, but the GOC has agreed to put these two persons on its payroll at the end of the project. In addition, CARE is in the process of attempting to develop a separate technical agreement with the Water and Forest Service. In sum, therefore, while the mix of personnel has changed substantially from that originally envisioned, and significant senior counterparts have yet to be assigned to the project, the commitment of the GOC to the project as evidenced by their provision of technical resources is considered solid.

The other GOC input under the provisions of the CA was the provision of certain unspecified rent-free facilities. The only rent-free facilities provided to date have been for the Mobile Maintenance Unit (MMU) at Bongor, one ONDR chemical storage warehouse at Cheddra, and temporary use of a Water and Forest Service central nursery to produce graft stock. While these have not been extensive, they tend to reflect the dearth of available facilities which could reasonably have been expected to have been provided by the GOC.

In general, the GOC contribution at the current time has been supportive and cooperative. It is recommended, however, that the Ministry of Agriculture and the Water and Forest Service

make every effort to complete both the contractual arrangements and the nomination and provision of remaining counterparts who are acceptable to CARE.

### 3.8 Food For Work

The final input to the project consisted of US\$ 4,037,050 worth of food for work (FFW) to be paid for wadi development, agroforestry and other non-cultivational activities. Work in all three of these sectors has been provided but only a fraction of the originally envisioned FFW budget has been spent. FFW activities were suspended because CARE found them incompatible with project goals in that they "distorted population patterns and made increases in agricultural production and development significantly more difficult to implement and evaluate." At the time of FFW suspension (July 1987), approximately 750,000 tons of sorghum, 42,500 tons of oil and 12,700 tons of NFDM had been distributed. FFW suspension is considered to have been an appropriate move by CARE, since moving from famine relief to development always has the potential to lead local populations to act as passive recipients of "cadeaux" rather than active participants in their own development. Indeed, it is incumbent upon those who manage such activities to closely follow the effect that FFW has and to determine when and if provision of FFW becomes counterproductive to development. In the opinion of the evaluation team, CARE both appropriately evaluated the impact of FFW and appropriately terminated it.

### 3.9 Project Expenditures To Date

As of 31 March 1988, the project was 50.7% completed with respect to the time frame of the activity. About 40.3% of all U.S. and local expenditures had been completed, with 43.2% of U.S. expenditures made and 39.3% of local expenditures made. Most "high ticket" items have been purchased, and CARE is expected to have a surplus of AID funds at its disposal at the end of the project given no change in the PACD.

### 3.10 Other Donor Contributions

In addition to the inputs described in the CA, additional inputs were provided by other private and governmental donors. The Mormon Church provided approximately US\$ 400,000 for materials, equipment and administrative costs; Live Aid/Band Aid provided about US\$280,000 to support the horses in the Nokou region and the services of the Mao-based expatriate forester; the European Development Fund provided about US\$300,000 for well lining at Cheddra and acquisition of materials and equipment for the southern perimeters as well as the salary of the project Agronomist for the first year of the activity.

It is important to note with respect to these inputs that CARE has shouldered a far larger load of donor responsibilities and commitments than have other FVO's under the umbrella project. A significant advantage of this is flexibility in implementing previously unforeseen activities which may arise and make sense to the field team (e.g., pesticide use and construction). A significant disadvantage, however, is the increased administrative and reporting burden which naturally results from the substantially different requirements and concerns of the respective donors. In light of this, USAID/Chad has agreed to accept CARE's internal reporting system for its own use, thereby relieving the reporting burden.

#### 4.0 OUTPUTS

##### 4.1 Food Production

The first project output described in the CA is "increased food production in each target area". The numeric targets were 85 ha of new land brought into production (i.e., extensification) and 400 ha showing an increase in yield by up to 10% (i.e., intensification).

Until 1986, CARE had no reliable baseline data on land use in the Kanem wadis. This makes it difficult to evaluate increases or decreases in land use, much less the economic impact of these changes. It is believed that in both the Nokou and Cheddra regions there was a net increase in the amount of land under cultivation between 1982/83 and 1984/85, as famine victims moved into the wadis to receive emergency food aid. Since then, especially after large scale food aid ceased in 1986, many of these refugees have left the wadis. Less land is believed to be cultivated now than in 1984/85, although probably more hectares are in production than in 1982/83.

To date, a total of about 48 ha of land have been brought into production according to CARE estimates. This includes 20 ha of rainfed cropland and 28 ha in irrigated perimeters in the south, although this may be an underestimate due to CARE's conservative approach to estimating project impacts. Additionally, and while quantification is difficult due to the absence of solid baseline data, CARE estimates that intensification has occurred on about 87 ha of irrigated perimeter in the southern region, on about 117 ha in the Cheddra area, and on perhaps as much as 110 ha in the Nokou region. No specific figures are available, however, to estimate the percentage increase in productivity which has resulted from these intensification efforts over and above what that productivity would have been in the absence of the interventions. It appears likely that productivity increases of greater than 10% have been realized in Cheddra, and that increases of less than 10% have been realized in the Nokou region.

4.1.1. Kanem region: Nokou. CARE's agricultural activities at Nokou are much less significant than in either Cheddra or the Mayo-Kebbi regions. CARE's current activities in Nokou developed out of involvement with food relief efforts around 1984, when CARE began exploring development of alternative life support strategies to permit food recipients, particularly traditional pastoralists whose herds had been decimated by the extended drought of the early 1980's, to better survive recurrent drought conditions through development of wadi agricultural improvements. At the same time, these interventions stimulated traditional wadi cultivators to intensify and improve their own agricultural practices. By 1987, there were approximately 1,845 families working in these wadis or about 50% more people than lived there previously. While many of those who settled near the wadis in the early 1980's remain, there has been considerable loss of population since that time due to the return of traditional pastoralists to a nomadic existence; this trend appears to continue.

Located in an area where access to markets is marginal and agricultural land is becoming a limiting factor, Nokou nonetheless contains relatively good agricultural land, albeit in extremely limited quantities in the wadi bottoms. Wheat, maize and potatoes can be grown with relatively good results, for example, with 1987 data indicating wheat production at greater than 1.0 tons/ha and potatoes at over 4.0 tons/ha. In general, however, there are considerable real and potential agronomic constraints in the internally drained wadis, including salinization, low natural soil fertility and extremely low annual precipitation (about 90 mm in 1987).

CARE is unlikely ever to develop a significant and sustainable commercial agricultural capacity in the Nokou region because of:

- 1) economic limitations such as poor or absent transportation infrastructure, distance from significant market foci, heavy competition from better quality and more strategically located agricultural lands, limited access to agricultural inputs and consumer goods for wadi villagers, restricted potential for sale of crop surpluses;
- 2) ecological limitations such as low natural soil fertility, extremely low natural rainfall, recurrent drought, salinization, nutrient depletion, recurrent pest outbreaks; and
- 3) sociological limitations such as limited land availability, land tenure problems, traditional social structures that are not particularly open to innovations or to collective endeavors, and general intercultural conflict.

4.1.2. Kanem region: Cheddra. Cheddra is more strategically located from the market perspective than Nokou, as it lies between N'Djamena, Moussoro, Massakory and, at a greater distance, Faya Largeau. This strategic location and the considerable availability of surplus land make Cheddra's agricultural activities of considerable potential national importance. There are also, however, serious economic obstacles. First, the only market for Cheddra farmers is an oligopsonistic group of a half dozen local merchants. This restraint on competition means that the farmers receive less than half of the N'Djamena market price. A possible solution, albeit far from an easy one, would be creation of cooperative groups for crop marketing. The other economic hurdle is the need to revise the agricultural calendar and to bring crops to market at more financially favorable times of the year. Bringing onions to market in December rather than April, or tomatoes to market in May rather than January, can mean a 100-200% difference in the price received by the farmer. Solutions to this problem are agronomic (e.g., finding a variety of tomato that will bear fruit in April) as well as economic.

In general, Cheddra can be divided into two agricultural zones, the Bahr-el-Ghazal and the eastern shore, where a total of about 21 wadis are under exploitation. Farmers can generally be divided into two groups, i.e. those who originated in the region and those who are displaced and have now settled in the region. The farming community currently consists of about 60% displaced persons and 40% original inhabitants. About 70% of all farming activities involve crop production and about 30% involve livestock production.

In both areas of Cheddra, farmers grow onions, tomatoes, okra, garlic, millet, wheat and melons. Onions occupy the largest proportion of land because they are grown for marketing purposes. Most produce is sold in the markets identified above. Melons occupy the second most important position and are sold on both the local and regional markets. Maize and wheat are grown in the wadis under irrigated conditions, but wheat is produced on a much smaller scale compared to any other cereal production. Millet is produced on the dunes under rainfed conditions. Recently, lack of rainfall has hampered millet production which is the traditional foodstuff of the region. Agronomic and economic interventions in the Cheddra region should concentrate on development of additional market crops, better timing of harvests relative to the market cycle, and reducing the power of the cartel of transporters and middlemen.

The 30% of agriculture consisting of livestock production is dominated by goats, sheep, donkeys and cattle. Goats are used for milk production and sold when financially necessary. No

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improvement of feeding programs is currently under way nor does there currently appear to be a good reason to undertake one.

CARE is setting up an experimental farm near Cheddra where varietal trials as well as training for extension agents and farmers will take place. On-farm trials will consist of testing newly released varieties from the research center at Gourom as well as locally collected seeds. Currently, CARE has an employee from the Ministry of Agriculture whose role is to coordinate the training activities at the training site in Cheddra as well as conduct the training for the staff. This GOC employee appears qualified to undertake such activities and should be of great value to CARE in its efforts to make Cheddra one of the most viable agricultural regions in the Sahelian portion of the country.

4.1.3. Irrigated perimeters: Mayo-Kebbi. CARE is currently managing four irrigated perimeters at Mouroup, Kolobo, Koyom and Kim. Perimeter size varies between four and 25.5 ha and each perimeter is divided into parcels of 25 ares where individual families grow rice under irrigated conditions. Average yield per plot is 2.24 tons/ha at Kolobo and 4.34 tons/ha at Koyom. Two rice varieties, one maturing in 90 days (I-Kumpao) and the other in 120 days (IR-46), are used in the perimeters. Output per unit of land varies between 10.8 and 14.7 sacks, or 3.5 tons/ha and 4.5 tons/ha, respectively, of paddy rice out of which seven sacks are taken by the village "Comite de Gestion du Perimetre" (Perimeter Management Committee) to cover capitalization of the pumps and recurrent costs such as fertilizers.

The agronomist, with the help of both the agricultural engineer and the agricultural economist, is conducting on-farm trials to determine the suitability of different techniques and their usefulness in improving production. For example, the agronomist is conducting an experiment to determine the efficiency of water uptake between the two rice varieties under rainfed as well as irrigated conditions, and has introduced peanuts, which are currently growing on experimental plots. At the end of the growing season, fields will be evaluated to determine output as a consequence of different varieties, spacing arrangements, watering regimes and fertilization status (i.e., 0, 50, 100 kg/ha of NPK).

It is worth mentioning that considerable effort has been expended to introduce new cropping techniques as well as to improve traditional practices. Although few data have been collected on agricultural activities outside of the irrigated perimeters to date, the CARE team has acknowledged the merit of undertaking data collection in such areas. This activity will permit quantification of other components in the farming community which will in turn allow better design and

implementation of successful project interventions. Farms in this region produce rice, sorghum and taro under rainfed conditions. Rice and sorghum are produced on an extensive basis whereas taro occurs on much smaller plots. However, taro constitutes one of the most important cash crops here.

CARE has been careful to take an approach to extension of their irrigated perimeter package here which does not discourage villagers from rainfed agriculture. This is because of the still somewhat experimental nature and uncertain sustainability of the irrigation package and the desire to ensure that under worst case conditions (i.e., total loss of the irrigated rice crop due to pests, pump breakdown or other factors) the ability of the villages to feed themselves using traditional means would not be compromised for even a single season. CARE is also undertaking a considerable effort to identify and test alternative dry season irrigated crops, preferably nitrogen fixers, which can produce a commercially viable crop at the same time that they reduce fertilizer costs which are extremely substantial. This is a major activity which should continue to receive special emphasis.

4.1.4. Irrigated Perimeters: Chari-Baguirmi. CARE is developing four irrigated perimeters in Chari-Baguirmi Prefecture, in the villages of Kassim, located 60 km north of N'Djamena, Oundouma, located 60 kms south of N'Djamena on the Logone River, and Ngaouma, 3 kms from Oundouma. In Kassim, about one hectare is exploited, with the 24 participating farmers each possessing 4 ares. Crops in these perimeters include okra, tomatoes, cowpeas, onions, cucumbers and maize. In Ngaouma, 3.5 ha are exploited, with another 9 ha potentially cultivable. Eleven ha are potentially cultivable at Oundouma, but only 5 ha are currently exploited. In both Oundouma and Ngaouma, each farmer has 12.5 ares, as more land is available than in Kassim. However, CARE believes that the Kassim farmers are the most motivated, as demonstrated by their quicker adoption of improved methods introduced by the agronomist (nursery preparation, manure application and furrowing).

In these villages, okra, tomatoes, and cucumbers are grown under irrigated conditions. Maize and cowpeas are produced under rainfed conditions with supplemental irrigation when necessary. Each "groupement" has a pump which is installed on the river bank. Seeds for okra, tomatoes and cucumbers are purchased from Senegal, and tested under experimental conditions at the Gassi research station before release to the farmers. Maize and cowpea seeds are obtained from Gassi.

There are significant differences in the organization of the perimeters. In Kassim, for example, the population is extremely homogeneous and works much better than at the other two sites, which have more heterogeneous populations. Work on

the canals has not yet been completed in the Ngaouma and Oundouma perimeters. The villagers had been receiving Food-for-Work rations until June 1987; as soon as the FFW distributions ceased, activities on the perimeters stopped as well. Other factors may also contribute to the lack of enthusiasm. For example, fishing seems to be important in these villages, possibly with precedence over other activities. When the total production system is understood, appropriate agronomic practices can be prescribed -- with a better chance for adoption.

If the project stopped in 1989, the chances for continuation and success on the perimeters would be limited to Kassim. However, if support from CARE continues for at least another year, chances for success in the other two villages may increase. More data will be available to allow better analysis, from which appropriate decisions will be made. There will also be more time for dissemination of improved farming technologies to the farmers. In addition, decision-making on the perimeters should be made by groups smaller than the current 24-person management committees (10 might work). The large number of participants makes for a cumbersome process. The proximity of these perimeters to the N'Djamena market works in their favor also.

#### 4.2 Water Use Efficiency

A second project output was increased water use efficiency, although no objectively verifiable indicators were proposed. The types of water management systems on which CARE has focused include:

- 1) motor pump irrigation in the southern region;
- 2) improved shadouf systems in the Kanem;
- 3) experimentation with motor pumps at Cheddra, which are in any case being slowly but spontaneously introduced by private individuals;
- 4) development of alternative pump types (e.g., treadle and solar pumps) in the Kanem;
- 5) reduction of water losses through improved plot layout, shortened canals and canal linings;
- 6) improved water delivery through experimentation with hoses and similar types of distribution devices not requiring use of canals; and
- 7) well lining to preserve structural integrity.

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In the Kanem as of about March 1988, approximately 500 wells had been lined; 17 test shadoufs had been constructed (but had not been spontaneously reproduced); demonstration layouts for more efficient water delivery had been built in four wadis; and an unspecified number of canal models had been put into place. Socioeconomic data being collected by the Agricultural Economist are, after analysis, expected to provide substantial information on the costs and benefits of these relatively modest innovations.

The furnishing by CARE of 4x4 timbers for the construction of shadoufs, and construction of shadouf support structures out of mud bricks, are both good ideas. The target areas for these interventions tend to have a relatively receptive population for new technology since, out of necessity, they are not so irrevocably committed to traditional waterlifting techniques. However, the initial costs of the mud brick shadouf support structures appeared to be prohibitive for adoption by farmers in the Nokou region and the design of the 4x4 constructed shadouf appeared to be inefficient.

Introduction of the treadle pump and the dalou waterlifting technology could be productive since components of these technologies are both replicable and sustainable. CARE should borrow the dalou technology developed by Africare and extend it to sites in the Kanem, particularly along the Bahr-el-Ghazal. The testing of an improved Jenkins treadle pump has taken place at the CARE pump workshop in N'Djamena with the result estimated to be 1.5 times the output of the traditional shadouf. Gasoline and diesel powered pumping units of various sizes are also being used on the different CARE irrigation sites, although the economic feasibility of using powered pumps in the Kanem remains to be demonstrated. Prior to any significant extension of motor pumps in the Kanem, the projected mid- and long-term impacts on groundwater hydrology need to be evaluated.

The suggested improvements in irrigation canal layout -- minimizing the length of primary and secondary canals and lining these canals with clay -- are also good ideas that need to be perfected and extended. It is estimated that this could save 30% of the water and therefore 30% of the waterlifting effort currently required to irrigate a given area. These innovations are also both replicable and sustainable. Innovative ideas have also been employed in canal lining technologies which appear to improve efficiencies, but cost and availability of materials have left the technologies unaffordable to date.

The use of steel barrels for well lining provides only a temporary solution to the well caving problem. Steel barrels in saline environments have a very short life expectancy,

probably on the order of about three years. A nylon or even plastic material would have a longer life below the water table, as would fired bricks, concrete blocks, or simple mortar blocks made of cement and sand. The use of steel barrels is replicable but is not likely to be sustainable due to the recurring expenditure necessary.

The only substantial water management interventions which have actually been adopted by farmers to date in the Kanem are improvement of garden plots through straightening of canal lines and rows, squaring off the dikes, and shortening canal lengths. It is currently felt that the two best hopes for socially, economically and technically feasible improved water management in the Kanem are canal lining and improved water lifting technologies, although minor improvements in shadouf technology (e.g., cheaper construction methods in the Nokou area, improved buckets) may provide minor improvements in efficiency. It is recommended that CARE adopt, demonstrate, and extend improved water lifting technologies, including shadouf/piston pump improvements being developed by ORT and dalou animal traction methods developed by Africare. Given the strategic location of Cheddra, its good soil and water quality and other factors, private sector introduction of motor pumps should not be discouraged in this specific area of the Kanem. Again, however, short-term TA to assess the medium and long-term effect of motor pump use on the groundwater hydrology of the Bahr-el-Ghazal is very strongly recommended.

With respect to the social acceptability of these interventions, improved water management techniques (well lining, diguettes) and new crop and tree seed varieties introduced by CARE seem to be, in general, readily accepted by the villagers. What appears occasionally problematic is the question of their replicability once CARE subsidy is withdrawn. Some, no doubt, become too reliant on CARE while others may be genuinely unable to provide the cash or labor necessary to, e.g., line their wells. Direct and indirect efforts by CARE to "force" villagers to organize themselves into para-cooperative associations have, so far, yielded mixed results; the Kanembou are known to be very individualistic. According to fieldworkers at Cheddra, however, there is evidence that villagers are increasingly in the process of organizing themselves to collectively take care of village nurseries, buy seed in nearby towns and undertake other agricultural activities cooperatively.

In the southern perimeters along the Logone River, water management interventions have focused almost entirely on provision and capitalization of water pumps, improvements to the layout of the pumped irrigation schemes, and reduction of water losses through canal linings. Defunct cooperatives have been revitalized by CARE through the input of pumps, seeds, and credit assurance.

#### 4.3 Training

The project training output as quantified in the CA was 20 irrigation and mechanics technicians trained and an unspecified number of farmers and farm group leaders trained. The actual number trained was not obtainable, and CARE should maintain better records on this for reporting and evaluation purposes. No pest management training has been conducted by CARE using AID funds.

#### 4.4 Agroforestry

Another project output was implementation of agroforestry and resource conservation activities, which have been intensively and extensively undertaken in all target regions by CARE. In general, efforts in this sector are considered to have been exemplary. CARE has concentrated on agroforestry for fruit and fodder production, soil nutrient replenishment, windbreak establishment, dune stabilization and salt extraction. By the end of February 1988, 29 community and nine central nurseries had been established and 1,018 individual farmers were expected to establish household nurseries. Approximately 530,000 seedlings have been distributed to date, and by late 1987 about 40% of the total project participants were either planting, maintaining or harvesting tree products. Because of the spontaneous growth of private nurseries as a direct result of CARE activities, CARE in fact began moving away from subsidized nursery development in late 1987. About 84 natural regeneration plots were also established and monitored in the Kanem. These were designed to represent a random sample of the variety of prevailing ecological environments in the wadis and to document vegetational changes while at the same time encouraging participants to conserve natural vegetational growth.

Certain CARE agroforestry interventions have naturally been more successful than others. Dune stabilization efforts, for example, were flawed from the outset by a lack of community involvement and participation. This component was only marginally successful in establishing trees in the worst of the windswept and denuded areas near Nokou. The block fence which was built at considerable cost has helped to protect the planted trees from animals and has also helped break the force of the wind in the immediate area. The problem is much larger, however, and a general area wide approach is needed if the intervention is to be successful. The input of an engineer knowledgeable in the science of fluid flow would be extremely useful. Simple temporary interventions such as drystacking of blocks in appropriately spaced stacks would interrupt the wind temporarily while trees and ground cover are becoming established; they would also cost much less and would be reusable. Random spacing as opposed to grid spacing of trees

and plants such as Leptadenia pyrotechnica would also help. The intervention effort should begin at the source of the sand which is the erosion site.

The current effort, however, is neither replicable nor sustainable as undertaken. Specifically, the dune stabilization program:

- 1) was too expensive;
- 2) would require 20 years and a well organized community to implement;
- 3) would require ongoing use of materials which are not locally available;
- 4) would require a desire and commitment on the part of the wadi farmers to undertake them;
- 5) would require some sort of short term incentive; and
- 6) suffered from the wadi farmers' desire for dune access to produce millet, which could not be avoided in the absence of strong enforcement.

Consistent and persistent problems also exist with respect to the lack of incentive to plant certain types of trees because of lack of ownership or control over those trees. This appears to be particularly the case with respect to some kinds of fruit trees. For example, owners of wadi plots will not permit outsiders to plant date palms because, under traditional land tenure arrangements, these trees give land ownership rights to the person who plants them. It is the opinion of CARE personnel that, with respect to the tree ownership problem, there is likely nothing that either CARE or the Water and Forest Service will be able to do about it. Nursery and fruit tree production among certain other groups, on the other hand, appeared to be spontaneously replicable. In general, agroforestry interventions are considered to be more important in the Kanem than in the Mayo-Kebbi, but in both regions CARE should emphasize agronomic and water management interventions through the PACD.

#### 4.5 Data Collection

Additional outputs included the collection of technical, environmental and socioeconomic data, all of which have been achieved or are ongoing at the current time. CARE was required, as a provision of the Initial Environmental Examination (IEE) as amended, to monitor soil and water salinity in appropriate locations of the internally drained Kanem wadis throughout the life of the project. It was to do

this in order to monitor the effects of project activities on soil salinization and sustainable agricultural production, and to technically evaluate methods of managing soil salinization. These monitoring measures should have been but were never ultimately incorporated into the CA; nonetheless, CARE has undertaken technical monitoring similar to that envisioned in the IEE. Baseline soil data collected to date include quantitative information on texture, pH, nitrate, nitrogen, phosphorus, potassium, calcium, magnesium and humus amount in the Mayo-Kebbi and Kanem regions. Soil samples were retained so that electrical conductivity could be measured, but those measurements and the final report on the results of the surveys are awaiting the arrival of a vacuum pump which was ordered several months ago. Baseline water data collected in the three target areas included information on depth, pH, conductivity, calcium, magnesium, sodium, SAR and general classification. In general, the quality of the data collected appears to have been solid, and the scope the sampling appears to have been generally sufficient if somewhat limited given the variability of soil conditions between different parts of different wadis.

It is recommended that CARE make a much greater effort to collaborate with the ORT data collection activities in Lac Prefecture; that CARE use these baseline data already collected as comparative values against which to measure changes in soil and water chemistry resulting from different types of cropping scenarios during project implementation; and that the results of that comparative analysis be submitted no later than the final year of the project.

CARE has made a serious effort to collect and analyze data on the impact and economic sustainability of the subproject. The Agricultural Economist has already prepared a detailed analysis of the economic environment of the southern irrigated perimeters, and has organized monthly surveys of the principal markets in the Kanem covering the price, quantity and transport cost of agricultural goods, livestock and handicrafts. He is also supervising a weekly survey of the revenues and expenditures of some 30 farm families in the Kanem region. These data have been entered into CARE microcomputers for eventual analysis using a data base management software package. CARE also hired a consultant for three months to adapt the software to its needs and to establish computer procedures.

The Agricultural Economist plans to undertake systematic analysis of the Kanem data in the coming months, and to publish the results in August or September 1988. He has been unable to do so earlier because the Kanem wadi development activity has been a secondary responsibility for him. Given the thoroughness and professionalism of his economic study of the Kim irrigated perimeters, however, there is every reason to expect that his work on the Kanem region will be useful.

The anthropological and sociological baseline data studies commissioned by CARE on the Nokou and Cheddra regions and in the irrigated perimeters are, in general, very well done and provide good data on all aspects of sociopolitical organization and cultural life of the targeted populations. They provide useful overviews of the two regions' production systems, and cover topics such as local credit systems, land tenure, agricultural resources and production and non-agricultural economic activities. There are excellent data on sexual division of labor, household consumption and expenditures, seasonal agricultural cycles, ethnic differences and patterns of interaction among groups.

No health impact study was ultimately required under the provisions of the IEE for the CARE activity, but a health study was conducted in May-June 1987 by outside sources and the final report made a number of recommendations related to development of a primary health care program. Establishment of a health component for the CARE activity is not recommended, however. It is, rather, recommended that CARE continue to focus on the principal objectives of water management and increased agricultural production, and on developing technical packages which are both replicable and sustainable rather than dilute its efforts by involving itself in activities which are important but peripheral to the major thrust of the project.

#### 4.6 Mobile Maintenance Repair Unit

The final output of the project specified in the CA was construction of a Mobile Maintenance repair unit; this unit is both completed and operational. The MMU, as discussed earlier, is key to the ability of the village irrigated perimeters to remain a viable and sustainable activity after the PACD. The MMU currently appears to be developing and operating as envisioned, and is staffed by a well qualified technician. It will be necessary, however, for CARE to follow very closely the continued development of the MMU and training in order to assure that this critical component succeeds.

#### 4.7 Other Construction

CARE is constructing a demonstration farm and training center near Cheddra. This center is expected to be completed in June 1988 and operational in July 1988. After the end of the project, it is currently anticipated that it will be transferred to and operated by DEFPA (the GOC's agricultural training office). The estimated cost of this center is approximately US\$50,600 including land purchase (US\$357), fencing, posts, temporary and permanent walls, buildings, a solar pump, labor and guards, training materials, office supplies and furnishings, and miscellaneous expenditures including transport, shadoufs and seeds.

#### 4.8 Beneficiaries

The CA envisioned project beneficiaries to include about 3,400 families with an average of 6.5 family members each. CARE estimates to date that about 3,000 families have actually benefitted from project interventions. This is considered to be a reasonable ballpark figure given the nature of the interventions. The actual level of benefit to each individual family has probably varied from somewhat substantial in the southern perimeters to minute in the Nokou region.

#### 4.9 USAID Strategy for Measuring Accomplishments

In terms of a strategy for USAID to measure accomplishments and assess the impact of the CARE subproject on target beneficiaries, crop production and sustainability through the PACD, USAID should:

- 1) require that CARE summarize baseline data on preexisting area of cultivation, crop productivity, and target area population sizes, to the extent practicable given data limitations;
- 2) require that CARE submit in its periodic "PIE Discursives" specific quantitative information on expansion of production (i.e., number of new hectares put into production); intensification of production (i.e., number of hectares affected by actual farmer adoption of one or more extended technologies); numbers of farmers actually adopting CARE-developed and extended technologies; and estimates of the impact (by weight per unit area or percentage) of those interventions; and
- 3) require that CARE submit as part of its annual work plan a rationale of that work plan based on a summary of the effectiveness of interventions broken down by technology type, level of extensification and intensification, and productivity impact from the previous year.

This should be done by all PVC's involved in water management or other on-the-ground interventions. The individual PVO's should be constantly advised of the importance of this type of approach in objectively verifying the impact of their activities. Without a means to objectively verify the impact of different interventions, it is impossible to draw firm conclusions about best and most appropriate activities available for continued funding.

This will not be an easy exercise because in some cases it can be extremely difficult to tease apart those changes which are in fact due to the interventions and those which would have

occurred anyway. It will be relatively easy in the Mayo-Kebbi area, where the size of newly established subproject perimeters is known, but in Cheddra and the Kanem wadis an expansion of hectareage in production may or may not be due to CARE intervention. There should be available, however, a baseline annual number of hectares in production by which to measure hectares in production the following year, and a sample of farmers responsible for that expanded production could be interviewed to determine why they initiated or expanded production in those systems. In the case of a decline in hectareage (e.g., northern Kanem), farmers still cropping in the wadis can similarly be interviewed to determine why they have reduced hectareage or why they have not abandoned farming there altogether. The increase in effort which such basic impact analysis will require on the part of CARE should, if necessary, be offset by decreases in other data collection efforts; the importance of quantitatively evaluating the overall impact of the subproject is critical.

A potential tabular approach to quantitative assessment of the impact of outputs is shown in Tables 1-3, below.

#### 5.0 ROLE OF THE GOC

There is an implicit assumption in the PP that the range of activities initiated will be sustainable without institutional support on the part of the GOC. With respect to the CARE subproject, the validity of this assumption depends on the specific activity undertaken. The assumption does not appear valid if applied to forestry activities such as dune stabilization in the northern Kanem wadis, to certain agronomic activities such as introduction of new seed varieties and new planting techniques (e.g., intercropping, sand lens insertion) and certain water management interventions (e.g., introduction of alternative water lifting technologies). It does, however, appear valid with respect to some forestry activities (e.g., fruit tree and other species introduction as evidenced by the spontaneous development of private nurseries), some agronomic activities (e.g., growing newly introduced crops which can regenerate without continued outside inputs) and some water management interventions (e.g., shortening of canal lengths).

The GOC's institutional capacity to continue field extension of new farming practices will ultimately be a critical factor in determining the range of new techniques available to farmers, and the extent of impact of the technologies developed. Still, some of those technologies will remain available, sustainable and reproducible even in the absence of continued GOC support. At the same time that the project works to increase GOC participation and effectiveness, therefore, it should also concentrate on interventions that will ultimately be sustainable in the absence of such GOC support.

## 6.0 PURPOSES

The purpose of the CARE subproject as specified in the CA is "to increase long-term food production capability in two discrete irrigable project areas in the Sahelian zone of Chad," i.e., the irrigated perimeters in the interriverine lands between the Chari and Logone rivers and the wadis of the Kanem. In fact, at around 900 mm of rainfall annually the target interriverine areas between the Logone and Chari rivers in the Mayo-Kebbi region do not occur in the Sahelian zone of Chad but rather well in the Sudanian and Guinean savanna-woodland zone. Moreover, the wadis of the Kanem comprise two different types of ecological systems, i.e., the internally drained, bowl shaped wadis and the ex-riverine (e.g., Bahr-el-Ghazal) wadis.

With respect to the explicit wording of the purpose of the CA, the evaluation team believes that CARE has indeed "increased long-term food production capability" in the two general project areas. Real and potential impact, however, has been extremely marginal near Nokou, acceptable to good near Cheddra, and excellent in the Mayo-Kebbi to date.

## 7.0 GOALS

The goal of the CARE subproject as specified in the CA is "to establish an indefinitely sustainable increase in food production by Chadian farmers and pastoralist families in three project areas in Chad's Sahelian zone." It is unlikely that this goal can be reached in the Nokou region, possible that it can be reached to a significant extent in the Cheddra region, and very possible that it can be reached to a very significant extent in the southern perimeters prior to the end of the PACD, especially if the PACD can be extended for two more years.

TABLE 1

First Quarter Implementation/Outputs/Impact Summary

DIRECT AGRICULTURAL IMPACT  
Extensification    Intensification

<u>OUTPUTS</u>	<u>QUANTITY</u>		
Long-T.Trng.	6 p-m		
Short-T.Trng.	97 p-d		
Crop Spp.Tested	11		
Experiment.Area	3 ha		
Seeds Distributed	480 lbs		12 ha
Fertilizer Appl.	68 t		41 ha
Pesticides Appl.	1200 l		472 ha
Tree Spp.Planted	13		
Seedlings Grown	6550		
Trees Distributed	2800		
No. of Recipients	38		
Windbreaks Planted	4		
Intercropped Area	7 ha		7 ha
Dune Stabilization	12 ha		
New Pumps Tested	1		
New Pumps Distributed	6		
New Pumps Adopted	1		0.25 ha
New Linings Tested	2		
Linings Adopted	200 m		4 ha
Other Systems Tested	2		
Other Systems Adopted	0		
Perimeters Est.	1	25 ha	
Perimeters Rehabilit.	1	11 ha	
Barrages Designed	0		
Barrages Completed	1	79 ha	
Barrages Maintained	3		
<u>TOTAL</u>		115 ha	536.25 ha

TABLE 1  
(CONTINUATION)

INDIRECT AGRICULTURAL IMPACT

OUTPUTS

Long-T. Trng.  
Short-T. Trng.

Crop Spp. Tested  
Experiment. Area  
Seeds Distributed  
Fertilizer Appl.  
Pesticides Appl.

47.2 ha (472 x 10<sup>3</sup>)

Tree Spp. Planted  
Seedlings Grown  
Trees Distributed  
No. of Recipients  
Windbreaks Planted  
Intercropped Area  
Dune Stabilization

9 ha (38 x .25 ha/)  
16 ha (4 x 4 ha/)

Impact but unquantifiable

New Pumps Tested  
New Pumps Distributed  
New Pumps Adopted

New Linings Tested  
Linings Adopted

Other Systems Tested  
Other Systems Adopted

Perimeters Est.  
Perimeters Rehabil.

Barrages Designed  
Barrages Completed  
Barrages Maintained

TOTAL

72.2 ha

TABLE 2  
ANNUAL IMPLEMENTATION/OUTPUTS/IMPACT SUMMARY

	<u>QUARTER</u>				<u>TOTAL</u>
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	
<u>DIRECT IMPACT</u>					
Extensification	115.00	0	10	0	125.00
Intensification	436.25	0	200.00	100.00	736.25
<u>Subtotal</u>	551.25	0	210.00	100.00	861.25
<u>INDIRECT IMPACT</u>	72.20	59.00	420.00	34.00	585.20
<u>TOTAL</u>	623.45	59.00	630.00	134.00	1446.45

TABLE 3  
DIRECT IMPACT SUMMARY OVERVIEW

LOCATION: Bahr-el-Ghazal (e.g., or Ngouri, or Ouaddai)

No. of Hectares Planted, 1/88: 2175  
 No. of Hectares Planted, 1/89: 2205  
 Difference: +80

No. of Farmers, 1/88: 4250  
 No. of Farmers, 1/89: 4350  
 Difference: +100

<u>Crop</u>	<u>Hectares Planted</u>	<u>Yield Increase</u>	<u>Percent Project</u>	<u>Project Impact</u>
Onions:	2030	+0.6 t/ha	25	+304.5 t
Tomatoes:	64	+0.3 t/ha	5	+1.0 t
Okra:	6	-0.53 t/ha	10	-0.3 t
Potatoes:	37	+1.1 t/ha	75	+30.5 t
Garlic:	17	no change	0	0.0 t
Hibiscus:	2	+1.10 t/ha	0	0.0 t
Taro:	10	-.6 t/ha	5	-0.3 t
Other:	39	unknown	-	-
<u>Total</u>	261			+335.4 t

ANNEX B

Sub-Project Review

OUIDAI RURAL DEVELOPMENT

Implemented by Africare

Review prepared by:

Djimé D. Adoum

Agronomist

U.S. Department of Agriculture

Office of International Cooperation and Development

May 1988

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## 1. SUMMARY AND CONCLUSIONS

Africare's Ouaddai Rural Development Project (ORDP) is the continuation of the 1984-1987 Abéché Rural Development Project (ARDP). This initial effort aimed to combine distribution of drought relief food aid with development initiatives in the areas of food grain production, construction of water catchment structures and agroforestry. ORDP was designed to de-emphasize the relief aspects while continuing the same developmental thrust. The Cooperative Agreement between AID and Africare was signed on August 27, 1987, and made retroactively effective from May 1, 1987. Sub-project activities did not really get under way, however, until the arrival of the bulk of the technical assistance team on November 3, 1987.

In the six months of effective sub-project implementation, provision of inputs by Africare, the GOC and other parties has generally been satisfactory. The long-term and short-term technical assistance personnel have been suited to their positions and have been assigned adequate GOC counterparts. Commodity procurement, construction and local support activities have generally been of good quality. Villagers have received Food-for-Work rations from the World Food Program in return for labor contributed to the forestry and water catchment construction components. The major problems encountered in provision of inputs have been:

(1) Africare's inability to recruit an experienced engineer for the Project Engineer position. Given the importance of the water catchment structures, this is a key slot that must be filled by a qualified person as quickly as possible. Ill effects of the vacancy have been mitigated by the high quality of Africare's local Assistant Engineer and short-term engineering consultant services.

(2) Under estimation of the budget for vehicle maintenance and operations.

(3) Poor quality garage and shop tools procured from Nigeria.

Substantial progress has been made towards achieving sub-project outputs. The most visible output to date of both the ORDP and the predecessor ARDP has been the construction of water catchment structures designed to retain flow from seasonal flooding in wadis. With the Ouaddai region's infrequent and irregular rainfall, this is thought to offer good potential for capturing water for agricultural and other uses. The water thus retained seeps into the soil and permits cropping as it recedes; this also raises the water table, thereby increasing the recharge rate of wells. Of the four structures attempted to date, the one at Mattar has successfully withstood the seasonal floods and retained enough water to permit significant cropping.

Construction methods are professional, and potential for downstream flood damage is minimal. During the 1987/88 cropping season at Mattar, farmers were able to produce recessional crops of tomatoes, peanuts, sesame and berbere sorghum. Preliminary economic cost-benefit analysis indicates that the uses of the water retained by these structures generate strong net benefits. Some caveats remain, however. First, the social impact of this new mode of organization on land tenure arrangements and the role of women remains unclear. Also, based on the mixed results of the actual construction of the structures, Africare should limit new starts to one per year. Finally, Africare should consider construction of much smaller retention structures across small wadis, built exclusively with inputs available to villagers. These could catch water for use by people and livestock and possible recessional crop production.

In addition to continuing work on water catchment structures, Africare has begun tests on the dalou, an animal traction system for drawing well water, with which TA team members had worked in Niger. This technology has great potential for increasing agricultural productivity in the Ouaddai. Wells are sometimes 20 to 30 meters deep, which is beyond the capacity of human-powered waterlifting, while motor pumps are beyond the financial means of the area's farmers. The dalou is simple enough that it can be constructed entirely from local materials. It can be built and operated in no more than three days. Given the appropriateness of this technology to the Ouaddai region, Africare should pursue testing, introduction and extension of it to the maximum extent.

Although the main focus of Africare's agronomic interventions is crop production around the water catchment structures, attention has also been paid to rainfed cropping in the dunes, the traditional source of staple grains. As a solution to the problem of low rainfall (144 mm in 1987) Africare will procure two tons of millet seeds and two and a half tons of cowpea seeds from Niger. These are early maturing varieties with much lower water requirements (as low as 100 mm) than the traditional local varieties. Given the inadequate and irregular rainfall in the project zone, the introduction of early maturing varieties should lead to much greater yields. The drought resistance of these newly introduced varieties should give them a better survival rate during periods of critical moisture availability.

The forestry and agroforestry component has two thrusts. The first is support to the Water and Forest Service's regional central nursery in Abéché to supply four regional satellite nurseries with planting materials, with the objective of teaching farmers the principles of tree production and nursery management. The major problems encountered have been: (1) minimal interest on the part of farmers in caring for trees; and

(2) the drying up of the well at the regional central nursery, which jeopardizes the survivability of seedlings. The second thrust is encouragement of the production of gum arabic as a source of cash income. Africare and the Water and Forest Service have helped villagers establish undisturbed stands of Acacia trees for gum production. At present, however, little is known about the financial and labor requirements as well as market potential in the establishment of larger scale commercial production.

Finally, the credit program is still in the design stage. It is essential that conception and execution of this program be based on a solid understanding of the socioeconomic structures of the proposed beneficiaries.

With the activity only six months into effective implementation, it is somewhat premature to judge progress towards meeting its purpose (to increase agricultural production, combat deforestation and bolster the rural economy in the Ouaddai region) and goal (to contribute to increased food security in the Ouaddai region).

## 2. RECOMMENDATIONS

### General

a. The ORDP should be extended through December 31, 1990, to allow all planned project activities to be accomplished.

### Water Management Technology

b. Africare should construct no more than one major water catchment structure per year until the end of the project and should build as many minor structures as possible each year. Africare should hire an experienced engineer, as called for in the Cooperative Agreement, as soon as possible to work on these structures.

c. On a demonstration/experimental basis, smaller and less costly water catchment structures of clay should be sited on minor catchment areas where a concrete spillway is not needed, and designed in a manner similar to a stockwatering dike. Simpler structures will be more replicable and more sustainable at the village level. These smaller structures could be used to retain water for livestock consumption as well as potentially serving for recessional crop production.

d. Africare has introduced the dalou, an animal traction waterlifting device which appears to have great potential in the agricultural activities of the Ouaddai region. Work on and extension of this activity should continue.

### Agronomy

- e. Proper data gathering methodologies should be designed immediately so that appropriate data on the incoming growing cycle can be collected and analyzed. Such an analysis should serve as a baseline for better management and cropping practices behind the water catchment structures as well as on rainfed cropland.
- f. Sound agronomic experiments should be conducted to determine the best water use efficiency as it relates to crop performance.

### Forestry and Agroforestry

- g. Africare, with the help of the regional office of the Water and Forest Service, should identify a funding source for a deep well at the central nursery in Abéché. This is of paramount importance in the forestry program. Since the current and prevailing water problems are causing significant losses in nursery establishments, further delay will cause irreversible damage to the forestry component.
- h. Africare should undertake a systematic analysis of gum arabic production to determine financial and labor requirements as well as market potential in the establishment of larger scale commercial production.

### Socioeconomic Issues

- i. Africare should undertake, in part or in collaboration with the national extension service (ONDR) and other development agencies, a study of all marketing channels in the Ouaddai region. This marketing study should orient production efforts into areas that have the greatest promise and should be factored into design of the credit program.
- j. Africare should undertake a study of the social division of farm and wage labor in the project zone. This will include on-farm family labor deployment as well as off-farm activities and wages.

### 3. BACKGROUND

a. Predecessor Activity. The ORDP is the follow-up to the Abéché Rural Development Project (ARDP), which was implemented by Africare with AID funding between January 1984 and January 1987. ARDP was conceived as a relief and rehabilitation effort following the serious drought and civil war of the early 1980s. Its thrust was to combine the distribution of urgently needed food aid with development initiatives; thus, labor for construction of water catchment structures and planting and

caring for trees was reimbursed through Food-for-Work. The components of this activity were:

- (a) distribution of seed grain for planting,
- (b) construction of new and repair of existing water catchment structures, and
- (c) promotion of small scale forestry, including the creation of tree nurseries and planting windbreaks, living fences and small woodlots.

ARDP succeeded in implanting a foundation on which the current project could build. Africare opened an office in Abéché, the capital of Ouaddai Prefecture, and established relations with both GOC officials and villagers. Experience was gained in the implementation of forestry initiatives in this difficult environment, as well as the construction and maintenance of water catchment structures. And, both Africare and the GOC realized the need to redirect interventions in the Ouaddai from relief to development.

b. Approval and Start-up of the Ouaddai Rural Development Project (ORDP). Africare first submitted its sub-project proposal to USAID/Chad in May 1986. Due to the need to make revisions suggested by USAID, however, ORDP was not finally approved until April 6, 1987. The Cooperative Agreement (CA) between AID and Africare was signed on August 27, 1987. The CA was made retroactively effective to May 1, 1987, and will end on September 30, 1989, the current PACD for the overall PVO Development Initiatives Project.

Although some commodity procurement began in Summer 1987 and the Shop Manager/Mechanic arrived in July 1987, the bulk of the technical assistance team did not arrive in-country until November 3, 1987. For programmatic and evaluation purposes, this should be considered the effective start of project activities.

#### 4. PROGRESS IN DELIVERING INPUTS

##### a. AID-Financed Inputs

(1) Long-term technical assistance. The following table compares the long-term technical assistance called for under the CA with the quantity of this input provided to date:

<u>Position</u>	<u>Per CA</u>	<u>Through 5/88</u>
Project Coordinator/Credit Mgr	36 months	6 months
Agronomist	36 months	6 months
Forester	30 months	6 months
Shop Manager/Mechanic	36 months	10 months
Project Engineer	36 months	None

The Shop Manager/Mechanic arrived in-country in July 1987, and the Project Coordinator, Agronomist and Forester arrived in November 1987. Africare is still recruiting for the Engineer, but has not yet identified a candidate. Because of the importance of water catchment structures in the sub-project, it is essential that this position be filled as quickly as possible with an experienced engineer.

The overall quality of the TA team is good. All members have previous experience in isolated environments similar to Abéché, and they have approached their professional assignments with enthusiasm and a spirit of self-reliance.

(2) Short-term technical assistance. Under the CA, Africare was to recruit six person-months of short-term advisory services in the areas of sociology, engineering, extension, forestry and evaluation.

To date, two months of the services of a Hydraulic Engineer have been provided, in April-May 1988. He looked at the design and technical soundness of the water catchment structures, as well as the dalou waterlifting device. The quality of his work has been excellent.

No other short-term consultancies are planned for the moment.

(3) Participant Training. Africare is to cover the costs associated with in-country training for GOC counterpart personnel as well as on-the-job training and extension training to individual farmers and groups of farmers. Training sessions are scheduled to begin in May 1988 and will be performed jointly by the Africare Agronomist and DEFPA, the agricultural training unit of the GOC Ministry of Agriculture. There will be three phases:

(a) training Africare and ONDR (GOC agriculture extension agency) employees in water conservation and advanced farming techniques,

(b) training farmers in the use of newly developed technologies, as well as the organization of small cooperatives for obtaining credit, and

(c) agroforestry training for Water and Forest Service employees, focusing on nursery operations, training and extension, and village fuel wood plantations.

(4) Commodity Procurement. Under the CA, Africare was to procure five light trucks, farm equipment and supplies, pumps, shop equipment and tools, office furniture and supplies, a computer, and household equipment. Three hundred eighty-five

thousand dollars were budgeted for this. With one exception, commodity procurement has proceeded smoothly.

The exception is that, in the opinion of the Shop Manager/Mechanic, additional garage tools and diagnostic testing equipment, as well as an inventory of common spare parts, need to be ordered to avoid excessive down time on vital equipment. Shop tools ordered from Nigeria were found to be inadequate.

It is worth noting that the Ouaddai regional offices of both the ONDR and the Water and Forest Service have been assigned four-wheel drive vehicles from those procured under ORDPA, to enable them to carry out their counterpart roles.

(5) Construction. Construction activities were budgeted at \$250,000, and were to include renovation of a workshop as well as procurement of materials and tools for improved wells, gabion terraces and water catchment structures. To date, renovation on the workshop in the Africare compound in Abéché has been completed, and materials and tools for water management-related construction have been procured.

(6) Local Support Costs. These were to include salaries of locally recruited project staff; in-country travel; housing rentals, maintenance and utilities; and vehicle operations and maintenance. These inputs have generally been provided as required. The following specific points should be noted:

(a) Chadian personnel. Africare has employed local support and professional staff for the Abéché office. The Assistant Engineer, in particular, is doing an excellent and professional job. Five extension workers who were to be hired by Africare are being provided as a GOC contribution instead.

(b) Vehicle operations and maintenance. The Africare proposal budgeted \$37,500 (10,687,500 CFAF) for this purpose for the activity's first year. In the opinion of the Shop Manager/Mechanic, this was grossly inadequate for vehicle operation and maintenance in an environment as difficult as the Ouaddai. Africare, with USAID concurrence, has therefore more than doubled this budget line item, to \$92,877 (26,469,980 CFAF).

(c) Support to GOC Services. As noted above, Africare has provided both the Water and Forest Service and the ONDR with vehicles. They have also been receiving a monthly allocation of 200 liters of fuel, which they thought inadequate for their needs. Africare and the GOC offices are now making arrangements so that this amount can be increased as needed for site visits.

(7) Overhead. Sub-project funds have also been reserved to cover the salaries and overhead of the Africare Country Representative in N'Djaména (33%) and an Africare Program Officer in Washington (25%). Backstopping provided by these individuals has been good.

(8) Budget Analysis. Of the AID-supplied budget of \$2,840,000, through April 30, 1988, \$544,466 (19%) had been expended, leaving a balance of \$2,295,534 (81%).

b. Non-AID Financed Inputs

(1) Africare. Under the CA, Africare was to contribute the cost of the sub-project design; procurement of equipment, supplies and construction materials for the forestry component; supplies and equipment for the credit component; two-thirds of the costs associated with its Country Representative; and a complementary gardening activity at Kiledji.

(2) GOC. The GOC is contributing counterpart personnel and the use of facilities.

(a) ONDR. ONDR has assigned a field agent as the full-time counterpart of the Africare Agronomist, as well as five other extension agents. Personnel are of good quality, and they have excellent relations with Africare staff.

(b) Water and Forest Service. No full-time counterpart has been assigned to the Africare Forester, although ... nurserymen are working on sub-project funded nurseries

(c) Rural Engineering Service (Génie Rural). This service just opened a regional office in Abéché. Although no formal counterpart relationship exists, the Regional Engineer takes an active interest in and collaborates closely with Africare's activities in the area of water catchment structures.

(3) World Food Program. Under the CA, it was estimated that 3,600 families may benefit from Food-for-Work (FFW) offered for tasks associated with construction and maintenance of water catchment structures. To date under ORDP, villagers have received FFW rations for providing labor to nurseries supported by the forestry component and for labor on water catchment structures.

## 5. PROGRESS TOWARDS ATTAINING OUTPUTS

a. Water Catchment Structures. The most visible output to date of both the ORDP and the predecessor ARDP has been the construction of structures designed to catch and retain water from seasonal flooding in wadis. With the Ouaddai region's infrequent and irregular rainfall, this is thought to offer good potential for capturing water for agricultural and other uses. The water thus retained seeps into the soil and permits cropping as it recedes; this also raises the water table, thereby increasing the recharge rate of wells.

Under ARDP, four such structures were built, using both manual labor from neighboring villagers (generally reimbursed with FFW) and technical supervision, skilled labor and heavy equipment supplied by Africare. Two of the structures collapsed in their first year, and one apparently had insufficient rainfall in its drainage zone to retain an agriculturally useful amount of water. The fourth, at Mattar, retained water that was used for cropping as well as human and livestock consumption in the 1987/88 season.

Under ORDP, there has been no construction of new water catchment structures. Efforts have focused, instead, on raising the height of the Mattar structure and on constructing small terraces ("diguettes") around it in order to increase the area of water retention and seepage.

### (1) Engineering Analysis.

(a) Terminology. The structures being built by Africare are not "dams", despite the confusion that may be caused by the lack of sufficiently descriptive terminology. Whether called barrages, weirs, water retention structures or water diversion facilities, these structures are not large enough, do not retain enough water, and do not pose a failure hazard in excess of the natural flash flood hazard to be accurately described as "dams". In fact, the word "dam" should be avoided since it evokes negative connotations that are irrelevant to the Ouaddai sites. In the event of a structural failure, there would be an insignificant increase in the amount of flood waters contributed to the flood channel from stored water in the retention structures. The impact of this additional water on the people and property in the flood plain would be equally insignificant. The flat regional topography and the fact that villagers in the region know the flash flooding potential of the major water courses also mitigate failure impact. Thus, future safety concerns are unwarranted.

(b) Construction methods and longevity. These water retention structures are earthen dikes constructed of clay placed with shovels, wetted by buckets and compacted through

hand tamping and wheel rolling. The concrete spillway adds to the life of the structure, but it is unrealistic to assume a design life in excess of seven years for the composite structure. The design life of the spillway itself could be 30 years as long as the failure of the earthen portion of the structure did not cause scour and subsequent failure of the spillway foundation. Failure of the spillway through material failure, overturning, or sliding is extremely unlikely.

(c) The Potential for Flood Damage. Standard practice methods were used to determine the area of the catchment basin, the top elevation of the structure, and the spillway's geometry, on the basis of water discharge resulting from a ten year storm. As a check on these figures, the designers used area residents' living memory and determined the flood level of a 1977 storm as the worst that the elders could recall. These levels were located on rocks and tree trunks, and the quantity of water flow was figured and compared. It appears that this work received adequate attention and sufficient, conscientious care. For the downstream terraces ("diguettes"), the potential for flooding should be as carefully investigated as the increased benefits. A simple control structure could be considered as well as closer spacing of the diguettes. Silting or filling behind the retention structure would not affect the usefulness of this type of structure as a source of water for crops, wells or livestock. In fact, the presence of sand or silt behind the catchment structures may even contribute to the retention of water for a longer period due to the reduction of evaporative losses in the manner experienced on the surface of a pond or reservoir.

(d) Suggested improvements. The construction of water retention structures began as a Food-for-Work exercise entirely performed with manual labor. This method was found to be very difficult and actually resulted in the loss of portions of the first few structures when they were not completed before the onset of the rainy season. Other losses took place when Africare unrealistically attempted to increase the number of water catchment structures completed in a year. Two structures were not completed before the rains began, and both experienced structural failure to portions of the earthen embankment from rushing water. The more recent structures were built using various combinations of hand labor and machinery. This resulted in the completion of better quality structures well in advance of the rains. Nevertheless, it is believed that the addition of certain selected equipment to the sub-project's tool list would improve the quality and survivability of the structures significantly. Better watering, compaction, earth-loading, powder hole drilling and blasting equipment would streamline the work and make the manual labor more productive while reducing the required haul distances of the materials. A densely compacted earthen structure, well protected with riprap stones

(or sandbags or bags of sand-cement mix), may survive mild overtopping.

Until more experience is gained, construction of these major water catchment structures should not exceed the rate of one per year.

(2) Agronomic Analysis. The water catchment structures have good potential for increasing agricultural production in their respective zones. So far, there has been only one cropping season at one catchment area, Mattar. Although, because of the late arrival of the technical assistance team, data are sketchy, one can still evaluate the two cropping regimes made possible by the water catchment structures.

(a) "Recessional" cropping. Recessional cropping is traditionally done along a lake shore. As water recedes towards the center of the lake after the rains end, land becomes available and farmers plant their crops. Under these conditions, crop growth and development depend almost entirely on the moisture of the soil and, to a far lesser extent, on rainfall.

Although land and production at the water catchment are not "recessional" in the strict, technical sense of the word, "recessional" is the best word available. Water accumulated behind the catchment during the rainy season recedes and, as such, leaves behind it land that is used by farmers.

Several types of crops can be grown under these conditions. During the 1987/88 season at Mattar, for example, farmers grew tomatoes, peanuts, millet and sesame. Unfortunately, general yield data are not available. Limited yield data indicate that about 2.26 tons/ha of dried tomatoes were obtained. Hopefully, the next growing season will provide more data and a thorough cost/benefit analysis of this type of cropping can be obtained.

(b) Cool season cropping. At Mattar, the only cool season crop was berbere, a variety of sorghum. Farmers established a nursery to provide seedlings at the beginning of September (i.e., at the end of the rainy season), transplanting the seedlings some 30 to 40 days afterwards. Because this crop survives on moisture accumulated over the course of the rainy season, farmers traditionally would construct small terraces around each plot to retain water from irrigation at the time of transplanting. Growth and development take place during the cool season of October through December. Harvest occurs in mid-January. The water catchment structure allowed farmers to secure a better crop because more water was harvested and conserved for a longer period. Yields from the 1987/88 season at Mattar are estimated at 1.62 tons/ha.

(c) Recommended guidelines. At present, production made possible by the water catchments cannot be estimated as a percentage of total farming activities. The 1988/89 growing season should provide data to evaluate this. In addition, data on market conditions, the moisture content of the soil and the nutritional capabilities of the soil need to be gathered and analyzed for future crop selection in these areas. In crops around the water catchment structures, intensive crop production must be emphasized because land is the limiting factor. Intensification can occur in time (e.g., intercropping of species with different rates of maturing) and in space (e.g., the use of relay cropping, whereby a second crop is planted at the time a first crop is harvested.)

Research and experience have shown that yield of some crops is proportionally related to population densities. As such there is a strong positive correlation between yield and higher plant population densities. Indeed, some genotypes respond better than others under increased population density. An important agronomic factor to consider is the fact that some crops tolerate shading while others perform very poorly under low light intensities. Consequently, appropriate genotypes that tolerate shading and high population density should be used.

Equally important is the spacing arrangement and row orientation. Another factor to be considered is the time of planting. It has been empirically determined that crops that are planted at the very beginning of the growing season meet their degree day requirement as well as their critical photoperiod. Delays in planting can result in a significant yield loss. All of the above mentioned elements are important in crop production and should serve as guidelines in directing production and improvement efforts on the sites.

The Agronomist should undertake systematic analysis and rigorous plot testing to determine which of the above identified variables plays the most significant role in increasing yield at the site. Since moisture availability is significantly higher at the site than elsewhere, production could be possible year round. It would not be advisable to prescribe a specific formula. Several crops can be attempted, with production and crop selection based on what requires the fewest inputs and guarantees the greatest return per unit area of land. Marketing data should be used to guide production efforts at the sites to those crops that can be grown most efficiently and that offer the best economic return on investment.

(3) Economic cost/benefit analysis. To date, ex ante economic cost-benefit analysis has not figured in decisions on whether to construct or improve the water catchment structures. No budget was prepared for the direct costs and contributed labor required for the 1988 extension of the Mattar structure,

making it difficult to relate these costs to estimated increases in production attributable to the structure. It is imperative that, in the future, budgets and detailed cost-benefit estimates be performed before deciding whether to proceed with a water catchment structure or extension.

However, information available to the evaluation team by Africare's Assistant Engineer and the ONDR office in Abéché made it possible to conduct a preliminary cost/benefit analysis for the construction and extension of the Mattar water catchment structure. This follows on the next page. Even under the assumption of a 50% annual discount rate, the Mattar structure shows a positive net present value. Although the valuation of the benefits used in this analysis should be carefully scrutinized (in particular the high value attributed to watering livestock), the positive result indicates that work on these structures should continue.

(4) Social impact issues. Along with the technical and economic issues raised above, Africare should pay attention to issues regarding land tenure arrangements in the water catchment areas and the role of women in building and utilizing the structures.

(a) Land tenure arrangements. Currently, access to and allotment of plots behind the water catchment structures are left completely in the hands of the canton chief. While this may be the only politically expedient way to handle land allocation, Africare should nonetheless be alert to possible abuse of traditional authority. It will be important to know if farmers have access to the same plot each planting season, and if any collective decisions are taken with regards to crop selection and fertilizer use. Is this relatively new mode of cultivation generating new modes of social organization?

(b) The role of women. The evaluation team and other observers have noticed that women seem to perform all of the hard physical labor required for the construction and extension of the water catchment structures (e.g., cutting stones at a quarry and laying out new terraces). Do women in the Ouaddai region normally undertake the heaviest labor in the fields and villages, or is this a new development? What has happened to the able-bodied men? Are the women working for the perceived future benefits of these structures or merely for FFW rations? If the latter, what is their cash value and how does it compare to wages paid to male laborers? If women are indeed performing the lion's share of the labor, are they receiving a proportionate share of plot allocations? Africare should make a serious effort to assess the economic and social impact of this activity on sex roles in the region.

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Africare Quaddai Rural Development Project  
Economic Cost-Benefit Analysis of Mattar Water Catchment Structure

Scenario 1: Discount Rate of 20% per annum

YEAR:	0	1	2	3	4	5	6	7
	--	--	--	--	--	--	--	--
COSTS (1)	39,525,760	0	0	0	0	0	0	0
PV Costs								
BENEFITS								
Tomatoes (2)	0	3,164,000	3,164,000	3,164,000	3,164,000	3,164,000	3,164,000	3,164,000
Cowpeas (3)	0	9,000,000	9,000,000	9,000,000	9,000,000	9,000,000	9,000,000	9,000,000
Sorghum (4)	0	12,187,500	12,187,500	12,187,500	12,187,500	12,187,500	12,187,500	12,187,500
M20 for Stock (5)	0	84,000,000	84,000,000	84,000,000	84,000,000	84,000,000	84,000,000	84,000,000
M20 for People (6)	0	3,505,000	3,505,000	3,505,000	3,505,000	3,505,000	3,505,000	3,505,000
		-----	-----	-----	-----	-----	-----	-----
Total	0	116,856,500	116,856,500	116,856,500	116,856,500	116,856,500	116,856,500	116,856,500
PRESENT VALUE OF BENEFITS:	421,219,977							
PRESENT VALUE OF COSTS :	39,525,760							
NET PRESENT VALUE :	381,694,217							

Scenario 2: Discount Rate of 50% per annum

YEAR:	0	1	2	3	4	5	6	7
	--	--	--	--	--	--	--	--
COSTS (1)	39,525,760	0	0	0	0	0	0	0
BENEFITS								
Tomatoes (2)	0	3,164,000	3,164,000	3,164,000	3,164,000	3,164,000	3,164,000	3,164,000
Cowpeas (3)	0	9,000,000	9,000,000	9,000,000	9,000,000	9,000,000	9,000,000	9,000,000
Sorghum (4)	0	12,187,500	12,187,500	12,187,500	12,187,500	12,187,500	12,187,500	12,187,500
M20 for Stock (5)	0	84,000,000	84,000,000	84,000,000	84,000,000	84,000,000	84,000,000	84,000,000
M20 for People (6)	0	3,505,000	3,505,000	3,505,000	3,505,000	3,505,000	3,505,000	3,505,000
		-----	-----	-----	-----	-----	-----	-----
Total	0	116,856,500	116,856,500	116,856,500	116,856,500	116,856,500	116,856,500	116,856,500
PRESENT VALUE OF BENEFITS:	220,034,324							
PRESENT VALUE OF COSTS :	39,525,760							
NET PRESENT VALUE :	180,508,564							

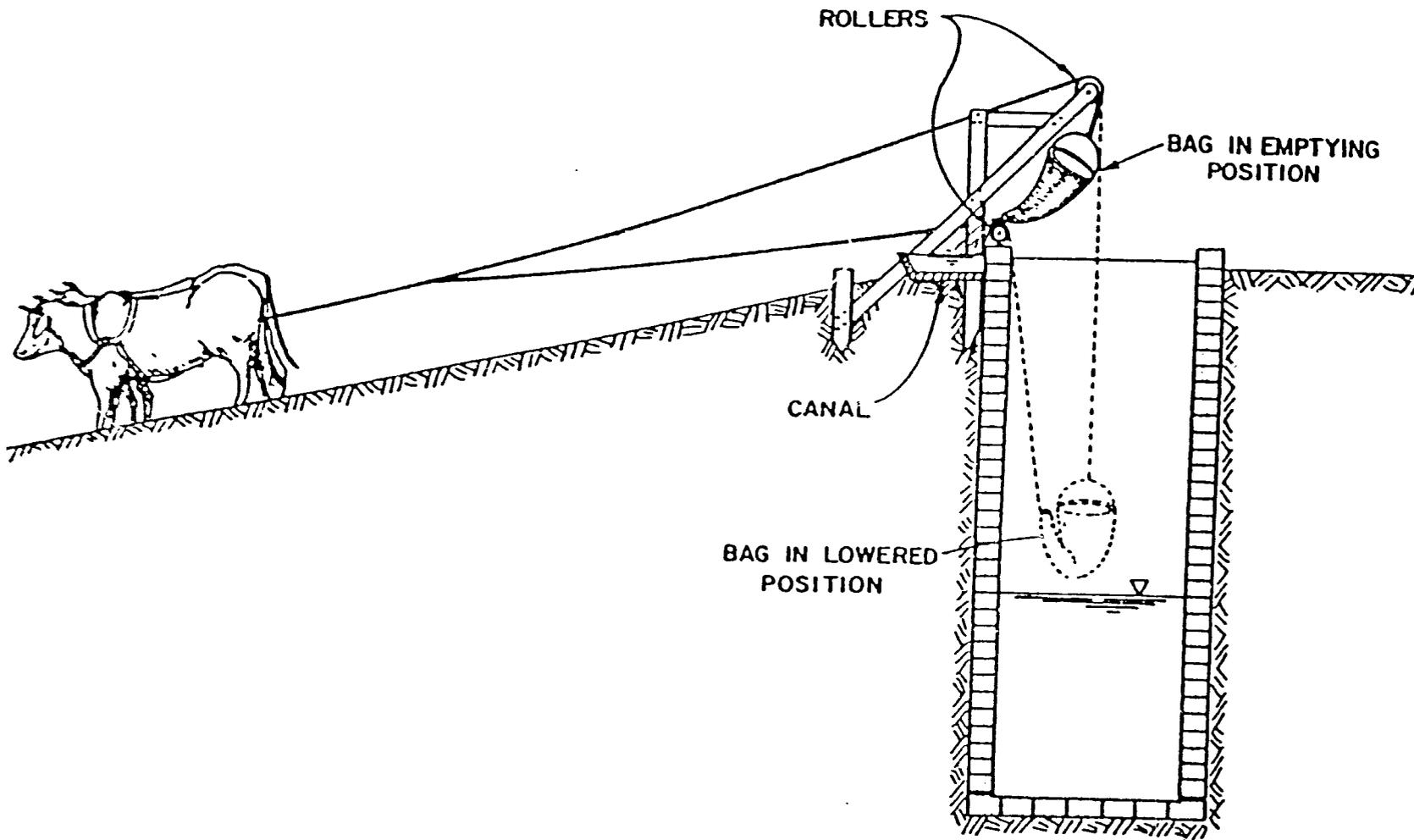
- NOTES: (1) Direct costs plus value of FFW labor.  
 (2) 20 ha x 2.26 tons/ha x 70,000 CFAF/ton.  
 (3) 20 ha x 3 tons/ha x 150,000 CFAF/ton.  
 (4) 130 ha x 1.25 tons/ha x 75,000 CFAF/ton.  
 (5) 200 CFAF/head/day (milk prod.) x 2000 head x 30 days x 7 months.  
 (6) 300 people x 9 liters/day/person x 15 CFAF/liter x 30 days x 7 months.

(5) A possible new direction. During site visits, the team observed that villagers had constructed small water retention structures across small wadis, apparently without outside assistance. While these structures generally do not retain enough water for recessional cropping, they can still catch water for use by people and livestock. The water retention also increases the rate of groundwater recharge into village wells. Because these structures yield potentially important benefits and can be built using inputs readily available to villagers, Africare should pursue a program of improving and extending this technology.

These smaller and less costly water catchment structures of clay should be sited on minor catchment areas where a concrete spillway is not needed, and designed in a manner similar to a stockwatering dike. Spillways should be provided but could be placed over natural rock or hard pan or soil/cement sacks as an alternative. The key to success of such structures is choosing the correct site. Such a dike would be less costly than the composite structures which have been constructed to date. These simpler structures may well be more replicable and more sustainable at the village level than the larger ones already put into place.

b. Testing and introduction of other water management technologies. In April 1988, Africare began tests at Kiledji village of a prototype of the dalou, an animal traction system for drawing water from a well, with which TA team members had worked in Niger. The dalou utilizes a leather bag with two openings which is connected by ropes at both extremities to two rollers and thence to a donkey or camel. The bag is lowered into the well, with water collected through the larger opening. The animal is then directed to pull away from the well and, by doing so, the bag of water is brought to the surface, where it empties as soon as it hits the lower roller. The water spills into a water catchment made of mud, which has three or four small openings feeding into small hand-made canals. When enough water is collected, these outlets are then opened so that water can be directed as desired. A diagram of the dalou follows on the next page.

This technology has great potential for increasing agricultural productivity in the Ouaddai. Wells are sometimes 20 to 30 meters deep, which is beyond the capacity of human-powered waterlifting, while motor pumps are beyond the financial means of the area's farmers. The dalou is simple enough that it can be constructed and operated in no more than three days. Africare built its prototype entirely from locally available material and believes that the structure can be constructed for less than 20,000 CFAF (\$70), with labor included. In addition, it can be operated by an unaided ten-year old boy. A constraint might be the availability of draft animals.



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It is anticipated that dalous will be used for irrigation of truck gardens producing crops such as onions, tomatoes, hot peppers, okra and ligi millet -- and not for production of the staple grains (sorghum and finger millet). These truck crops are either marketed for the farmers' cash needs or consumed on the farm in the event of failure of the staple grain crops. Thus, the return on a farmer's investment in a dalou will be dependent on marketing opportunities and the likelihood of rainfed crop failure. Existing data here are sketchy. Knowledge of the cropping and marketing systems needs to be expanded so that the most suitable use of the dalou technology can be identified.

In general, the evaluation team found the dalou to be a well adapted technology with great potential for the Ouaddai region. Africare should pursue testing, introduction and extension of the dalou as far as possible.

c. Other agronomic interventions. Although the main focus of Africare's agronomic interventions is crop production around the water catchment structures, attention has also been paid to rainfed cropping in the dunes. This has been the traditional source of staple grains, but drought conditions in recent years (e.g., 1987 rainfall of 144 mm in Abéché) have reduced production dramatically.

One solution to this problem already proposed by the Agronomist is procurement of two tons of millet seeds and two and a half tons of cowpea seeds from Niger. These are early maturing varieties with much lower water requirements (as low as 100 mm) than the traditional local varieties. These varieties are native to the northern Sahelian region of Niger, and therefore have none of the drawbacks of selected hybrid seeds. Given the inadequate and irregular rainfall in the project zone, the introduction of early maturing varieties should lead to much greater yields. The drought resistance of these newly introduced varieties should give them a better survival rate during periods of critical moisture availability.

At present, agronomic characteristics of the new varieties are not known. However, at the end of the growing season data on their performance should be available to allow analysis of their advantages and disadvantages relative to traditional varieties.

Cowpeas offer an additional advantage. At the end of the growing season, their shoots that remain above ground can be disked under to increase the water holding capacity and the organic matter content of the soil.

d. Forestry and agroforestry

(1) Agroforestry. This component has gotten off to a good start. Africare is cooperating with the Water and Forest Service to strengthen the capacity of the regional central nursery in Abéché to supply four regional satellite nurseries with planting materials. The main nursery will be able to produce 40,000 seedlings a year, while the satellite nurseries will produce 9,000 apiece. The satellite nurseries are intended to provide farmers the opportunity to learn the principles of tree production and nursery management, as well as to preposition seedlings closer to where they will ultimately be planted before the onset of the rainy season.

Most of the planting material is obtained through selection of local varieties, with the exception of the exotics Prosopis, Leucaena and Azadirachta. Although most of these varieties do not have a high water requirement, consistent watering in the first year is extremely important for tree survival. With a few exceptions, such as Kiledji village, farmer interest in caring for trees has been minimal. In the village nurseries that have been established, laborers receive FFW rations from the World Food Program.

Africare will arrange for the training of Water and Forest Service agents through DEFPA, as described in Section 3.a.3. above. Training will include nursery care and management, site and species selection, fruit tree production techniques, gum arabic production, and the uses of agroforestry.

A serious constraint on this component, however, is the drying up of the well at the central nursery in Abéché, which reduces the water available for seedlings and thereby jeopardizes their survivability. Africare, with the help of the regional office of the Water and Forest Service, should identify a funding source for a deep well here. This well is of paramount importance in the forestry program. Since the current and prevailing water problems are causing significant losses in nursery establishments, any further delay would cause irreversible damage to the forestry component.

(2) Gum arabic. Production of gum arabic, which is harvested from the sap of an Acacia species, is seen as having good potential as a source of cash income. Africare and the Water and Forest Service have helped villagers establish undisturbed stands of Acacia trees for gum arabic production. This would seem to be a promising area, because little labor is required after planting and a first year of watering the sapling. However, it takes seven years for a tree to begin producing gum. Also, very little is known about the market for gum arabic. Africare should therefore undertake a systematic analysis of gum arabic production to determine financial and

labor requirements as well as market potential in the establishment of larger scale commercial production.

e. Credit program. According to the CA, Africare is to begin implementation of an in-kind farm credit program in the second year of the sub-project, with the first year spent in collection of relevant data and design of the program. Efforts to date have been of a very general nature.

There has been no serious effort to collect socioeconomic or agricultural production data on potential target populations. Africare says that necessary data are available from a study, "Analyse Régionale Sommaire du Ouaddai Géographique au Tchad", prepared by German Agro-Action. This is an excellent overview of the region's natural and human resources, as well as its social organization and economic production system. It does not, however, provide the detailed understanding of socioeconomic conditions necessary for design and implementation of a successful credit program.

Actual plans for the credit program are couched in general terms. The sub-project's 1988 work plan says that 15 sets of animal traction equipment are to be distributed to "pre-cooperative groups" around Kiledji village and three more in the areas around the water catchment structures. If poor crops make repayment impossible, the equipment is to be returned to Africare with no charge. It is essential that more be known about the socioeconomic structures of the proposed beneficiaries and that operational questions, such as selection of beneficiaries and determination of repayment schedules, receive careful study.

## 6. SUB-PROJECT PURPOSE

The purposes of the sub-project are threefold:

(1) to increase agricultural production in the wet and dry seasons through improved water management, institutional development, diffusion of improved farm technology and input supply;

(2) to combat deforestation and environmental degradation;  
and

(3) to bolster the rural economy in the Ouaddai region.

As the activity has been in implementation for less than one year, it is somewhat premature to judge progress towards meeting its purpose. However, some progress is already discernible towards the first component; both the water catchment structures and the dalou offer good potential for increased agricultural production through enhanced and better controlled application of

water to crops. No other technological innovations have yet been tested, developed or extended. As for the second and third portions of the purpose statement, no concrete results are available yet.

7. SUB-PROJECT GOAL

The sector goal of this activity is to contribute to increased food security in the Ouaddai region. To the extent that agricultural production is augmented in a sustainable way through the water management innovations being introduced (dalou and water catchment structures), progress is being made towards this goal.

ANNEX C

Lake Chad Agricultural Development and Farmer Training  
Project: American ORT Federation.

Sub-Project Review

Prepared by: Amal Rassam  
Social Anthropologist  
REDSO/WCA  
May 1988

LAKE CHAD AGRICULTURAL DEVELOPMENT AND FARMER TRAINING PROJECT  
(Organization for Rehabilitation through Training)

BASIC DATA AND INFORMATION

Lake Chad Agricultural Development and Farmer Training Project  
American ORT Federation.

Cooperative Agreement signed: June 8, 1987, and made  
retroactive to December 1, 1986.

Project start up date: May 27, 1986.

Project Assistance Completion Date: September 30, 1989.

Project Goals:

This sub-project is aimed at increasing the amount and dependability of food production in Chad. More specifically, it is aimed at increasing agricultural food production in the Ngouri sub-prefecture through introducing improved pump systems, improving traditional agricultural practices, and strengthening SODELAC's extension capabilities.

Project Purposes:

- A. To increase wadi food production in Ngouri subprefecture while maintaining or improving soil fertility.
- B. To identify models for increased wadi food production that are replicable under similar conditions.

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## I. SUMMARY AND CONCLUSIONS

The ORT Lake Chad Agricultural Development and Farmer Training Project is a three year activity with a USAID funding level of \$2,592,000. The sector goal of this PVO/DI sub-project is to increase the dependability of food production in Chad. The project has a dual purpose, (i) to increase wadi food production in the Ngouri sub-prefecture while maintaining or improving soil fertility, and (ii) to identify models for increased food production which will be replicable in similar conditions. The GOC implementing agency for the project is the Ministry of Agriculture and Rural Development, more specifically its Société de Développement du Lac (SODELAC).

ORT had no operational base in Chad prior to the signing of the Cooperative Agreement; as such, there were some delays in providing some of the inputs. This in turn resulted in a slower than expected rate of accomplishments for the first year. The construction of an office complex and a residence in Ngouri have yet to be finished, and, as yet, there is no radio contact established between the N'Djaména head office and Ngouri. On the other hand, three of the long term TA staff have been in Chad since Summer 1987; the Rural Works Engineer came in October. Short term TA provided to date has, in general, been of good quality.

The scheduled training of ten or so SODELAC agents has not yet taken place. This is in part due to ORT's early difficult relationship with SODELAC and the problems involved in identifying candidates. The ORT-SODELAC relationship has yet to be fully resolved, but it seems likely that five or so SODELAC agents (including the two currently assigned to Ngouri) will be sent to Senegal for training as initially planned.

In general, ORT needs to reexamine and redefine the participant training component of its project in light of its first year's field experience. It is suggested that they use some of their resources to hire and train locally a number of Chadians who will assist the team members in their respective activities.

The ORT Agronomist has successfully demonstrated the advantages of a number of techniques. For example, the use of furrows, as opposed to growing cops on 80 by 80 cm. square plots, resulted in much higher yields. Farmers seem to be receptive to and appreciative of the small but significant new technologies he has introduced. An impressive amount of technical data has been collected and, when analyzed, should provide ORT with the ability to make better technical and management decisions.

The pump program, on the other hand, has experienced some serious difficulties. The Pump Specialist has not developed any pump technology that has been adopted by the farmers. The

search for improved pump technology has gone beyond the limits of pump types suggested in the sub-project proposal, and investigations have covered a wide range of additional pump varieties. These investigations led to the conclusion that the varieties examined were, in general, unsuitable to the conditions of the area. The ORT team has, nevertheless, conceptualized a method of combining a below ground piston mechanism in a PVC pipe with the rocker mechanism of the traditional shadouf, which is a promising technology for human powered water lifting. The evaluation team recommends that concentrated effort be expended in the development and extension of this idea. The method of tapping the confined aquifers of the region should also be further refined and utilized by the Rural Works Engineer. Dissemination of motor pumps in the area is not recommended at present. Testing and demonstration of motor pumps should be limited to existing commitments.

At this point, ORT's activities have not yet brought any new land into production, as their efforts have been focused on improvement and intensification of agricultural production. In the medium to long run, improved agronomic and water management practices may result in cropping of new acreage in existing wadis. In general, land is not a constraint in this area. There is some evidence, however, that groundwater depth has been increasing in a statistically linear fashion since about 1963; in areas with a shallower water table, there have been problems with recharge of wells. This implies that, all other factors being equal, new land will generally not be available for potential production because of the present limitations of shadouf type water lifting technology, unless:

- (i) water lifting technologies can be improved,
- (ii) better water conserving technologies can be adopted, and/or
- (iii) the lower regional aquifer can be tapped to improve water quantity in wadi wells.

The ORT team is working on all three fronts, with some notable success in improving traditional techniques of tapping the confined aquifers in the wadis of the Ngouri area.

## II. RECOMMENDATIONS

The following recommendations specific to the ORT Lake Chad Agricultural Development and Farmer Training Project were jointly agreed upon by the members of the PVO/DI evaluation team.

It is recommended:

1. That the PACD for the ORT project be extended for one more year, until September 30, 1990. Such an extension would allow enough time for the ORT team to develop or adopt and disseminate improved water-lifting and agricultural practices throughout the Ngouri area.
2. That the ORT team should adopt and extend the animal traction water-lifting system, the dalou, introduced by Africare in the Ouaddai.
3. That the ORT team should perfect the hardware for the innovative idea of combining the piston mechanism in a vertical tube (or tube well) with the traditional shadouf.
4. That ORT should make a concerted effort now to extend interventions that exist and work, e.g., furrow planting, manure application, improved canal layout, and tapping of the confined aquifers.
5. That ORT purchase a data base management software package; hire, either locally or from abroad, a consultant to adapt it to project needs (analysis of socio-economic and other technical data); and train project personnel in its use.
6. That ORT continue testing of soil and water chemistry so that, by the PACD, solid conclusions can be established regarding the impacts of the different interventions.
7. That the ORT team stake, measure, and monitor dune movement in the Ngouri region before any dune stabilization program is undertaken.
8. That ORT continue and deepen its collaboration with CARE regarding Kanem interventions and data collection.
9. That an agreement be reached among ORT, the Water and Forest Service, and SODELAC with regards to the agroforestry program. Such an agreement should spell out the responsibilities of the respective parties and insure that a competent Chadian will be available to manage the central nursery at Ngouri. If this is not done, the team questions the viability of the agroforestry component of the project.
10. That ORT work out a contract with SODELAC as soon as possible. The project's success is in part dependent on the participation of SODELAC agents in all project activities. It is also important that an arrangement with SODELAC be made to acquire more manpower and to identify the five to ten agents who will be sent to Senegal for training.

11. That ORT suspend, for the time being, the follow-up health effects study proposed in the Cooperative Agreement until such time as any reasonably foreseeable adverse health effects are likely to materialize as a result of project interventions. By the same token, ORT should not, at this time, develop a primary health program as called for in the health consultant's report.

12. That ORT undertake a special study of the credit situation in the Ngouri region utilizing, among others, the socioeconomic data collected by the project.

13. That ORT's future efforts to extend the technical packages into new wadis not outstrip the project's managerial and extension capabilities.

### III. INPUTS

#### A. Inputs Financed by AID

##### 1. Technical Services:

a. Long-Term Technical Assistance. The ORT Cooperative Agreement (henceforth CA) specified that ORT is responsible for recruiting a four person long-term technical assistance team that includes: a Chief of Party (36 person-months); an Agronomist (33 person-months); a Rural Works Engineer (30 person-months); and a Pump Specialist (18 person-months.)

The project now has its full complement of long term technical staff. The Chief of Party arrived in N'Djaména on May 27, 1987; the Agronomist came to Chad on June 16, 1987 and after a brief orientation stay in N'Djaména went to Ngouri where he has been installed. The Pump Specialist arrived July 15, 1987. He is permanently installed in N'Djaména where the pump shop is located and makes regular visits to N'gouri. The Rural Works Engineer arrived in Chad on October 5, 1987 and went immediately to Ngouri.

b. Short-Term Technical Assistance. The CA provided for 17 person-months of short term technical consultancies.

(1) A Social Scientist was hired from June 1 - July 9, 1987, to conduct a preliminary survey in the Ngouri area; the purpose of the survey was to identify five pilot wadis for the project and to establish the guidelines for collecting socioeconomic data. The same Social Scientist was hired again for one week in February, 1988, while she was in-country on another assignment, to analyze social data. A report of the initial survey is available.

(2) ORT originally programmed an unspecified number of person-months for an "Environmental/Soils or Market

Specialist". This was allotted to an Environmental/Soils Specialist, a British national with a Ph.D in ecology, who was hired for the period July 29 - August 26, 1987. Review of the study and chemical analysis he prepared indicate that the quality of the consulting services provided was excellent.

(3) The Project Paper had an unspecified number of person-months of short term forestry consulting services plus four person-years of PCV forestry services. The first one month tranche of forestry TA was appropriately delayed to the period of December 1987-January 1988 to coincide with the arrival of the two PCVs to Ngouri in early January 1988. The second tranche of the forestry TA is planned for the third year of the sub-project to provide advice and assistance to the PCV foresters in light of accomplishments to date. It appears that the effectiveness of the first tranche forestry TA was reduced somewhat by his minimal experience with as arid an environment as Ngouri's. This should be corrected by obtaining the services of a forester with substantial experience in similar types of wadi systems in the Sahel for the second tranche short term TA. There is a sizeable international pool of such expertise available.

(4) ORT originally proposed that a Health Specialist "determine baseline health conditions prior to project interventions," and that a second survey "follow a year later to determine the health effects of project interventions." The baseline conditions were established by Dr. Alfred Buck in a study financed by AID/Washington through the Vector Biology and Control Project (936-5948). It is recommended that the follow-on effects study be suspended until such time as any truly and reasonably foreseeable adverse health impacts of the project appear likely to materialize. This is because adverse health impacts do not in fact appear to be a likely result of current project interventions. It is also unlikely that any documented changes in health conditions between the first and later years of sub-project lifetime could be unambiguously attributed to project interventions. Related to this issue, ORT had proposed 24 person-months of PCV assistance in the health field. At this time, these services are considered "unlikely to materialize"; this is not considered to represent a significant shortcoming of the project for the reasons cited above. If, in fact, adverse health impacts appear likely to result from project interventions, additional assistance should be brought in to assess the problem and remedial measures should be undertaken as appropriate.

2. Participant Training. The CA called for:

a. Short term training at the ORT/DDA Training Center in Senegal for approximately ten SODELAC agents participating in the project.

b. Training for a SODELAC agent, a pump specialist, and a village leader in pump and tubewell mechanics in Bangladesh or another third country.

The participant training program has not started yet. This is in part due to the project's early difficult relations with SODELAC. While the situation with SODELAC may have improved, ORT has now to wait until the end of the rainy season to send the agents to Senegal for training. ORT expects to do so next October; until then, it hopes to be able to recruit two more agents to bring up the total to five. To date, there are only three SODELAC agents working with ORT including the counterpart of the Agronomist.

Having tested the Bangladesh pump, ORT's Pump Specialist decided that it was not technically or economically suitable for the Ngouri area. Training in Bangladesh has, therefore, been dropped; ORT is meanwhile exploring the possibility of doing the training in a nearby Sahelian country that has developed a suitable pump and water management system.

3. Commodities. The Agreement specified purchase of the following commodities:

- 3 pickups
- 2 station wagons
- 1 five ton truck
- Spare parts
- Shop equipment
- Supplies
- Soil testing equipment
- Forestry supplies

ORT has so far purchased four pickups and one station wagon; pickups were deemed to be more suitable to the terrain. The original agreement specified a two wheel drive truck which ORT is now unlikely to purchase. It would have been useful during the establishment of activities in Ngouri. ORT has also bought a motorcycle for transportation in N'Djamena and an IBM PC-AT microcomputer; a second microcomputer has been ordered.

4. Construction. The CA called for:

- (1) Renovating the SODELAC Office and residence in Ngouri.
- (2) Building a new residence, nursery, and warehouse in Ngouri.

The SODELAC office and residence in Ngouri proved to be in very bad shape and did not warrant the investment in repair. ORT is

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now in the process of constructing an office, two residences, and one storeroom on SODELAC land. They have also constructed a nursery in a nearby wadi on land ceded to ORT by the local canton chief. There is, as yet, no warehouse for the nursery.

It would have been useful if the USAID Mission Engineer had been consulted about the construction plans and had been able to inspect building progress from the laying of foundations. Although not required, as is the case for non-PVO projects, this could have provided valuable technical input.

5. Project Support: Project support was to include:

- 2 Administrative Assistants
- 1 Bookkeeper
- 2 Secretaries
- Surveyor
- Shop supervisor
- Driver/mechanics
- Security Guards

Most of these positions have now been filled; there is, however, no secretary available in Ngouri and the position will be difficult to fill given the low level of literacy in the region. As the Ngouri shop is not yet set up, ORT has not hired a shop supervisor. ORT contracted with the GOC's Génie Rural (Rural Engineering Service of the Ministry of Agriculture) for the services of a surveyor.

B. Inputs to be Financed by ORT (\$603,500)

The Agreement calls for ORT to finance approximately 20% of the total cost of the project and to seek external sources of financing for a credit program and health related activities.

ORT's contribution to date has been the payment of home office overhead expenses, as well as the collection of relevant technical documentation from the ORSTOM library in Paris. This totalled \$175,451 through February 29, 1988.

ORT has also submitted a request to Band Aid/Live Aid for approximately \$230,000 to fund the credit component and other activities.

C. Peace Corps Inputs

The CA called for 12.5 person-years of services of 6 PCVs.

The original memorandum of understanding between the Peace Corps and ORT, signed January 8, 1985, called for the assignment of 6 PCVs to Chad to work under the auspices of ORT since there was

no Peace Corps program then in Chad. This was renegotiated with the Chad PC Representative upon her arrival in N'Djamena in May 1987.

Two PCV foresters arrived in Chad on January 5, 1988 on an extended third year assignment. One of these found it difficult to adjust and left Chad on April 9, 1988. The other forester is in Ngouri. Two more PCVs are scheduled to be assigned to ORT: one pump technician (currently in training by the PC in Chad) will join the ORT team on May 22, 1988. The other, a well construction improvement engineer, is scheduled to arrive from Zaire in October, 1988. The PCV pump technician's assignment is for two years; the water improvement engineer's for one. Should the project be extended, ORT plans to ask for additional PCVs in the forestry sector.

D. Budget:

The Agreement specified the following breakdown for USAID inputs:

Technical Services	\$ 913,000
Participant Training	\$ 69,000
Commodities	\$ 566,000
Construction	\$ 160,000
Project Support	\$ 649,100
Contingency/Inflation	\$ 235,700

So far, expenditures of AID funds have amounted to approximately \$596,000 out of the \$ 2,592,800, leaving an unexpended balance of about \$2,000,000.

IV. PROJECT OUTPUTS:

The ORT project was designed in terms of two overlapping yet distinct phases. The first, encompassing approximately the first twelve months of the project, was to concentrate on establishing the operational base for project activities, collection of baseline data, testing of techniques and technologies, and establishing the capabilities for the second or dissemination phase. The emphasis during the second phase would be on extending to farmers the technological packages identified and developed in phase one. A brief discussion of phase one of the project in terms of outputs identified in the CA follows:

A. Establishment of Operational Base

The ORT office headquarters was set up in July 1987 in the SODELAC compound in N'Djaména. There is, to date, no radio communication with the Ngouri office, but that is expected to be established by the end of June 1988. All the vehicles and support staff are in place in the N'Djaména office.

Progress at Ngouri has been slower than at N'Djaména. The SODELAC office and residence there were deemed to be too expensive to repair. Instead, ORT undertook construction of an office/storeroom complex and two staff residences. One residence, that of the Agronomist, has been completed. Construction of the office and second residence has been delayed due to problems in receiving commodities and contractor inefficiency. ORT expects to have the work completed within the coming two months.

As discussed in Section III.A.4. above, it is suggested that construction plans be approved and progress inspected by the USAID Mission Engineer.

#### B. Collection of Baseline Data

The Social Scientist who was hired by ORT in June 1987 conducted a quick survey in the Ngouri area; the purpose of the survey was to identify five pilot wadis (later a sixth was added) for the first year of the project. The report, Irrigated Agriculture: Farmer Training Baseline Social Survey, provides a general survey of the socio-political organization and farming systems of the targeted population. Moreover, and with the help of the project Agronomist, the Social Scientist worked out the general guidelines for the collection of socioeconomic data. A questionnaire was developed and left with a Chadian assistant who was trained and charged with the monthly collection of data. When the Social Scientist was in Chad in February, she reviewed the assistant's work and found it unsatisfactory. She then revised the questionnaire and entrusted it to the Agronomist. As such, it is too early to assess the utility of the data being gathered on the social impact of the project.

The weekly questionnaires cover data on household and expenditures for agricultural and non-agricultural activities, inventory of land holdings, livestock and other assets, and marketing activities. The project is also keeping weekly records of crop and food prices at the nearby Dibinetchi and Djigidada markets, the largest in the Ngouri area. These data will be used to:

- (i) identify periods of relatively low income, which will then be addressed by changes in cropping techniques and the agricultural calendar,
- (ii) assess the role of wadi production in the villagers' overall production system, and
- (iii) identify the villagers' most important expenses for targeting by the credit program.

The Agronomist is working with enthusiasm and direction; one problem, however, is that more data have been collected than can be analyzed manually, which is the only means available at Ngouri. The ORT office in N'Djaména, on the other hand, has an IBM PC-AT which could easily handle the necessary analysis. It is therefore recommended that ORT purchase a data base management software package and hire, either locally or from abroad, a consultant to adapt the software to project needs as well as train the Agronomist in its use. The Agronomist and other technical personnel could then come to N'Djaména periodically to enter and analyze the socioeconomic and other technical data. Without this computerization, it is unlikely that the data will be of use in evaluating the effectiveness of project interventions or establishing the proposed credit program.

### C. Improved Waterlifting Technologies Introduced, Tested, and Adopted

ORT has recruited an impressive team of young, energetic, and talented individuals. However, this team has, so far, not succeeded in producing an alternative pump technology which is both more efficient and no more costly than the traditional shadouf. The problem is not with the qualifications of team members or their level of effort, nor is it with the quality of material resources available to them. The problem is rather with the unrealistically formulated targets.

The ORT proposal called for tests of a number of different waterlifting devices:

- (1) Rower pumps, utilizing a piston mechanism in a PVC pipe, have been introduced at two locations but they are being utilized only occasionally, if at all. They have not replaced the shadouf as the primary irrigation mechanism.
- (2) The Bangladesh treadle pump is considered to require fabrication techniques for manufacture that are beyond the capabilities of existing workshops at N'Djaména. Therefore, no tests have been conducted.
- (3) The rosary pump was tested at the main Water and Forest Service nursery at Ngouri.
- (4) The traditional shadouf was studied in order to quantify its production potential. The output of the shadouf is, however, extremely variable since it is based on the geometry of the individual installation, the depth of water, and the strength and skill of the farmer. The project has so far expended considerable effort in trying to determine the average production of the shadouf, with the apparent conclusion that the efficiency of this system has been highly underrated.

(5) Motor pumps will also be introduced to one farmer in each of the project wadis, and their use monitored, as suggested in the ORT proposal. The advisability of further dissemination of this technology at present is questionable. Despite local farmers' expressed preference for motor pumps, widespread dissemination seems to be impractical both financially and technically. It is unlikely that this technology can be maintained or sustained, let alone replicated. It would be very difficult to sustain even simpler diesel powered pump technology. Portable pump units will have to be carried home every night and remounted every morning; gasoline is likely to be only periodically available locally. Maintenance and repair can only be achieved by sending the unit to Nigeria. Some better off farmers in the area apparently already possess this technology. As such, they do not constitute the primary targeted population of the project. The only plausible reason to continue with the introduction of motor pumps would be to obtain the necessary cooperation of the local population and administrators. Careful evaluation of the costs and benefits must be done before disseminating this technology as it is unlikely that motor pumps will prove to be replicable or sustainable in the Ngouri region.

(6) Team efforts were also directed at the development of alternative pump component fabrication techniques.

This diffusion of effort has led the team to invest too much time and effort in investigating a wide range of pumps and has prevented them from concentrating on those items/technologies that might have positive payoff potential. In other words, the search needs to be more narrowly focused on results and not on replicability in this case.

It appears unlikely that the team will find a pump technology which is more productive and efficient than the shadouf, without being more expensive. A suggested alternative goal is to develop a water lifting technology which builds on and improves the shadouf and has the low recurrent cost of that traditional technology. ORT could capitalize in the initial phase these more efficient pumps and get the technology to the farmers. Such technology would allow the farmers put more land under cultivation and weather periods of food shortages. One such idea is to mount the rower pump vertically and attach the piston mechanism to the traditional rocker mechanism of the shadouf. This has efficiency improvement potential and should be further investigated. The fact that it could be operated in the traditional manner would make it more attractive to farmers than other alternatives. ORT could also assist the farmers by subsidizing the initial cost of proven technology.

Another promising improvement in wadi farmers' water supply which is being developed by ORT is the tapping of what is thought to be a regional aquifer by driving tubing through the

impervious confining layer. This has been shown to be an effective method to increase the supply of water in certain wells. This work is commendable and should be continued. Concurrently, the water from this aquifer should be periodically tested and monitored to insure the maintenance of water quality, as suggested in the sub-project proposal.

The project should also focus on such "low-technology" interventions as improved canal layouts, which seem to have considerable potential for increasing production at an affordable cost to farmers.

The project could benefit from the use of modular units in all major activities, ranging from pump technology to field layout and building construction. This will save time on the learning curve and provide economies of effort and scale.

D. Pump Maintenance Training Given to Farmers, and Local Pump Manufacturers Assisted in Starting Businesses

No basic extendable improved pump technology has as yet been developed. Consequently, no maintenance training has been given to the farmers. However, five motor pumps have been purchased by ORT. Distribution and utilization is scheduled to take place after the five volunteers selected to receive the pumps finish a short (one week) training session at the CARE pump shop in Bongor.

The ORT team does not deem it reasonable at this juncture to involve local manufacturers since no technological package has yet been identified to introduce and extend into the project area. No effort has, therefore, been directed at local entrepreneurs and no credit arrangements have been attempted.

E. Monitoring of Impact of Wadi Irrigation on Human Health and the Physical Environment

The CA and the amended IEE required ORT to:

- (1) monitor soil and water salinity in appropriate locations throughout the life of the project;
- (2) technically evaluate methods of managing soil salinization in at least one of the internally drained wadis; and
- (3) conduct a survey of human health impacts of interventions if they become involved in "flooding of outlying depressions for recession agriculture" to determine the need for provision of prophylactic drugs or drugs to treat potential increases in water-related disease incidence rates.

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No other monitoring was required, including monitoring of water logging of groundwater drawdown.

Baseline salinity and other soil and water chemical and textural conditions were established by short term TA in July-August 1987, using soil and water testing equipment delivered in July 1987. Ongoing testing has been conducted by the rural works engineer and agronomist since that time. This testing and monitoring program has addressed hydrological, pedological, agronomic, topographical, and meteorological parameters, and is currently considered to be adequate to ultimately measure and evaluate the impact of wadi irrigated agriculture on the physical environment in the five/six wadi sites. The ultimate impact of the interventions should be assessed by ORT, including a full technical discussion of the data, data collection methodologies, and data quality during the last year of the project.

ORT does not currently expect to become involved in "flooding of outlying depressions for recessional agriculture" and, therefore, no health monitoring was required. Nonetheless, a health impact study was conducted in May-June, 1987; the final report made a number of recommendations related to the development of a primary health care program.

The establishment of such a health component is not recommended at this time unless project interventions are found to substantially and adversely affect local health conditions or unless ORT desires to undertake such a program and proposes a solid rationale for expanding the scope of its activities. Instead, it is recommended that ORT focus on the principal objectives of water management and increased agricultural production and the development of a technological package which is replicable and sustainable, rather than dilute its efforts by involving itself in activities which are peripheral to the major thrust of the project.

Pursuant to the provisions of 22 CFR 216, ORT is authorized to procure and use pesticides but only "for research or limited field evaluation purposes by or under the supervision of project personnel." Such use may be for either protection of trees or for production of food or fodder crops. Should ORT use pesticides under these conditions, they must ensure that "the manufacturers of the pesticides provide toxicological and environmental data necessary to safeguard the health of research personnel and the quality of the local environment in which the pesticides will be used." Toxicological data were available to ORT at the time of the evaluation, as provided by the manufacturers, for most of the compounds that ORT has been interested in using.

Should ORT decide to treat crops which will be used for human or animal consumption, however, they are authorized to use only pesticides for which "appropriate tolerances have been established by EPA or recommended by FAO/WHO." Further, the "rates and frequency of application, together with the prescribed preharvest intervals, (must) not result in residues exceeding such tolerances." ORT should make sure that either the national crop protection service or the distributor or USAID/Chad has such data available and should ensure that residues do not indeed exceed those tolerances.

In the event that such tolerance data are not available from any of the readily available sources, ORT should request of USAID/Chad to forward a cable directly to AID/W/S&T/AGR Attention: Carroll Collier and request information and clearance for use of the target compounds. Information which should be contained in the cable includes the compound name, the target crop species, the target pest organisms, the form and concentration of the compound recommended, and experience with the compound by the national plant protection service.

ORT is authorized to use those specific compounds for those specific uses for which USAID/Chad has obtained clearance from AID/W, including but not necessarily limited to the following:

Warfarin (rodents);

Fenitrothion and Decis, provided that the specific labelling of the products to be used is furnished to the REO, REDSO/WCA;

Dimethoate, provided that impermeable gloves are worn, boots or boot covers are worn, long-sleeved shirts and long pants are worn, a wide-brimmed hat is worn, and respirators are worn by any flaggers and mixers/loaders;

Actellic as a seed treatment;

Thiram used by itself without heptachlor;

Phostoxin provided that a training component is implemented before this seed storage protectant is used.

To the extent practicable, the national crop protection service should be used to procure and use pesticides rather than ORT. Again, however, ORT is authorized to procure and use pesticides for research or limited field evaluation purposes by or under the supervision of project personnel provided that the conditions above are met.

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#### F. Salinization Monitoring

The principal short and long term effects of ORT's interventions were predicted during a 1987 environmental review to include:

- (1) increased wadi salinization throughout those areas of the wadis where groundwater is applied to surface soils for crop production;
- (2) increased and largely irreversible salinization in areas closest to the center of the wadis where maximum groundwater depth is less than 1.5 meters;
- (3) increased salinization in areas where maximum groundwater depth is between about 1.5 and 3.0 meters which will likely persist, and therefore cause steady declines in agricultural production especially in the absence of application of sufficient water to leach these salts annually and/or remove salts from the upper soil profiles; and
- (4) temporary annual increases in salinization where maximum groundwater depth is more than 3.0 meters, and where stable agricultural production can occur given sufficient annual application of water to leach salts into the lower soil profile and out of the crop root zone.

Increased salinization or "natronization" has already been observed in the target wadis by both the short term TA who conducted the baseline soil/water physiochemical study, and by the ORT technical personnel as noted in their quarterly reports. The ORT team will continue to monitor this development; the results of this monitoring should be evaluated in light of the various interventions actually taking place in the five test and one control wadis. They can then be measured against the predicted effects during the final year of the project.

Monitoring and evaluation of the effects of agriculture on soil and water chemistry is one of the most critical technical aspects of agriculture in these hydrophysiological units. This will largely determine whether, where, and to what extent replication of these efforts is technically appropriate.

One indicator of the potential impact of salinization on crop production is reflected by the ORT's agronomist's experiments with inserting a sand layer under the surface soils used to produce wheat. This clearly does not appear to be a replicable or adoptable intervention at the present time, but the very preliminary results were said to be extraordinary with an increase in production of from 1.2 to 4.0 tons/ha being reported. While these results should be viewed with extreme

caution, it does appear now that the only major variable that was isolated here was salt quantity. If in fact similar results are shown to indicate a reduction of production by even half due to presence of salts in the upper horizons, then much greater concentration should be placed on salt control or salt impact mitigation.

As noted in the March 1987 report of the Regional Science Advisor, REDSO/WCA, decline in yield potential of Kanem crops is rapid as soil salt concentration increases, even when salt levels are relatively low. Most wadi salts appear to be concentrated in the soil rather than in the water (as well water conductivities are generally below 1000 micromhos). Efforts should therefore be targeted at salt leaching or removal from the upper soil profiles. There are, of course, other agricultural limiting factors in the soils which should also be considered and addressed. In the absence of future inputs, such as fertilizers and manure, the increasing decline of a number of these nutrients can be expected to continue. This has definite implications for the long term sustainability of cropping in these internally drained systems, although sustainable cropping in the mid term appears to be clearly evidenced by the presence of cropping for three generations in certain of ORT's target wadis. It is, therefore, extremely important that soil and water chemistry testing continue so that by the PACD solid baseline and impact conclusions can be statistically drawn.

#### G. Agroforestry Program:

ORT's activity in the agroforestry sector to date consisted in (a) the hiring of a short term (one month) consultant to draw up an agroforestry program for the Ngouri region, and (b) approximately six person-months of PCV assistance. As noted earlier, the TA's report reflects his limited experience with Sahelian and wadi agroforestry; also, one of the PCVs terminated after two months in-country.

ORT's agroforestry priorities are currently a) establishment of central and small scale wadi nurseries; b) germination and dissemination of fruit trees; c) windbreaks; d) dune fixation. As of May 1988, accomplishments include the following:

- (1) Ten separate village nursery groups were established in the six project wadis to tend nurseries with an approximate total of 7,500 pots. The central nursery at Ngouri has 16,000 pots of which approximately 1,200 are reforestation species and 4,000 are fruit trees. The central nursery has not been completed and lacks a warehouse.

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(2) Three SODELAC counterparts were trained in nursery activities.

(3) Several wadi farmers are now capable of raising seedlings independently.

ORT's Year 2 plans include a nursery campaign targeting the project's new wadis.

The project's delivery of seed and tools constituted the first tangible benefits of the project and, in general, farmers have shown great interest in fruit trees. Despite some initial problems that necessitated reseedling in two of the wadis, it now seems likely that the six wadis (ten nursery groups) will successfully produce from 800-2,000 trees. Anywhere from one to five years, however, are needed before one can assess the ultimate success of the program as this will depend on survival rates, fruit production, and the continued raising of seedlings.

The current PCV forester is scheduled to leave Chad in January 1989. The PC will not replace him with a two year volunteer unless the project is extended beyond its current PACD of September 1989. An agroforestry coordinator/supervisor will be needed in Ngouri to ensure that the nursery workers will be fully versed in all aspects of nursery operations.

Privatization of the central nursery has been proposed. This is a doubtful proposition at this point; proceeds from the sale of Year 1 fruit trees, however, should provide a better idea of the potential success of privatization. One alternative would be to turn the central nursery over to the Water and Forest Service and to find some funds to subsidize its operating costs (e.g., food for work, salaries for workers, Red Cross material support). The Water and Forest Service have its own nurseries in Mao and Bol, but according to the ORT forester these are inadequate to meet local demand. Meanwhile, the Water and Forest Service has announced its intention to establish a nursery at Ngouri. This would seem to be an unwarranted duplication of effort and an inefficient deployment of scarce resources. ORT and the Water and Forest Service need to work out their relationship and better coordinate their efforts in the agroforestry sector.

At this point, it is unrealistic to expect any significant increases in agricultural production to ensue from ORT's agroforestry program although some improvement over and above a "no action" scenario can be expected. On the other hand, it is difficult to do much harm with these types of interventions.

With respect to dune stabilization, there is some technical question as to the actual extent of dune movement in the ORT area. Some dune movement was observed during the site visits,

but in general this appears to be far less significant than is the case in the Mao and Nokou areas.

The ORT team noted that they intend to do some dune staking to quantify dune movement, and this should definitely be undertaken. They should also continue and expand their collaboration with the CARE team to identify lessons learned to date in this sector in Kanem and Lac Prefectures (e.g., shortfalls in dune stabilization activities in the north, species distributed, acceptance and survival rates.)

#### H. Testing and Adoption of Improved Agricultural Techniques

The Agronomist arrived in Ngouri on June 19, 1987 and by mid-July had selected volunteer farmers in five wadis to undertake the experiments. These were selected according to the following criteria:

- (a) The farmer must own his land.
- (b) The farmer's main activities must be crop production in the wadi.
- (c) The farmer must be working in his own field full time.

Once the farmer selection was completed, five prototype pumps were to be introduced. Each participating farmer was to use one prototype on his field. At the end of a growing season, data collected on participating farmers were to be analyzed and conclusions drawn on the effectiveness and cost efficiency of the pumps. Problems and delays with pump design resulted in the completion of only two prototypes. When these two mechanical pumps were introduced, the farmers deemed their performance to be significantly less than the shadouf and, as a result, rejected them.

The Agronomist conducted a series of on-farm trials on plot size, spacing arrangements, manure application, and dates of planting. On all accounts, yields obtained from demonstration plots were significantly higher than yields obtained on farmer plots. Once the participating farmers saw that the outputs were far superior to their own, they adopted the innovations without much difficulty. It is worth noting that none of the above mentioned technologies involve any radical changes in inputs or techniques and, as such, their adoption was much easier than could have been realized had a more advanced innovation been used. However, given the experimental nature of the project, adopting a new technology in one cropping calendar is excellent. Data on socioeconomic activities were also collected to determine the proportion of income secured from these adoptions and the impact on the well being of the individual

farmers. The agronomist already has a huge amount of data which have yet to be fully exploited to clearly separate and quantify each discrete activity. These data should be analyzed as soon as possible to guide the next interventions.

The Agronomist is also working to improve and expand the varieties of crops grown in the wadis, which include onions, okra, tomatoes, eggplant, pepper, cassava, sorghum, and millet (ligi). The major cash crop in the wadis is onions; farmers sell their onions in nearby markets and to merchants who transport them to more distant markets. Okra is the second most important crop in the area; it is harvested over an extended period, dried and sold in the market. It provides a small, but steady income for the farm family. Tomatoes, peppers, eggplants, and the newly introduced carrots are considered less important.

At this point, ORT's activities have not yet brought any new land into production as their efforts have been focused on improvement and intensification of agricultural production. In the medium to long run, improved agronomic and water management packages may result in cropping of new acreage in existing wadis. In general, land is not a constraint in this area. There is some evidence, however, that groundwater depth has been increasing in a statistically linear fashion since about 1963; in areas with a shallower water table, there have been problems with recharge of wells. The implications are that, with all other factors being equal, new land will be removed from production potential given the present limitations of shadouf type water lifting technology unless:

- (1) water lifting technologies can be improved;
- (2) better water conserving technologies can be adopted; and/or
- (3) the lower regional aquifer can be tapped to improve water quantity in the wadi wells.

The ORT team is working on all three fronts with some notable success in improving the traditional techniques of tapping lower aquifers in the immediate Ngouri area. There is also evidence that a number of wadi farmers have been doing shadouf type wadi cropping for at least three generations in the Ngouri region; there is, however, little incentive for new farmers to move in unless groundwater depth is less than about six meters.

#### H. Credit Program

Contingent on the availability of supplementary funding, ORT had proposed to establish a credit program to enable entrepreneurs to obtain the necessary tools and supplies to manufacture pumps. A second credit program for agricultural production was also to be established for Ngouri farmers.

The establishment of a credit program for pump manufacture is in abeyance. The project has neither developed an acceptable pump prototype nor has it identified Chadian entrepreneurs interested in manufacturing pumps. Nevertheless, ORT has reached an agreement with VITA for lending to a potential pump manufacture under the latter's private enterprise credit program. VITA's rigorous loan criteria may discourage some potential manufacturers.

As for a credit program for agricultural production in the Ngouri area, ORT has requested approximately \$130,000 from Band Aid/Live Aid. This program would establish in each project wadi an approximately 500,000 FCFA revolving fund which would be managed by a committee selected from the wadi farmers. ORT hopes that this approach would increase repayment rates by relying on peer pressure rather than outsiders, that it would enhance the ability of farmers to reach group decisions on matters of common concern, and that it would reduce the program's overhead. Loans would be made to individual farmers for purchase of agricultural production inputs such as seeds and well construction materials. Solvency of individual revolving funds would be assured by requiring realistic interest rates or user fees, as well as limits on the total amount of outstanding loans and strict adherence to repayment schedules. Equitable distribution of credit would be achieved by setting ceilings on the amount of individual loans to prevent "crowding out" by wealthier or better connected farmers. In addition to the revolving fund in the wadis, ORT proposes to set up a special loan fund for agriculture related activities by entrepreneurs, merchants and blacksmiths in the project's zone. ORT plans to hire two Chadian credit specialists to manage the credit program, as well as a short term expatriate consultant to set up basic procedures and train the local personnel at the activity's onset.

Because of the considerable lead time required for approval of Band Aid/Live Aid funding, ORT has submitted this request before analyzing the available socioeconomic data collected in the wadis. As such it relies on some large assumptions and, once in implementation, could prove uneconomic. If Band Aid/Live Aid approves the proposal, actual implementation of the credit component should wait for analysis of socioeconomic and technical data from one complete growing cycle. Of particular concern are the results obtained from the pump tests, as well as analysis of marketing data. Other areas of concern that must be addressed are:

- (1) The farmers' ability to service additional debt.
- (2) Availability of markets for crops whose production would be financed by ORT credit program.

(3) The farmers' attitude towards an externally funded credit program. Will they really believe that a village managed revolving fund belongs to the village rather than to ORT?

(4) Farmers' ability to manage a village revolving fund. Their present patterns of lending and borrowing should be closely scrutinized in this context.

(5) ORT's capacity to oversee the program.

## V. PURPOSE

This sub-project has a two-fold purpose:

(a) To increase wadi food production in Ngouri subprefecture while maintaining or improving soil fertility.

(b) To identify models for increased wadi food production that are replicable under similar conditions.

Progress has been made towards some elements of both halves of this purpose statement. For example, the Agronomist has tested and had adopted by farmers in the five sub-project wadis yield-enhancing improvements in cropping techniques. Similarly, the development of new waterlifting technology incorporating a below-ground piston with an above-ground rocker mechanism is promising.

However, ultimate attainment of project goals will depend on two factors. First, data collection and analysis efforts will have to be continued, to permit medium term assessment of the effects of sub-project interventions on crop production, soil fertility, farm budgets, etc. Second, ORT must find a way to support, both administratively and technically, the planned expansion in its geographic scope, from five to twenty-five wadis. This will have to come through either improved collaboration with SODELAC, such as secondment of its agents, or an expanded ORT staff.

## VI. GOALS.

This sub-project is aimed at increasing the amount and dependability of food production in Chad. More specifically, it is aimed at increasing agricultural food production in the Ngouri sub-prefecture through introducing improved pump systems, improving traditional agricultural practices, and strengthening SODELAC's extension capabilities.

Progress towards attainment of the overall goal, "increasing the amount and dependability of food production in Chad," is difficult to assess this early in sub-project implementation. Of the three specific components identified in the statement, the most progress has been made in "improving traditional agricultural practices," as discussed in Section V. above. The component for "introducing improved pump systems" has had mixed results, although some innovations seem promising. Finally, "strengthening SODELAC's extension capabilities" has shown very little progress, due primarily to the difficult relationship between SODELAC and ORT.

ANNEX D

SUB-PROJECT REVIEW

PRIVATE ENTERPRISE PROMOTION IN CHAD

Implemented by Volunteers in Technical Assistance (VITA)

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May 1988

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## I. SUMMARY AND CONCLUSIONS

Implementation of the Cooperative Agreement (CA) for the Private Enterprise Promotion in Chad sub-project (PEP), signed by AID and VITA on September 9, 1987, and retroactively effective from February 24, 1987, has been more difficult than anticipated.

AID, VITA and the Government of Chad have provided on a timely basis all the inputs required by the CA and the sub-project proposal.

Progress towards attaining desired outputs, however, has been mixed. VITA has created a credit organization with a well-trained, motivated staff and established procedures for loan administration. Business and technical advice provided to clients is excellent. The technical assistance team has in addition prepared a thoughtful proposal for institutionalizing the program through creation of a Chadian credit PVO. However, reduced demand for loans from small/medium sized enterprises (SME) and low repayment rates from existing clients raise serious doubts as to the ultimate sustainability of any SME credit program in Chad. Although both new loan volume and repayment revenues have tumbled, administrative overhead costs have risen. For a loan volume of 35.0 million CFAF (\$122,800) since January 1987, VITA's overhead costs were 136.5 million CFAF (\$479,000), or a ratio of 3.9:1. These problems may in large part be due to general economic stagnation in Chad, which has also affected the operations of the local commercial banks. VITA is trying to turn the situation around by broadening its base of serious customers through more aggressive marketing, as well as by improving loan collection rates. The next year will therefore be a key test of the viability of supervised credit in Chad.

In contrast to the credit program's problems, VITA's initiative to develop export markets for Chadian fruits and vegetables looks promising. A project-funded Marketing Consultant identified French wholesalers potentially interested in Chadian produce and also recommended specific agronomic and commercial actions for penetrating this market. VITA put together and sent one trial shipment, which demonstrated the potential acceptability of Chadian produce on the Paris market. VITA proposes the creation of a "VITA Export Association" to take advantage of this opportunity, by providing local farmers needed inputs, technical advice and a guaranteed price and market for their crops. For VITA, the activity would enhance loan repayment rates, increase demand for new credit, and help cover administrative overhead. Many details of the export activity need to be worked out -- including its relationship with the existing credit program -- but it clearly merits implementation as soon as possible.

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If the export activity proves viable while the credit program's problems continue, redesign of the sub-project may be warranted, to reflect the new possibilities.

## II. RECOMMENDATIONS

- A. The project should be extended by 18 months beyond its current PACD of February 23, 1989, until August 30, 1990. This will allow VITA to test the effectiveness of proposed cost reduction and revenue enhancement measures, and also to implement the "Export Project". In the period of the extension there may also be an improvement in economic conditions, which may result in higher loan application and repayment rates.
- B. The "Export Project" for Chadian produce should be pursued as rapidly as possible, as a concrete effort to find new markets for local farmers. The financing of this activity and its relationship to the supervised credit program need to be clarified. Consideration should be given to financing start-up activities here from the undisbursed balance in the revolving loan fund. USAID, VITA and the GOC need to come to terms on how VITA can act as a commercial intermediary.
- C. If there is no significant improvement in the cost-benefit performance of the supervised credit program by mid-1989, steps should be taken to begin its orderly close-out.
- D. VITA should revise its interest rate and fee structure with the goal of enhancing revenues. Options could include charging fees for loan administration and advisory services, and charging different interest rates for different borrowers and different types of activities.
- E. VITA should recruit a consultant to conduct a survey of traditional and informal credit markets in N'Djaména and elsewhere. The aim of this study will be to find ways of increasing serious loan applications and improving repayment rates.
- F. The second expatriate position (Assistant Director) should be eliminated, with a Chadian recruited to serve as Assistant Director. This will both reduce administrative overhead costs and encourage greater integration of Chadian staff in project management.
- G. USAID/Chad should provisionally accept VITA's institutionalization plan. However, neither USAID nor VITA should make any firm commitment to third parties relative to this plan, pending evidence of improved financial performance by the supervised credit program and development of a macroeconomic environment in Chad that is more conducive to credit programs. (See also Recommendation C above.)
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H. Per U.S. Government environmental regulations and the provisions of the IEE in the sub-project proposal as approved by AID, all loan agreements must contain a clause prohibiting "use of loan funds for procurement or use of pesticides."

### III. BACKGROUND

#### A. Predecessor Activity -- Private Enterprise Project

The current project is the continuation of the "Private Enterprise Project" (PEP-1) implemented by VITA between March 1984 and February 1987. Total AID funding of PEP-1 was \$2.051 million, from the Africa Resettlement Services and Facilities Project, the African Private Enterprise Development Fund, and local currency generated by PL 480 sales. Under this activity, all of the basic structure of the supervised credit program was set up: procedures for evaluating credit applications and monitoring loans; recruitment of local staff; and recruitment of the two long-term advisers retained for the current project.

Through mid-1986, when PEP-1 was evaluated and the current project designed, the financial data showed an extraordinary success story for a new credit program working in very difficult conditions. As of June 30, 1986, PEP-1 had made 95 loans and had \$448,601 in outstanding loan commitments. Only 7% of this portfolio was in default or under litigation, and 75% of all due payments had been received. In addition, the cost of administering this activity was remarkably low: only \$1.60 for each \$1.00 lent. (This covered both "banking" and "advisory" costs, as well as both "local" and "expatriate" costs.)

Against this background, the current project was designed with very high expectations. Significant expansion of credit activity was believed both possible and desirable, and financial self-sustainability seemed possible within a foreseeable future.

#### B. An Aside on Subsidized Credit and Financial Performance

We should note here that making a financial profit has never been one of VITA's near term objectives for the supervised credit program. This is appropriate, as loans with assured profits will be made more efficiently by a commercial bank or moneylender -- and will not need the overhead of business advisory services provided by VITA. Subsidized lending and advice in the early years of a supervised credit program should yield economic benefits far beyond the financial returns to the project. Especially in an environment as difficult as Chad, these subsidies are unavoidable. They should be regarded as investments in the intangible assets of confidence and training.

However, after a certain point economic benefits and financial profits should dovetail; i.e., a financial loss by the

credit program will then be an economic loss as well. Thus, although profits per se should not be expected in a credit program's start-up phase, a trend leading ultimately towards profitability, or at least cost recovery, is a good indicator of the program's soundness and viability.

#### IV. INPUTS

AID, VITA and the GOC have to date furnished the inputs that the sub-project proposal called for. Inputs have been timely and of appropriate quality.

##### A. AID-Financed Inputs

1. Long-term technical assistance. Under the proposal, VITA was to recruit a Project Director and Assistant Director, each for 24 months. Both positions have been filled for all 15 months since the activity's effective authorization date. VITA continued in these positions the Director and Assistant Director who had been in country under the predecessor Private Enterprise Development activity, since May 1984 and October 1985, respectively. With their experience and knowledge of credit programs in Chad, the performance of both advisers has been very good.

The Director will return to the United States in late May 1988, with the current Assistant Director replacing him. VITA has not yet identified a new Assistant Director, as it has had difficulties in recruiting a qualified candidate for the nine months remaining under the sub-project's current authorization.

The two advisers have assumed three primary roles: reporting and other relations with financing agencies, including AID; logistical backstopping for credit and business advisory operations; and overall supervision of the sub-project's credit and business advisory programs. Day to day responsibility for loan activity and client relations is with the Chadian professional staff.

In light of the competence of the local staff and the largely administrative and liaison roles of the Project Director, it is questionable whether the Assistant Project Director needs to be replaced by another expatriate. Since the new Director will already have three years experience with VITA/Chad, he will face no learning curve. Instead, VITA should consider recruitment for the Assistant Director position of a Chadian with potential for eventually becoming Project Director.

2. Expatriate Consulting Services. VITA's proposal called for the provision over the sub-project's two year life of 11 months of consulting services in a variety of areas. Through May 1988 the following consultancies, totalling six and a half months, had been performed under AID financing:

- Agroforestry                    3 months (plus 3 months funded under the predecessor activity and 4 months funded by USA for Africa)
- Marketing                      2 months
- Computer Systems              1 1/2 months

The quality of these services has been good to excellent. The Agroforestry Consultant helped identify the major problems of VITA's agricultural clients and set up the Service Agronomique et Technique which institutionalized this problem-solving and consulting capability. The Marketing Specialist did a remarkable job in identifying potential export markets for Chadian agricultural products in France and Cameroon and in advising how to meet the requirements of these potential clients. (See Section V.E. below.) Finally, the Computer Specialist has created the shell for an integrated data base, using VITA's microcomputers, that will permit systematic analysis of loan clients and facilitate preparation of routine statistical reports. Implementation of his recommendations will begin in late May 1988.

At present, no other consultancies are planned, with the possible exception of a return by the Marketing Specialist. According to VITA, this is due to the slowdown in loan activities.

In the evaluator's view, VITA should consider additional consultancies, precisely because of the slowdown in credit activities. Specifically, a consultant should study the traditional and non-formal credit markets in the N'Djaména region, with the aim of finding ways of improving serious loan applications and repayment performance.

3. Commodity procurement. Commodity procurement has proceeded with no problems. VITA has purchased with AID funds three motorcycles and one standby generator on the local market, and one IBM PC/AT microcomputer system, with peripherals and software, in the U.S. The sub-project did not purchase the 4WD vehicle mentioned in the proposal because funds for this purpose were made available by USA for Africa; AID funds were reprogrammed for purchase of a generator following severe problems in early 1988 with the N'Djaména city power supply.

4. Use of AID Funds for Local Operating Expenses. One hundred seventy thousand dollars were budgeted for this purpose in the CA. Although the evaluator was unable to obtain details, it seems that funds have been disbursed for this purpose.

5. VITA Home Office Backstopping. VITA's home office has been supportive of field operations in Chad. Inquiries and requests for support have received fast and satisfactory responses.

B. Non-AID Financed Inputs

1. VITA Inputs. VITA's contribution consists of the \$19,528 cost of preparing the sub-project proposal and about 150 technical information brochures for training both staff and clients. Although the proposal stated that eight VITA-financed consultants would provide assistance to the sub-project, no such consultancies have been carried out and none are currently planned. The VITA/Chad Director believes that the multidisciplinary nature of the activity makes it difficult to target assistance from VITA Volunteers.

2. GOC-Controlled Funds. The GOC has made available for this activity the full \$600,000 of local currency generated by an emergency rice sales program (RISAX II), as called for by the proposal. These funds have been used as planned for salaries of local professional and support staff, as well as for other local currency operating costs. The quality of the local staff hired from these funds is excellent.

3. Revolving Loan Fund. The full amount of the revolving loan fund at the completion of the Private Enterprise Development activity, the CFA franc equivalent of \$693,294, has been available for the Private Enterprise sub-project's credit program.

4. USA for Africa. The sub-project has also received a grant of \$124,645 from USA for Africa. These funds have been used to finance a portion of the Agroforestry Consultant's services as well as to purchase a 4WD vehicle.

C. Financial Data (\$US 000)

	<u>Budget</u>	<u>Expenditures thru 12/31/87</u>
1. AID	1,200.0	211.5
2. GOC		
RISAX II	600.0	123.4
PEP-1 Rev. Fund	693.3	458.7*
3. VITA	53.7	19.5
4. USA for Africa	0.0**	124.6
TOTAL	2,547.0	937.6
TOTAL (excl. Revolving Fund)	1.853.7	478.9

\* Total value of loans outstanding on 4/30/88.

\*\* Not foreseen in sub-project proposal or Cooperative Agreement.

V. OUTPUTS

A. The Lending Organization and Structure.

1. Chadian Staff. VITA has done an extraordinary job in putting together a local staff of considerable quality. Under the current activity, it has retained the personnel recruited under PEP-1, in addition to hiring two additional loan officers, two agronomists, and three semi-professional staffers. The 12 Chadian professionals are all at least high school graduates. Most have university degrees or technical school diplomas, and some had extensive banking experience before joining the project. In discussions with the evaluator, they came across as knowledgeable, competent, enthusiastic -- and tough when necessary. They would make an excellent core for an indigenous credit institution.

2. Administration of the loan fund. The loan fund is administered in a businesslike manner. VITA uses a normal banking loan processing system, including application forms, legal documents, monitoring procedures, etc. In addition, it provides extensive and time consuming technical assistance to help loan applicants prepare sound applications, especially market assessments and record keeping, and in correcting problems that arise during implementation. Decisions on loan applications are usually made within a month, and are based on assessment of applicants' character and management skills as well as project site visits. Because of clients' lack of credit history and the absence of general economic or market data, subjective factors necessarily weigh heavily in VITA's evaluation of loan applications. Each project receiving a loan

is visited at least once a month for identification of problems. The project keeps careful track of timeliness of payments, with one staffer assigned to securing repayments from delinquent borrowers.

3. Administrative management and overhead costs. Between January 1 and December 31, 1987 administrative costs amounted to \$479,000. On this basis, it cost \$3.90 to lend \$1.00. Of these expenditures, approximately 45% can be attributed to normal banking activities and 55% to business advisory services. This is a worrisome deterioration from the cost performance in the first project. It seems to be due to two opposing trends. First, a perceived economic slump is believed to have produced a sharp decline in sound loan applications and hence in lending activity. Second, VITA expanded its staff and purchased new equipment in the expectation that loan volume would grow significantly.

### B. Revolving Loan Fund

1. New loan applications and approvals. PEP is processing and approving many fewer loan applications than its predecessor, as shown in Table 1 below. One hundred twenty-three applications have been received and 69 loans have been made (a 56% approval rate) under the new project through March 1988. (These figures are distorted by the large number of micro-loans made to rice farmers in the Casier B project near Bongor.) Of the approved loans, 60, or 69%, have been in the food and agriculture sector. The volume of loan activity was 35 million CFAF (\$123,000), with an average size loan of 1,400,507 CFAF (\$4,914).

Table 1  
Loan Requests & Loans Made by Type, and Loan Volume  
VITA/Chad Private Enterprise Project

	<u>1987</u>	<u>1988 (1st Q)</u>	<u>Total</u>
Agriculture			
Requests	33	14	47
Loans *	58	2	60
Services			
Requests	34	23	57
Loans	4	3	7
Fabrication			
Requests	12	7	19
Loans	2	0	2
Total			
Requests	79	44	123
Loans	64	5	69
Volume (CFAF millions)	24,078	10,920	34,998
Volume in \$ (285 CFAF/\$)			\$122,800
Average Loan Size (CFAF)			1,400,507
Average Loan Size in \$ (285 CFAF/\$)			\$4,914

\* The number of loans is greater than the number of requests because of the lag in approving prior period requests.

The small volume of loan activity is disturbing. The main reason for it seems to be Chad's continuing economic and business slump, although satisfaction of the initial backlog of entrepreneurial demand for loans in 1984-85 and increasing awareness of VITA's sound banking requirements may have also caused the reduction in volume. VITA is trying to counteract this trend with an active publicity campaign. Initial signs are encouraging, as new loan activity increased from zero in the 4th Quarter of 1987 to five new loans, totalling 10.9 million CFAF (\$38,315), in the 1st Quarter of 1988.

VITA has made no special efforts to extend credit to women. Of the 69 loans between January 1, 1987, and March 30, 1988, only one, for 1.0 million CFAF was made to a female entrepreneur. VITA evaluates potential female clients along the same criteria as their male counterparts.

2. Experimentation with new revenue enhancement measures. Under the current phase of the project, VITA has tried no innovations in its interest rate structure; nor has it introduced user fees for its advisory services. All clients are

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charged 12% annual interest (except the rice farmers in Casier B in Bongor, who are charged 8%), but there is some variability in the scheduling of payments. For instance, seasonal businesses will have monthly payments in different amounts to reflect fluctuations in revenues. Loans are also rescheduled when clients have difficulties making payments.

VITA should consider changing the structure of its borrowing charges. First, variable interest rates should be charged, as different borrowers and types of projects do not have the same risk or return. For example, previous clients with a good past repayment record might still be charged the "prime rate" of 12%, while a first time client in a risky economic sector might pay as much as 18 or 20%. Also, lower interest rates could be charged to clients who are able to collateralize their credits. (No collateral is presently required for VITA loans.) By way of comparison, the two commercial banks charge between 11 and 20% on loans. A second change would be introduction of fees for advisory and other services, which a client would pay up-front like "points" on an American student loan or mortgage. It would be unrealistic to expect to recover more than a small percentage of VITA's services at the beginning, but it would be worth trying as a test of the project's ultimate sustainability.

Attempts to increase borrowing charges have faced resistance from the GOC. VITA recently proposed increasing the interest rate to 14%, but was advised not to do so by the Permanent Secretary for NGOs in the Ministry of Planning. Certain elements in the GOC feel that there should be a larger subsidy in VITA's loans because of the state of the Chadian economy. Also, the Ministry of Justice has asked whether VITA's basic agreement with the GOC provides a legal basis for it to collect interest on money lent to third parties. Resolution of these issues in a way that restricted VITA's operational autonomy would seriously jeopardize the supervised credit program's viability.

3. Agricultural Production Loans. VITA has made 60 agricultural loans, with a total value of 15.4 million CFAF, since February 1987. These loans fall into two categories.

(a) N'Djaména Region Loans. These are loans made within a 60-km radius of N'Djaména. They are administered directly by VITA and are handled, with one exception, like other credits. The difference is that the agricultural borrowers receive periodic advice on farming issues from the Service Agronomique et Technique, in addition to the business consulting given all clients.

(b) Bongor Region Micro-Loans. The second category of agricultural credit is the portfolio of 72 small loans (25,000 -

80,000 CFAF) made to farmers participating in the Casier B irrigated rice production project in Mayo-Kébbi prefecture south of N'Djaména. This was a cooperative venture in which credit came from VITA, technical assistance from the FAO, and administration from the Ministry of Agriculture's Casier B office. Loan guarantors were the Prefect of Mayo-Kébbi and third parties. The farmers used the credit to purchase locally made animal traction equipment. The interest rate was arbitrarily set at 8%, as a compromise between VITA's usual rate of 12% and the 5% rate desired by the Casier B project administration.

In the first two years these loans were made, 1985 and 1986, repayment rates were highly satisfactory; the Casier B administration guaranteed the farmers a floor price which enabled them to make their loan payments. In 1987, however, Casier B was unable to support farmgate prices, and the repayment rate dropped to 75%.

Since loan administration has been performed by Casier B and the FAO, the overhead cost to VITA of these loans has been minimal. VITA, however, is not interested in extending the program until the farmers are better organized. This, in turn, presupposes the existence of a better market for the farmers' rice.

4. Loan Repayment Rate. Since 2nd Quarter 1987, loan repayment performance has been bad, especially in comparison to the 1984-1987 project. Table 2, below, documents loan payment performance for both phases:

Table 2  
Loan Repayment Performance  
VITA/Chad Private Enterprise Projects

<u>Quarter</u>	<u>No. Due</u>	<u>No. Paid on Time</u>	<u>No. Paid w/i 30 days</u>	<u>Total Made</u>	<u>Payments Not Made</u>
1984	8	5	8	8	0
1985-1	19	5	19	19	0
-2	50	3	36	50	0
-3	80	1	49	77	3
-4	100	2	52	92	8
1986-1	143	9	61	121	22
-2	156	11	59	118	38
-3	139	11	36	91	48
-4	162	9	36	91	71
1987-1	169	9	37	100	69
-2	189	4	3	105	84
-3	163	3	32	75	88
-4	141	4	31	67	74
1988-1	162	6	33	58	104

Only 20% of all payments have been made within 30 days of the due date, and 17% of VITA's active loans were, as of December 31, 1987, in litigation. Some economic sectors have performed better than others, as shown by Table 3 below:

Table 3  
Loan Repayment Performance by Sector  
VITA/Chad Private Enterprise Project  
4th Quarter 1987

<u>Sector</u>	<u>Performing Loans</u>		<u>Late Payments</u>		<u>Litigation</u>		<u>Total</u>
	<u>No.</u>	<u>%</u>	<u>No.</u>	<u>%</u>	<u>No.</u>	<u>%</u>	
Services	16	44	14	39	6	17	36
Agric.	6	32	10	53	3	16	19
Fabric.	3	20	9	60	3	20	15
Total	25	36	33	47	12	17	70

The poor payment record comes in spite of considerable efforts by VITA. The preference is to reschedule loans if clients are in difficulty, but uncooperative clients receive tough treatment. Six delinquent clients and their guarantors have been brought to court since February 1987. VITA has won all three cases that have been concluded. In April 1988 VITA seized assets worth 650,000 CFAF from one delinquent client and sold them at a public auction.

The problem may stem, rather, from Chad's stagnant economic environment. Commercial bankers and VITA clients all report a profound crisis in the confidence of Chadian consumers (the clients of VITA's clients) and a lack of money in circulation. The latter is confirmed by a Central Bank report that 37 billion CFAF in bank notes -- equivalent to half the money supply or 12% of Gross Domestic Product -- left Chad for Europe in 1987. An atmosphere of uncertainty and capital flight is particularly difficult for small, undercapitalized businessmen.

### C. Advisory Services to Clients

VITA provides three general categories of advice and training to its clients -- business management, relations with the GOC and lending organizations, and agro-technical. All advice to clients is given by the local staff, who have received thorough on-the-job training in this function and perform it excellently.

General business management advice is provided to all clients, and focuses on ensuring rational use of loan funds as well as general management improvement. When prospective clients apply for loans, VITA loan officers help them identify markets for their products and plan actual production as well as procurement of inputs. At the same time their bookkeeping systems are reviewed by the project accountant, who recommends a simple system of accounts that can be implemented by anyone with basic literacy and numeracy. Bookkeeping, inventory control and other management skills are reviewed and reported on during monthly follow-up visits by project loan monitors.

The second area of advice is how to deal with credit and government bureaucracies, as a VITA loan may be a client's first experience with this sort of administrative procedure. Project staff help clients fill out loan application forms, open and maintain checking accounts, and obtain necessary permits and registrations from the GOC revenue and commerce departments.

Finally, the Service Agro-Technique focuses on VITA's agricultural clients. Of particular interest here is ensuring routine maintenance of motor-pumps used by clients with irrigated production projects, as well as recommending improved technical packages such as improved seeds and fertilizer use. SAT visits agricultural clients on a monthly basis, in addition to the visits by loan monitors.

### D. Institutionalization Plan

1. Summary of the Plan. VITA submitted the required plan for institutionalization of the supervised credit program in December 1987. The two major issues identified in the plan are:

(i) Improvement of the project's financial performance and cost effectiveness, by improving loan collection rates and increasing serious applications and loan approvals.

(ii) Development of a flexible structure that will increase the project's integration in the Chadian financial community while maintaining its effectiveness and increasing its non-AID funding options. This will be done by transforming it over five years into a local Non-Governmental Organization (NGO) with Chadian management and expatriate technical assistance. The NGO's management would report to a Board of Directors comprising both Chadian and expatriate (VITA and AID) representatives.

2. Institutional and Personnel Implications of the Proposed Structure. From an institutional and human resources viewpoint, VITA's plan is very well conceived. The alternative would be to merge the operation into one of the two local commercial banks or into a revitalized Development Bank of Chad (BDT) as the small loan window. This is not viable because the commercial banks are not interested because the activity is not and will not be a profit maker, while the fate of the BDT is uncertain. Becoming a local NGO will "Chadianize" the institution, while permitting it to function along current lines and with flexibility in operations. Retaining expatriate technical assistance and an outside presence on the Board of Directors will reinforce the independence of the Chadian management. VITA's current local staffers are capable of assuming increasing responsibilities for credit policy and overall project administration. As discussed in Section IV.A.1. above, VITA should immediately begin recruitment of a Chadian as Assistant Director, with the goal of preparing this person for the Directorship.

3. The Financial Problem. Despite the plan's adaptation to institutional and human conditions in Chad, it will not be workable unless VITA begins to make a greater volume of loans and receive a higher proportion of repayments due. A credit program that receives only 36% of the payments due it (in 1st Quarter 1988) and that has overhead costs of \$3.90 for each \$1.00 it lends is simply not sustainable. Given the positive externalities generated by the project (valuable training of project local staff and of Chadian entrepreneurs), we cannot -- should not -- expect it to turn a financial profit in the near to medium term. But there must be evidence of an overall positive trend in the financial numbers if it is to warrant continuation.

#### E. The Export Project

1. Background. VITA believes that a major cause of the poor performance of its agricultural production loans is the shallow and unstable local market. For this reason a Marketing

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Consultant with many years of experience in the production and export of tropical crops (see Section IV.A.2. above) was hired in February-March 1988 to study possible export markets for Chadian truck crops in Europe, Cameroon and the Gulf. The Consultant found that, during the October-April dry season, Chad could produce green beans, okra, melons and hot peppers of the quality demanded by European markets, and that possibilities also exist for exporting a wide variety of fruits and vegetables to northern Cameroon because of the different cropping seasons. He recommended the necessary inputs and agricultural techniques for growing export quality produce. He also laid out the specific steps for harvesting, collecting, boxing, storing and arranging air shipment for the produce; this included lists of contacts for suppliers of packing materials, air freight services and potential clients in Paris. The Consultant calculated that Chad could export 285 tons of beans, okra, melon and peppers to Paris in one season for a net financial profit (i.e., exclusive of the profits accruing to individual producers) of 57.5 million CFAF (\$200,000).

2. A Trial Run. In March 1988, VITA ran a test of the consultant's recommendations. RISAX funds were used to buy 450 kilograms of produce, which were collected and boxed by VITA staff, stored in an air-conditioned office and freighted to Paris on the regular UTA flight. The Paris market received the Chadian produce very well, with one French wholesaler saying that he was willing to place a standing order for two tons a month. On receipts of 300,000 CFAF (\$1,050), VITA lost about 28,500 CFAF (\$100) on the operation. Nevertheless, it is considered a success since it established the feasibility of collecting, packaging and air freighting Chadian produce, as well as the acceptability of Chadian produce on European markets.

3. Future Plans. Based on the success of the trial run, VITA would like to continue and expand the agricultural exports. VITA's thinking for the moment is to create a "VITA Export Association" which would bring together growers under VITA management. The Marketing Consultant has identified two trainees from a French agricultural college who would be available on a volunteer basis to provide management and technical assistance. VITA's role would be to project sales for a season; estimate the acreage, seeds and other inputs needed for that level of sales; and then broker out production to the individual farmers. VITA would invest in storage facilities and packing materials, as well as provide the farmers with production inputs on credit. In turn, the farmers would be guaranteed a base price for their crops, which would assure profits for both the producers and the Export Association. VITA would like the Export Association to be a self-financing, autonomous operation capable of absorbing some PEP personnel and other overhead expenses.

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VITA believes that pursuit of these export possibilities would help solve the three most serious issues facing the overall project. First, creation of a new, external market would turn around the financial position of its agricultural borrowers and thus lead to a recovery in loan reimbursement rates. Second, the expanded market for local produce could also lead to an increase in the possibilities of new, productive loans. Finally, this profitable operation could help VITA recover a greater share of its overhead costs.

A number of issues remain to be resolved. Will VITA run into legal or administrative problems if it becomes a large-scale, commercial exporter? Is it really necessary to spin off the export activity from the credit program? What will be the disposition of profits from the program? Would it be desirable to subsidize the credit program from the export activity? Should the overall thrust of VITA's program shift from credit to agricultural marketing?

Despite these issues to resolve, the Export Association offers the greatest potential of VITA's current activities, and the USAID Mission should encourage VITA to pursue it. With the drop in loan demand and the \$235,000 balance in the loan fund (as of April 30, 1988), VITA should consider financing the activity's initial costs from the loan fund. Because seeds and related inputs need to be ordered in June for the cropping season that will begin the following October, the decision to proceed must be taken now.

#### VI. SUB-PROJECT PURPOSE

The dual purposes of the VITA/PEP activity are to:

- (1) provide both urban and rural small and medium enterprises with credit, management and other direct technical assistance and market information, and
- (2) incorporate the established supervised credit program into the Chadian financial system through the selection and implementation of an appropriate turnover mechanism.

It is unlikely that the purpose as stated above will be achieved by the current PACD of February 23, 1989. VITA has made good progress toward achievement of the first part of the purpose, as technical assistance and market information are being provided to urban and rural SMEs. As for the second part, even though VITA has prepared an institutionalization plan, the supervised credit program's ultimate incorporation into the Chadian financial system remains in doubt, because of the sub-par financial performance described in Section V. above.

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Failure to accomplish both halves of the purpose may not necessarily mean that the overall sub-project is not a success. The "Export Project" holds a great deal of promise, but addresses the concerns of only the first half of the purpose. VITA and AID may want to restate the purpose, in order to make the promising export marketing activities more central.

VII. SUB-PROJECT GOAL

The goal of the sub-project is also stated in two parts:

- (1) To stimulate economic production and private sector growth, especially food production, through the small and medium private business sector in Chad; and
- (2) To improve the quality of life for the low-income population in the targeted geographic area (within a 60 kilometer radius of N'Djaména).

Somewhat paradoxically, the goal may have a better chance of being achieved than the purpose. The reason for this is the potential of the "Export Project", which lies within the goal statement but, as noted above, outside of the purpose.

## ANNEX E

### TERMS OF REFERENCE USAID/CHAD PSC PROJECT COORDINATOR

#### DUTIES:

1. Monitor on a day-to-day basis, both technically and administratively, the activities of the four PVOs implementing sub-projects under the PVO Development Initiatives Project. This will involve frequent site visits within Chad, which could represent 50% of the Project Coordinator's work time.
2. Serve as principal liaison among AID, the four PVOs and GOC counterpart agencies (e.g., National Agricultural Extension Agency and the Water and Forest Service) for technical and administrative questions of common concern. Technically, this will mean identifying project interventions that are successful in one PVO activity and that might work elsewhere, and keeping other interested parties informed. Administratively, it will mean helping the GOC and PVOs develop more productive working relationships.
3. Handle all correspondence and documentation relating to the umbrella project and the individual sub-projects, for the USAID Mission.
4. Assist the USAID Project Officer and Project Committee in determining the best uses for the uncommitted balance of funds under the project.
5. Perform other duties as required.

#### RELATIONSHIPS:

The Project Coordinator will work under the supervision of the USAID/Chad General Development Officer, who is Project Officer for this activity. Within USAID/Chad, he or she may also work closely with the Agriculture Development Officer, the Mission Engineer and other personnel. Outside of USAID/Chad, the incumbent will work closely with the PVO Country Directors and Project Directors, as well as their technical staffs. He or she will also be expected to develop counterpart relationships with personnel in the GOC Ministries of Planning, Agriculture and Tourism and Environment who work with the project.

QUALIFICATIONS:

The Project Coordinator should have university training in a technical field related to the project (agronomy, rural or hydraulic engineering, forestry or agricultural economics), and at least five years of professional experience in Africa, preferably under arid or semi-arid conditions. Familiarity with AID, PVO and Francophone African administrative procedures, a proven record of initiative and responsibility, and solid negotiating skills are highly desirable. As a considerable portion of work time will be spent in field visits to remote sites, physical and mental ability to withstand harsh conditions is also necessary. Fluent French, as measured by an FSI score of S-3/R-3 or better, is required.

A NOTE ON ADVERTISING:

AID is often penny-wise and pound-foolish when it comes to advertising positions. Missions place advertisements in the CBD or in a single newspaper, and are then surprised when only a small number of marginally qualified candidates respond. Investing in a larger advertising budget might yield much better returns in the quality of technical assistance. It is therefore recommended that USAID/Chad advertise for this position in The Economist, a weekly news magazine with a widely read section of international professional opportunities, as well as major U.S. newspapers such as the New York Times, Washington Post or Los Angeles Times.

ANNEX F

LIST OF INDIVIDUALS CONTACTED

U.S. GOVERNMENT:

USAID Mission to Chad

Mr. Cary Kassebaum, Acting AID Representative

Ms. Dianne Blane, General Development Officer

GOVERNMENT OF CHAD:

Ministry of Planning and Cooperation

Mr. Issa Ngarmbassa, Permanent Secretary for Non-Governmental Organizations

Ministry of Agriculture

Mr. Abdelwahab Charif, Director General

Mr. Djidingar kamougue, Program Officer

Mr. Bembayragosso, Agricultural Training Specialist (DEFPA)

Ministry of Tourism and Environmental Protection

(Water and Forest Service)

Mr. Brahim Barka, Eastern Regional Inspector (Abeche)

National Rural Development Office (ONDR)

Mr. Djibrail Mikail, Director

Mr. Siniki Soulariba, Assistant Director for Administration

Mr. Abdelmajide Zakaria Hagar, Chief of the Abeche Sector

Mr. Denge Enway, Field Agronomist (seconded to CARE)

Mr. Misdongarti, PICS Coordinator (seconded to CARE)

Lac Development Corporation (SODELAC)

Mr. Mahamat Mokhtar Ali, Director

PRIVATE VOLUNTARY ORGANIZATIONS:

Africare

Mr. Tyrone Gaston, Country Representative

Mr. Thomas More Hattenschwiler, Logistician

Mr. William Fitzgerald, Chief of Party

Mr. Mark Buccowich, Forester

Mr. Mario Iachella, Mechanic

Mr. Kurt Lonsway, Engineering Consultant

Mr. Ahmet Moussa, Assistant Engineer

Mr. McKinley Posely, Agronomist

CARE

Ms. Lizette Echols, Director  
Mr. Joseph Wambach, Assistant Director  
Mr. Charlie Stockton, Project Coordinator  
Mr. Tom Ahmat, Evaluation and Statistics Specialist  
Mr. Jean-Philippe Audinet, Agricultural Economist  
Mr. Lewis Brittain, Mechanic  
Mr. Kadi Debaine, Forester  
Dr. C. Khan, Agricultural Engineer  
Mr. Nick Marshall, Forester/Kanem Regional Manager  
Ms. Alberta Mascaretti, Agronomist  
Mr. Gos Ngoniri, Coordinator for Kanem  
Mr. Hadji Ramadan, Loan Monitor for Cheddi

Organization for Rehabilitation through Training (ORT)

Mr. William Stringfellow, Chief of Party  
Mr. Mike Chiropolous, Peace Corps Volunteer/Forester  
Mr. Christian Eberschweiler, Rural Works Engineer  
Mr. Tom Mirti, Pump Specialist  
Mr. Firmin Masis, Agronomist

Volunteers in Technical Assistance (VITA)

Mr. Richard Slacum, Director  
Mr. Robert Reitemeir, Assistant Director  
Mr. Yondailaou Tolloum, Administrator  
Mr. Abakaka Alladji, Loan Officer  
Mr. Abdoulaye Adami, Agronomist  
Mr. N'Deikounda Jacob, Accountant  
Mr. M'Baoundarim Telet, Loan Monitor

ANNEX G

LIST OF DOCUMENTS REVIEWED

GENERAL

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CARE -- IRRIGATED AGRICULTURE DEVELOPMENT PROJECT

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ANNEX H

Evaluation Team Composition

Mr. William Brooke Stallsmith, Economist/Team Leader,  
USAID/Chad, N'Djamena, Chad

Dr. Amal Rassam, Social Anthropologist, REDSO/WCA, Abidjan, Cote  
d'Ivoire

Mr. Djime Adoum, Agronomist, USDA Office of International  
Cooperation and Development, Washington, D.C.

Mr. Robert Hanchett, Engineer, REDSO/WCA, Abidjan, Cote d'Ivoire

Mr. Jeffrey W. Goodson, Geographer/Applied Ecologist, REDSO/WCA,  
Abidjan, Cote d'Ivoire

## ANNEX I

### Evaluation Team Itinerary

The USAID/Chad PVO Development Initiatives Formulative Evaluation Team began work on April 23, 1988.

The Team Leader/Economist, Anthropologist, Engineer and Agronomist, as well as the USAID/Chad General Development Officer, drove to Abeche to conduct an on-site review of Africare's Ouaddai Rural Development sub-project on April 26, returning by road on April 30.

The Geographer/Applied Ecologist, who had conducted site visits to all three PVO regions during preparation of the Initial Environmental Examinations for the individual sub-projects in January-February 1987, arrived in N'Djamena on May 1.

The entire team conducted site visits of the ORT Lake Chad Agricultural Development and Farmer Training sub-project in Ngour on May 5 and 6, and of the CARE Irrigated Agriculture Development sub-project in Nokou and Cheddra on May 7 and 8.

The Anthropologist, Engineer, Agronomist and Geographer/Applied Ecologist conducted a site visit of CARE activities in Mayo-Kebbi Prefecture from May 12 through 14. At the same time the Team Leader/Economist reviewed the VITA Private Enterprise Promotion sub-project in N'Djamena, including site visits to clients.

In addition, the Engineer and Geographer/Applied Ecologist conducted an aerial reconnaissance of the irrigated perimeters along the Chari River between N'Djamena and Lake Tchad, and the wadis and polders along the southern, eastern and northeastern edge of Lake Chad, on May 16.

## ANNEX J

## MODELS OF PROPOSED PVO TECHNICAL IMPACT REPORTS

TABLE 1

First Quarter Implementation/Outputs/Impact Summary

DIRECT AGRICULTURAL IMPACT  
Extensification      Intensification

<u>OUTPUTS</u>	<u>QUANTITY</u>		
Long-T.Trng.	6 p-m		
Short-T.Trng.	97 p-d		
Crop Spp. Tested	11		
Experiment Area	3 ha		
Seeds Distributed	480 lbs		12 ha
Fertilizer Appl.	68 t		41 ha
Pesticides Appl.	1200 l		472 ha
Tree Spp. Planted	13		
Seedlings Grown	6550		
Trees Distributed	2800		
No. of Recipients	38		
Windbreaks Planted	4		
Intercropped Area	7 ha		7 ha
Dune Stabilization	12 ha		
New Pumps Tested	1		
New Pumps Distributed	6		
New Pumps Adopted	1		0.25 ha
New Linings Tested	2		
Linings Adopted	200 m		4 ha
Other Systems Tested	2		
Other Systems Adopted	0		
Perimeters Est.	1	25 ha	
Perimeters Rehabilit.	1	11 ha	
Barrages Designed	0		
Barrages Completed	1	79 ha	
Barrages Maintained	3		
<u>TOTAL</u>		115 ha	536.25 ha

TABLE 1  
(CONTINUATION)

INDIRECT AGRICULTURAL IMPACT

OUTPUTS

Long-T. Trng.	
Short-T. Trng.	
Crop Spp. Tested	
Experiment. Area	
Seeds Distributed	
Fertilizer Appl.	
Pesticides Appl.	47.2 ha (472 x 10%)
Tree Spp. Planted	
Seedlings Grown	
Trees Distributed	
No. of Recipients	9 ha (38 x .25 ha/)
Windbreaks Planted	16 ha (4 x 4 ha/)
Intercropped Area	
Dune Stabilization	Impact but unquantifiable
New Pumps Tested	
New Pumps Distributed	
New Pumps Adopted	
New Linings Tested	
Linings Adopted	
Other Systems Tested	
Other Systems Adopted	
Perimeters Est.	
Perimeters Rehabil.	
Barrages Designed	
Barrages Completed	
Barrages Maintained	
<u>TOTAL</u>	72.2 ha

TABLE 2  
ANNUAL IMPLEMENTATION/OUTPUTS/IMPACT SUMMARY

	<u>QUARTER</u>				<u>TOTAL</u>
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	
<u>DIRECT IMPACT</u>					
Extensification	115.00	0	10	0	125.00
Intensification	436.25	0	200.00	100.00	736.25
<u>Subtotal</u>	551.25	0	210.00	100.00	861.25
<u>INDIRECT IMPACT</u>	72.20	59.00	420.00	34.00	585.20
<u>TOTAL</u>	623.45	59.00	630.00	134.00	1446.45

TABLE 3  
DIRECT IMPACT SUMMARY OVERVIEW

LOCATION: Bahr-el-Ghazal (e.g., or Ngouri, or Ouaddai)

No. of Hectares Planted, 1/88: 2175  
 No. of Hectares Planted, 1/89: 2205  
 Difference: +30

No. of Farmers, 1/88: 4250  
 No. of Farmers, 1/89: 4350  
 Difference: +100

<u>Crop</u>	<u>Hectares Planted</u>	<u>Yield Increase</u>	<u>Percent Project</u>	<u>Project Impact</u>
Onions:	2030	+0.6 t/ha	25	+304.5 t
Tomatoes:	64	+0.3 t/ha	5	+1.0 t
Okra:	6	-0.53 t/ha	10	-0.3 t
Potatoes:	37	+1.1 t/ha	75	+30.5 t
Garlic:	17	no change	0	0.0 t
Hibiscus:	2	+1.10 t/ha	0	0.0 t
Taro:	10	-.6 t/ha	5	-0.3 t
Other:	39	unknown	-	-
<u>Total</u>	261			+335.4 t

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